International Conference on Diet and Activity Methods 2015

1 - 3 September 2015
Brisbane Convention and Exhibition Centre | Brisbane

ABSTRACTS

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ICDAM9

1-3 September 2015 Brisbane Australia
Eat well, be active. How do you measure up?

Welcome

It is my great pleasure to announce the release of this abstract book, which includes all keynote, invited, oral and poster presentations at the 9th International Conference on Diet and Activity Methods (ICDAM9), 1-3 September, 2015, held at the Brisbane Convention and Exhibition Centre (BCEC).

ICDAM9 builds on the notable successes of the previous conferences held in Minneapolis, USA, 1992; Boston, USA, 1995; Arnhem, The Netherlands, 1998; Tucson, USA, 2000; Chiang-Rai, Thailand, 2003; Copenhagen, Denmark, 2006; Washington DC, USA, 2009; and Rome, Italy, 2012.

ICDAM9 generated significant interest from a wide cross-section of the scientific community such that we received approximately 400 registrations from a large number of countries. The list of keynote and invited speakers is extremely impressive and a testament to the Scientific Committee led by Professors Neil King and Nuala Byrne with great assistance from many members of the International Advisory Committee.

Similarly, we were very fortunate to receive support from a range of Scientific Partners including the International Atomic Energy Agency (IAEA), American College of Sports Medicine (ACSM), Commonwealth Scientific and Industrial Research Organisation (CSIRO), Exercise and Sport Science Australia (ESSA), and Sports Medicine Australia (SMA).

I would very much like to thank in particular, Neil King, David Keating, Nuala Byrne and Martin Bowerman who were the backbone of the conference organisation and were assisted by various administrative staff at ICMS Australasia over the years, in particular, Emma Taylor and Suellen Holland. Particular thanks must also go to Alison Gardiner and colleagues at BCEC for their sterling support over the same period.

Finally, I wish to sincerely thank all members of the International Advisory Committee who unselfishly gave of their time to help create a quality program. Similarly, all conference exhibitors and delegates helped to make the program worthwhile and viable.

Many thanks to all involved.

Professor Andrew Hills
Chair – ICDAM9

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Committee

Professor Andrew P Hills	Martin Bowerman
David Keating OAM	
Professor Neil King	
Professor Nuala M Byrne	

International Advisory Committee

Professor Barbara Ainsworth	Professor Peter Howat
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Keynote

Invited Speakers

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S07: Open Acess to High Quality Methods in Diet and Activity

S08: Challenges and Opportunities for Measuring Physical Activity in Children

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S10: ISCOLE: Novel Methods for Measuring Physical Activity, Sedentary Behaviours and Sleep

S11: Use of Technology in Dietary Intake and Food Environment Assessment

S12: INFORMAS 1: Benchmarking Food Environments: Country Experiences

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S14: New Developments in Statistical Modelling to Mitigate Effects of Diet and PA Measurement Error

S18: INFORMAS 2: Benchmarking Food Environments: Key Challenges and Future Directions

S22: Physical Activity Interventions: Limitations and Improvements

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Theme 05: Dietary Biomarkers

Theme 06: Dietary Patterns

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Theme 08: Dietary Interventions: Limitations and Improvements

Theme 09: Using Images for Dietary Assessment

Theme 10: What Should We Measure and Why?

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Theme 12: Novel Methods for Measuring Physical Activity, Sedentary Behaviours and Sleep

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Theme 13: Measurement of Energy Expenditure: Prediction Equations

Theme 14: Advances in Technologies for Physical Activity Assessment

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Keynote

Physical Activity: historical and future perspectives

Barbara Ainsworth[1]

1 *Arizona State University*

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The quest to determine the epidemiological relationships between physical activity, morbidity, and mortality has involved the measurement of physical activity. In the early discovery period, job classifications and use of simple records and logbooks were sufficient to show the impact of inactivity and various levels of physical activity intensities on health. Increased interest in knows what types of leisure activities and the quantification of physical activity movement has expanded the paradigm of physical activity assessment methods. This presentation will provide a historical overview of the contributions of physical activity assessments toward our understanding of the relationships between sedentary behaviors, physical activity intensity, morbidity, and mortality in the past 70 years.

Dietary reporting: Historical and future perspectives

Barbara Livingstone[1]

1 *University of Ulster*

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Interest in measuring the food intake of individuals emerged during the 1930's and there is now an extensive literature base spanning eight decades. The major problems and sources of error in dietary assessment were identified early and addressed in each successive decade but the first five decades of research was unable either to satisfactorily quantify the errors, or to determine the true validity of any method. The decade from 1986 to 1996 however produced radical advances. The development of biomarkers of intake, particularly the ability to validate energy intakes using doubly labelled water measurements of energy expenditure led to the universal recognition that mis-reporting, particularly under-reporting is rife in dietary surveys. The reasons for such mis-reporting are clearly complex and operate in different ways in different people. However, it is a measure of the complex nature of diet and the dependence of dietary assessment on human behaviour that progress towards quantifying errors and determining the true validity of dietary survey methods has been limited. Since the mid 1990's the body of evidence supporting the potential of innovative technologies for enhancing the recording and analysis of dietary intake data is growing rapidly. Although many techniques are still under development, major advances have been made. However, as these advances move rapidly forward, rigorous evaluation of their efficacy, particularly the extent to which they can resolve the individual bias inherent in self-reported dietary intake is a key priority. When the behavioural and psychological issues of dietary reporting are better understood, it may be possible to devise techniques of dietary assessment that are less prone to bias. Even then, human nature may be such that the ultimate goal of totally valid dietary assessments is probably not achievable.

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Invited Speakers

Which dose should I follow? Comparing disease specific PA recommendations from epidemiological studies

Barbara Ainsworth[1]

1 *Arizona State University*

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There are many epidemiological studies on the health benefits of moderate- and vigorous intensity exercise. This has increased consistency of results showing that regular physical activity is a powerful agent in preventing disease and promoting health. The downside of having multiple studies that focus on disease-specific outcomes is that the physical activity measures are varied and hard for a practitioner to compare. This presentation will attempt to bridge the recommendations toward a common level of understanding of the various ways physical activity is assessed in the studies.

Should we invest in 'sitting less' or 'moving more' ? The epidemiological evidence and policy consequences of researcher attention on inactivity and sedentary behaviours

Adrian Bauman[1]

1 *School of Public Health, Sydney University, Australia*

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For the past three decades there has been some policy interest in promoting physical activity; this follows the six decade epidemiological evidence that physical activity is associated with a range of beneficial health outcomes. Over the past decade interest has increased in reducing sedentary behaviour (sitting time), focusing on it as a distinct and different risk behaviour, particularly contributing to chronic disease risk. This presentation reviews current epidemiological evidence for increasing physical activity relative to the evidence for decreasing sedentary behaviour, and using epidemiological methods, identifies the interaction between them. Further, measurement issues will be considered, consistent with the ICDAM theme. These measurement challenges in assessing physical activity and sedentary behaviour are now intertwined with the development of new and wearable technologies. Attention being focused on these two as separate fields creates a policy tension between them. It is likely that increasing focus on reducing sitting time has impacted on the resources available for increasing physical activity. The policy context is confused by the way the evidence is portrayed by scientists, the innovation and novelty of reducing sitting time, and the evidence base for action. The long-term consequences of displacing physical activity efforts with efforts to decrease sitting time may be counter-productive to both fields.

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Moving more, sitting less: Strategies, approaches and assessment for behaviour change

Stuart Biddle[1]

1 *ISEAL, Victoria University*

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The explosion of interest in sedentary behaviour (sitting time) is clearly evident over the past 10 years or so. Researchers are now engaged in a critical debate concerning whether any health effects of sedentary behaviour are truly independent of moderate-to-vigorous physical activity (MVPA). Whatever the outcome of this debate, it is likely that we will be promoting the dual messages of less sedentary behaviour and more MVPA. If this is the case, we will be required to scrutinise different behaviour change approaches to both clusters of behaviours. One area where sedentary behaviour change may benefit the most is from an analysis of more automatic processing of behavioural cues rather than the traditional 'reflective' approach often used in MVPA research. This will mean more research on the strong habitual nature of sitting. In this presentation, MVPA and sedentary behaviours will be contrasted for potential behaviour change strategies, including an analysis of both clusters of behaviour on various characteristics such as frequency, duration, effort and cognitive load. In addition, different sedentary behaviours will be considered, including TV viewing, workplace sitting, and overall sitting time. Finally, implications for measurement of behaviour change constructs will be discussed.

Image based dietary assessment: Limitations and improvements for measuring dietary outcome

Carol Boushey[1]

1 *University Of Hawaii Cancer Center*

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Technology is transforming traditional assessment tools used by researchers and practitioners to assess adherence to dietary recommendations or intervention goals. This presentation will highlight novel applications developed to reduce respondent burden which will translate to enhanced monitoring of dietary goals associated with an intervention outcome. The innovative mobile food record (mFR) holds tremendous promise for improving the accuracy of the dietary record. With the image-based mFR, respondents simply 'snap a picture' of foods prior to consuming. A choice of review processes following the collection of images allows users to clarify or identify components of interest to researchers or practitioners. In turn, the images or other contextual information can be used as random prompts to deliver salient messages to intervention participants. To maintain engagement, reminders modelled after ecological momentary assessment have been incorporated into the system. Questionnaires have also been launched at specific times to capture changes after key food choices. The results and lessons from studies completed and ongoing using mobile devices will be described. These enhanced dietary assessment methods offer investigators and practitioners the opportunity to monitor progress in real-time, interact at impressionable moments, and minimize burden on both respondents and the research team. Ultimately, these advances will aid in better estimating dietary intakes and delivering interventions.

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Dietary exposure assessment using new methodologies

Janet Cade[1]

1 *Nutritional Epidemiology Group, University of Leeds, UK*

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We are in a new era of dietary assessment. Our diets are now more complex than ever before; with over 40,000 different products available in the average supermarket. At the same time, web-based and mobile eHealth technology is developing rapidly. This gives us the potential to capture detailed dietary data on large numbers of individuals without the need for costly and time-consuming manual nutrition coding. In this talk, I will focus on both web-based tools and apps for measuring diet. I will discuss how we developed a web-based tool to assess diet myfood24. This will be a practical exploration of what users wanted in the tool and the development of our new food composition database using back-of-pack information. The importance of usability testing and the need for validation will be highlighted. I will also review smartphone apps used to measure diet with a focus on obesity; reporting on a randomised controlled trial of a dietary self-monitoring app to support weight loss. I will consider strengths, limitations and challenges of this approach. Finally, I will report on a systematic review of the potential for new technologies to be used in national diet and nutrition surveys. New methodologies applied to dietary assessment provide us with a step-change in our ability to reliably characterise food and nutrient intake in population studies. These new approaches may help to reduce measurement error and advance our understanding of nutritional determinants of disease.

Compositional data analysis: Toward integrated guidelines for sleep, sedentary behavious and physical activity

Sebastian Chastin[1]

1 *Glasgow Caledonian University, School of Health and Life Sciences*

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To date the relationship between health and each daily physical behaviours i.e. MVPA, LIPA, SB and sleep has only been studied in isolation adjusting only for one other behaviour, because standard statistical methods cannot deal with the whole day (time spent in each behaviour is highly collinear and correlated even when correlation indices are low). There is a dearth of information about the combined effect of allocating time to these different behaviours. During the day time is finite, time spent in one behaviour naturally displace time in others. Time budget data are therefore intrinsically compositional in nature and require adopting statistical methodology consistent with this type of data. Compositional data analysis enables to investigate how different allocation of time spent in different activity is associated with health outcomes and adequately adjust model for time spent in all behaviours. A compositional paradigm has the potential to advance the epidemiology and enable the development of combined guidelines for daily movement behaviour, but it requires a different philosophical approach and a rethinking about how we conceptualise time budget data.

What should we measure and why?

Clare Collins[1]

1 *Priority Research Centre in Physical Activity & Nutrition, Faculty of Health and Medicine, University of Newcastle, NSW, Australia*

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Research studies examining diet-disease relationships are paramount in building an evidence base and synthesising findings. Graded evidence statements can be used to inform national dietary guidelines and make nutrition recommendations for prevention and treatment of diet-related, non-communicable diseases (NCD). It is widely recognised that dietary intake measurement is fraught with numerous sources and types of error. Other practical challenges include; time, cost, age, literacy and numeracy, SES, the individual's body weight and; subject and analytic burden; and access to methodology expertise. Should we therefore forget about diet and not measure it? Dietary patterns and food intake are potentially modifiable and important contributors to NCDs and therefore should be measured and interpreted appropriately. Researchers should consider the specific components of dietary intake relevant to their research question when selecting a method as one approach does not fit all purposes. A decision matrix that balances good practice with practical constraints will be presented. This will include examples from Australia and internationally and demonstrate how strengths, limitations and challenges associated with assessment methods have been weighed in measuring dietary intake across a range of studies, from children to adults; and settings, from schools to clinical populations to communities. A hierarchy for selecting appropriate dietary methods will be provided in order to facilitate improvements in quality of dietary intake assessment and reporting within research will broadly contribute to the development of a strong evidence base evaluating the relationship between diet and health that can inform both nutrition policy and practice.

Monitoring athlete training: Theoretical concepts and practical applications

Aaron Coutts[1]

1 *Sport & Exercise Discipline Group, UTS: Health, University of Technology Sydney (UTS), Sydney, Australia*

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Precise quantification and control of an athletes training load is essential for optimizing performance, maintaining health and reducing injury risk. Indeed, high performance athletes now invest significant time and resource into monitoring their training. Common input measures into these monitoring systems include measures of training load, player wellness and athlete 'readiness' (i.e. fitness/fatigue status). An athletes training load has many constructs (i.e. internal and external load variables) and selecting the most appropriate variables for monitoring depends on the specific nature of the sport. Until recently the quantification of external load was difficult, but with the development of various microtechnologies (i.e. Global Positioning Systems (GPS), accelerometers, gyroscopes etc.), relatively precise measures are now easily obtained. In contrast, the internal training load has been relatively simple to assess through heart rate and/or the athletes rating of perceived exertion (RPE) measures. When the internal and external training load data are integrated and interpreted in the context of other factors such as the training goals and athlete's readiness measures, informed decision on future training can be made. This presentation will examine the theoretical basis of athletes monitoring systems, describe the validity and reliability of common

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input variables into these systems (i.e. training load, fitness and fatigue measures) and provide examples of how these have been applied to athletes in the field. Finally, practical recommendations for monitoring athletes in the field will also be provided.

Current approaches and future directions for dietary assessment in children

Emma Foster[1]

1 *Newcastle University, Human Nutrition Research Centre*

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Assessing the dietary intake of children can be extremely challenging. Young children may lack the skills required to keep a record of their food intake and may have limited knowledge about the types of foods and drinks they consume. While parents may be able to provide accurate information on the foods their child eats while in their care, they have limited ability to report on the significant amount of food and drink which is provided for their child at nursery, school or whilst their child is in the care of others. In addition staff at nurseries and schools are unlikely to be able to provide detailed information on the individual food intake of the many children in their care. Traditional pen and paper based methods, such as weighed or estimated food diaries, have been found to under-estimate children's intake. Technology including smart phones and wearable cameras offer the opportunity to capture more accurate information on food intake in this population. Adolescents may possess the skills required to keep a reasonable account of their food intake but may lack the motivation. Using technology based methods may increase the engagement of participants in the process and reduce the burden associated with keeping a food diary or record. Text messages can be a useful adjunct to remind participants to record their intake. Some of the key challenges in assessing dietary intake in children and young people will be discussed along with some of the novel methods employed by researchers rising to these challenges.

Making the most of your dietary data: Energy adjustment, categorization and measurement error

Laurence Freedman[1]

1 *Gertner Institute Of Epidemiology*

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Working with self-reported dietary data is very challenging, not the least due to inaccuracies of reporting and in food composition databases. However, there are some statistical practices that enhance the accuracy of our analyses and some practices that detract from their accuracy. In this talk I will review and illustrate the advantages and disadvantages of practices related to energy-adjusted versus unadjusted nutrient intakes, use of continuous versus categorized intakes, and adjustment versus no adjustment of estimates for measurement error. Much of the evidence that I will bring regarding energy-adjustment and regarding adjustment of estimates for measurement error comes from the Validation Studies Pooling Project, a collaborative project between investigators of five large studies that studied the validity of self-reported dietary data by comparison with recovery biomarkers.

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Physical activity and wearable sensors

Patty Freedson[1]

1 *University of Massachusetts, Amherst*

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Measurement of physical activity and sedentary behavior with accelerometers has gained widespread attention as technology has improved and cost for these tools has declined. These devices have been used in surveillance studies, activity and sedentary behavior interventions and investigations examining determinants of physical activity and sedentary behavior. Wearable sensors have been used to quantify physical activity and sedentary behavior in children and youth, young and older adults, and in various clinical populations. Researchers continue to struggle with fundamental questions about device selection, algorithms and signal-type (e.g. raw acceleration, device-specific counts) to translate accelerometer output into behavior measures. However, it is clear that these devices are now widely accepted tools to quantify various features of activity and sedentary behavior dose in exposure and outcome studies. This presentation will first highlight the evolution of progress in physical activity and sedentary behavior assessment using wearable sensors. Second, a new validated method for research-grade wearable sensor data interpretation will be offered that is driven by specific research goals and objectives. The steps involved with this approach will be summarized and advantages of this process will be discussed. Application of the principles governing this systematic methodology using consumer-grade activity trackers will be presented demonstrating how to improve the validity of these monitor metrics and the consumer-device interface experience.

Physical activity measurement considerations: Development and validation of new algorithms for wrist worn accelerometers

Patty Freedson[1]

1 *University of Massachusetts, Amherst*

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This investigation developed models to estimate aspects of physical activity and sedentary behavior from three-axis high frequency wrist worn accelerometer data. The models were developed and tested on twenty participants (n=10 males, n=10 females, mean age= 24.1, mean BMI = 23.9) who wore an ActiGraph GT3X+ accelerometer on their dominant wrist and an ActiGraph GT3X on the hip while performing a variety of scripted activities. Energy expenditure was concurrently measured by a portable indirect calorimetry system. Those calibration data were then used to develop and assess both machine learning and simpler models with fewer unknown parameters (linear regression and decision trees) to estimate METs and to classify activity intensity, sedentary time, and locomotion time. The wrist models, applied to 15-second windows, estimated METs (random forest: rMSE = 1.21 METs, hip: rMSE = 1.67 METs) and activity intensity (random forest: 75% correct, hip: 60% correct) better than a previously developed model that used counts per minute measured at the hip. In a separate set of comparisons, the simpler decision trees classified activity intensity (random forest: 75% correct, tree: 74% correct), sedentary time (random forest: 96% correct, decision tree: 97% correct), and locomotion time (random forest: 99% correct, decision tree: 96% correct), nearly as

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well or better than the machine learning approaches. Preliminary investigation of the models' performance on two free-living people suggests that they may work well outside of controlled conditions.

Sit less AND move more: Targeting change across the activity spectrum

Genevieve Healy[1]

1 *School of Public Health, The University of Queensland, Australia*

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Regular physical activity at a moderate or vigorous intensity (MVPA) has well established benefits and has been the primary focus of public health efforts over the past several decades. However, for most adults, MVPA constitutes a small proportion of their waking hours (some 3% to 5% based on objective-measurement studies). A further perspective on health-enhancing physical activity has emerged over the past decade through a scientific and public health focus on the adverse consequences of prolonged sitting. Sitting accounts for some 50% to 70% of adults' waking hours, with the majority of non-sedentary time being accounted for by standing and light-intensity activities. Such evidence has stimulated a broader consideration of all activities across the day, and how best to address the balance of time spent between them. In particular, the epidemiological and experimental evidence on the harms of too much sitting has prompted calls for interventions targeting reductions in sedentary behaviour - particularly prolonged, unbroken sitting. However, these calls beg the question - if not sitting, then what? and; how feasible would such changes be to achieve? This presentation will report on the estimated benefits of reallocating time from one activity to another for cardio-metabolic biomarkers and mortality outcomes. Then, using data from workplace interventions, it will illustrate the effectiveness and acceptability of various intervention strategies, or combination of strategies, to encourage office workers to sit less and move more. The policy implications for addressing the overall activity spectrum -being mindful that established physical activity guidelines have been broadly inclusive of all activity as well as MVPA - will be discussed.

The impact of dietary methodology when translating research into practice: Clinical advice for liver disease as a test case

Ingrid Hickman[1]

1 *Department of Nutrition and Dietetics, Princess Alexandra Hospital, and The Mater Research Institute - University of Queensland; Brisbane, Australia*

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For nutrition research in chronic disease to impact broadly on clinical practice, scientific data needs to be translated into practical health information for patients, and for those health professionals providing their treatment. Nutrition research is complex not only due to the confounding nature of free living environmental conditions but also due to the variety of methodologies used to capture the frequency, duration and type of dietary intakes. This presentation will use chronic liver disease as a test case to illustrate examples where evidence of links between nutritional intake and disease

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severity, obtained through observational or cross sectional methodologies, have been translated into dietary recommendations for disease treatment. Discussion will include recent developments on the role of dietary factors across the spectrum of liver disease severity including fructose, coffee consumption and the Mediterranean Diet. It will highlight the importance of understanding the methodologies used in clinical research and question how much we are willing to compromise the representation of pure scientific results in order to develop an effective, pragmatic health message.

Image based dietary assessment: Limitations and improvements for dietary interventions

Deborah Kerr[1]

1 *Curtin University, Perth, Australia*
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Dietary assessment in interventions is challenging as methods need to be sensitive enough to track change over time. Concern with participant burden and analysis costs, particularly with repeated assessments, has led researchers to use less precise methods such as brief assessment methods. Diet records, whilst prone to reactivity bias allow the capture of detailed information on the types of foods consumed and the combination of foods eaten together. The presenter will share her experiences in the use of diet records in various interventions targeting nutrition and physical activity conducted over the years and how this work has led to a 10-year collaboration on the Technology Assisted Dietary Assessment or TADA [1]. The drive to undertake this work was to improve the accuracy and precision, whilst addressing respondent burden. The mobile food record (mFR) application runs on various devices (iPhone, iPod and Android). A strength of the mFR is that the food and beverage images contain a time and date stamp for each eating occasion providing metadata to explore changes in eating occasions over time. Findings from intervention studies in community dwelling young adults and overweight and obese adults will be presented. In both of these interventions, a trained analyst undertook the dietary assessment. The mFR images were analysed for eating occasions and food groups serve. Participants ranged in age from 18 to 60 years. Future improvements in machine learning algorithms will lead to upscaling and automation of the process. Potential applications of the mFR for dietary interventions will be discussed. Boushey, C.J., et al., *Use of technology in children's dietary assessment.* European Journal of Clinical Nutrition, 2009. 63: p. S50-S57.

Assessment of built environment - Use of GPS/GIS

Jacqueline Kerr[1]

1 *Department of Family Medicine & Public Health, University of California, San Diego*
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This presentation will review the evolution of GIS and GPS to assess built environments and transportation modes and place current research within an agenda that can help influence policy makers. It will review the methodological and theoretical improvements that have occurred to make analysis of GPS data within GIS possible. Results from recent studies around the world with GPS and GIS data will be summarized. New findings will be presented on a Kernel density method to assess

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exposure to the built environment and the implications for GIS data and concepts will be discussed. In addition, changes in GPS/GIS based life space will be presented in older adult participants from a multilevel randomized control trial. These data and techniques will demonstrate how the next generation of GPS/GIS data can proceed. Conceptual, processing and analytic challenges still remain for this growing field.

Diet quality indexes

Susan Krebs-Smith[1], Jill Reedy[1]

1 *US National Cancer Institute*

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It is widely accepted that diet needs to be understood in its totality, rather than nutrient-by-nutrient or food group-by-food group, because dietary components can have cumulative and synergistic effects on health. This inherent complexity has led to the development and evaluation of a number of multi-dimensional diet quality indexes to characterize intakes relative to recommendations. Indexes vary with regard to the dimensions of the diet included and how those dimensions are specified, scored and scaled. Most are designed to measure unique sets of guidelines or patterns of eating, although there are some guidelines (e.g., DASH eating plan) and patterns (e.g., the Mediterranean diet) for which multiple indexes have been developed. Indexes which are scored on a density basis (e.g., per 1000 kcal) can be used to assess the quality of any mix of foods, including national food supplies and foods offered or sold through community markets or outlets, as well as individual-level diets. Because indexes are specified a priori, they provide standardized metrics which can be used across studies; this is particularly helpful to the field of dietary patterns research which has been challenged with many irreconcilable results. Overall diet quality can be assessed by examining total scores, whereas gauging the multi-dimensional pattern of quality requires the individual component scores be examined separately but collectively. Indexes provide useful metrics for surveillance, epidemiologic, and intervention research, and much of what has been learned from using them to assess diet quality also might be beneficial to the multi-dimensional study of physical activity.

Measuring dietary intake in athletes

Kristen MacKenzie-Shalders[1]

1 *Bond Institute of Health and Sport, Bond University, Gold Coast, Australia*

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The accurate measurement of dietary intake in athletes is important to ensure that sports nutrition interventions are evidence-based and have direct relevance to athletes and sporting programs. However, measuring dietary intake in athlete populations, who often have unique requirements and challenges in comparison to non-athletes, poses a range of analytical and methodological challenges for practitioners. Despite clear implications for athlete health and performance, there is a paucity of research in the area. Therefore, the methodological considerations, unique (and shared) challenges

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with non-athlete populations, current evidence and recommended future directions for effectively measuring dietary intake in athletes will be discussed.

Measuring intake and expenditure for exercise and training

Chris McLellan[1][2]

1 *Bond University Institute of Health and Sport, Gold Coast, Australia*
2 *Brisbane Lions Australian Football Club, Brisbane, Australia*

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The integration of applied monitoring strategies to determine athlete preparedness for training and competition has become commonplace in professional sport. During training and competition athletes regularly participate in high-intensity physical efforts, including running, repeated sprint activities, high speed changes of direction, accelerations, decelerations, jumping and landing. Team sport athletes in professional football codes will also experience frequent bouts of blunt force trauma associated with tackling and collisions. Sustained participation in training and competition over an extended in-season period may contribute to the manifestation of physiological and perceptual fatigue, increased injury risk and a subsequent decrement in performance. A systematic approach to athlete monitoring using subjective and objective strategies is key to the quantification of the demands of training, competition and recovery on a daily basis. Global Positioning Systems (GPS) and integrated tri-axial accelerometry are universally considered the predominant portable training and competition load analysis system in sport and exercise. Limitations exist with respect to isolated integration of GPS / acclerometry data to establish an individualised model of physiological preparedness for optimal sports performance. A more robust quantification of the impact of training and competition on daily activities may be provided via the incorporation of athlete monitoring strategies to identify the neuromuscular, endocrine and immunological profile of individuals to inform sports science and performance practitioners and facilitate individualised training interventions to optimise performance. This presentation will provide insight into current athlete monitoring techniques to determine the impact of training on daily activities in team sport athletes.

Overview of lifecourse studies, methodologies utilized and issues for diet and physical activity

Nancy Potischman[1]

1 *National Cancer Institute/NIH*

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Lifecourse epidemiology investigates associations between biological, environmental and lifestyle factors acting throughout life starting from fetal development to later health-related outcomes. Ideally, it investigates how these factors act independently, cumulatively, interactively over time or at critical times. The optimal study would include prospectively collected data at multiple points throughout the lifecourse entailing data collection for 6-7 decades because of the late onset of most adult health outcomes. In general, cohort studies that include a lifetime of risk factors are not large enough to generate sufficient numbers of cases of any particular disease outcome. Pooling of data from smaller birth cohorts using different methodologies and assessments at different time points

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presents challenges but has potential. Large epidemiologic studies of adults are limited in the amount of early information available from subjects and issues related to recall of the distant past. Most studies have evaluated birth information, body weight over time and other exposures that may be documented. A limited number of cohorts collected dietary and activity data at 2 or 3 time points but used different methodologies at each making it difficult to compare exposures for changes over time and critical time periods. Recent and pending studies may address some needs by encompassing long periods of time and use of intermediate biomarkers as outcomes. Technologic advances in the measurement of diet and physical activity could be employed in future longitudinal studies that encompass long periods and would provide opportunities for studying the role of these exposures over time.

Use of the Automated Self-Administered 24-Hour Dietary Recall (ASA24) in the real world

Amy Subar[1], Beth Mittl[2], Thea Zimmerman[2], Sharon Kirkpatrick[3], TusaRebecca Schap[4], Amy Miller[2], Magdeline Wilson[1], Christie Kaefer[1], Nancy Potischman[1]

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Objective
To describe the use of ASA24 in real-world studies
Methods
Descriptive statistics were generated to summarize usage characteristics of ASA24 across studies.
Results
From September 2011 until July 2015, 1303 studies (28/month) registered to use ASA24 and 125,000 recalls were completed (2733/month). Mean and median numbers of participants/study were 643 and 80, respectively (range: 10-420,000) and mean and median numbers of recalls/participant were 11 and 3, respectively. Mean (median) times to complete with and without the supplement module were 34(27) and 26(21) minutes for the 2011/12 versions and 30(25) and 22(18) minutes for the 2014 versions, respectively. Mean time to complete was higher in first versus subsequent recalls, indicating a learning effect. Mean numbers of foods and beverages reported/day were 13 and 12 for the 2011/12 and 2014 versions, respectively. The percentages of studies using the following options in the 2014 version were: unscheduled logins - 86%; multiple vs. single logins -72% (adults), 58% (kids); midnight-to-midnight vs. past 24-hrs - 63% (adults), 49% (kids); completion time restricted to 24 hrs - 72%. The percentages including optional modules were: supplements - 49% (adults), 34% (kids); location of meals - 80%; source of foods - 36%; with whom meals were eaten - 43%; electronic device use during meals - 44%. Most researchers (80%) were affiliated with academic or government institutions. Applications included epidemiologic, surveillance, intervention and clinical research as well as teaching.
Conclusion
Researchers are making use of the various features of ASA24 to meet diverse research and teaching needs.

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Objective measurements of diet and physical activity using a smart wearable device

Mingui Sun[1]

1 *University of Pittsburgh*

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Recently, wearable electronic devices have emerged and attracted millions of users because they add new functions to those provided by smartphones and tablets. With research grants from the National Institutes of Health in the United States, we have developed a special wearable device called eButton for objective evaluation of diet and physical activity. The size of eButton is similar to a common chest badge or pin, and the weight of this device is only about one-fifth of a smart phone. The face of the eButton is covered by a removable sticker which can be designed personally. Despite its simple and personalized appearance, eButton is a complex miniature computer with a powerful CPU, massive data storage, and wireless functions. It is also equipped with an array of sensors, including a wide-angle video camera, a light sensor, an inertial measurement unit (containing an accelerometer, a gyroscope and a magnetometer), and a barometer. With its wireless links, it can also share sensors within a smart phone, such as a GPS sensor. We have developed data processing algorithms and software to process massive amounts of data, including food identification, portion size measurement, calories and nutrient determination, physical activity identification, and calorie expenditure estimation. The eButton has also been used to measure the heart rate and respiratory rate non-invasively using the ballistocardiogram without any skin contact. We have conducted a series of experiments on human subjects in real lives and demonstrated the usefulness of this multifunctional wearable device.

What do we need to measure and why?

Stewart Trost[1]

1 *School of Exercise and Nutrition Sciences, Faculty of Health, QUT Centre for Children's Health Research, Brisbane, Australia*

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Medical and public health organizations around the globe have identified "moving more" and "sitting less" as key behavioural strategies for disease prevention and health promotion. With this recognition, it is critically important for researchers, clinicians, and practitioners to have access to valid, yet practical measurement tools to quantify free-living physical activity and sedentary behaviour. This presentation will provide a brief overview of existing approaches to measuring physical activity and sedentary behaviour and discuss key issues in the selection of an appropriate measurement tool and associated endpoints . Gaps in our current knowledge base and priorities for future research will be identified.

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How Circadian Rhythms are connected to sleep, meal frequency, and physical activity

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Circadian rhythms are 24‰ oscillations in physiology and behavior, and disruptions have been shown to have negative effects on health. Regular vs. irregular timing of meals improves carbohydrate and lipid metabolism, increases diet-induced thermogenesis, decreases energy intake, increases insulin sensitivity, and decreases plasma cholesterol concentrations. Consequently, for energy balance and metabolic health related food intake assessment, assessment of timing is necessary. Physical activities appear to contribute importantly to circadian rhythms. In addition, timing of sleep, duration, and quality sleep explain BMI, energy balance, and metabolic health in adolescents as well as in adults. Change in sleeping hours was inversely associated with change in BMI during puberty. Total sleeping time and HOMA-IR was inversely associated in prepubertal girls. Change in quality sleep was inversely associated with change in energy balance in adults. Fullness, GLP-1, and insulin sensitivity were disturbed by sleep fragmentation Consequently, in addition assessment of timing of sleeping hours and of quality sleep is necessary, in adolescents as well as in adults. Circadian misalignment over 3 days causes an adapted pattern but different levels of glucose, insulin, and GLP-1 concentrations. Contrarily, circadian misalignment over 3 days does not cause changes in the pattern of melatonin, cortisol and leptin concentrations. Consequently, desynchronisation of food intake takes place, which is a risk factor for energy balance and insulin sensitivity. Taken together, measurement of circadian rhythm, including the measurements of physical activities, sleep, timing and alignment of food intake is necessary to explain energy balance and metabolic health.

Can we improve on the 'Gold Standard'? - Considerations for the DLW approach

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The doubly labeled water method is the gold standard for the measurement of energy expenditure under free-living conditions. It is the generally accepted reference for the evaluation of methods to measure food intake like questionnaires and for methods to assess physical activity like accelerometers for movement registration. The method was first used in humans in 1982 and continues to be improved. Critical aspects of the method are isotope dose, equilibration time, sample frequency, and period of measurement, background isotope changes, sample preparation, and sample analysis. The procedure as adopted in Maastricht includes an isotope dose of 2.25 gram water per kg estimated body water, 10% enriched for 18O and 6% for 2H. Subjects consume the dose at night before bedtime. The equilibration takes place overnight and two urine samples are collected the following morning, in the middle of the period of measurement and at the end, usually after two weeks. Sample preparation is performed by equilibration of the samples with hydrogen for 2H and with carbon dioxide for 18O, and subsequent analysis is performed with an isotope-ratio mass spectrometer. Conclusions from more than 30 years application are: the isotope dose cannot be

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reduced unless there is an independent measure for background isotope changes. Isotope equilibration takes four to ten hours, depending on the size of the subject. The minimal sample number is five, one background and two at the start and end of the period of measurement. The optimal period of measurement for the average adult subject is two weeks.

Symposium Speakers

S02: Advancing Dietary Patterns Research: Levels, Layers and Life Course

Dietary patterns framework: Extending research methods through levels, layers and lifecourse

Susan Krebs-Smith[1]

1 US National Cancer Institute

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Dietary patterns refers to a way of conceptualizing myriad diet exposures as a multidimensional construct. It is significant because the totality of the diet may have synergistic and/or cumulative effects with regard to health. Dietary patterns have traditionally been defined as the quantities, proportions, variety, or combination of different foods, drinks and nutrients in diets, and the frequency with which they are habitually consumed, and accordingly researchers have focused on the nutritional aspects of what individuals are eating at a given point in their lives. An enhanced understanding may be gained from expanding that definition to include additional layers of information other than nutrients or food groups; multiple levels of the environment beyond the individual; and the entire lifecourse rather than a single point in time. Characterizing additional layers, such as timing and labeling of meals, would be relevant for patterns research examining environmental, social, economic, or health effects. The concept of levels is a way of noting distinct points along the food supply chain worthy of exploration, because consumption occurs within the context of a broader food system. Lifecourse is important because diet is dynamic and has the potential to change over days, seasons, and at various times throughout the lifecycle, and we theorize that cumulative exposure or critical periods of exposure may be related to health outcomes. As each of these additional features introduces more complexity to an already inherently complex area of research, a more integrated framework is needed.

Layers: Understanding dietary patterns and diet quality: considering the importance of meal patterns

Sarah McNaughton[1]

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Traditionally, nutrition science has focused on nutrients and foods, and although there has been a recent move towards investigation of dietary patterns, there has been little study of eating occasions or meals, which may be considered the "fundamental unit" of eating patterns. Eating occasions

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('eating event' or 'eating episode') refer to the occasions when food or beverages are ingested. The field of meal patterns research is broad and may cover patterning (includes the frequency, size, timing/time of day, spacing of eating occasions, meal skipping), format (food types and combinations and the sequencing of foods) and context (social context or the situational factors that accompany the meal). A number of methodological challenges have limited research into meal patterns, and associations with diet quality and health. Lack of clear definitions is a major barrier as numerous definitions exist in the literature including those based on time of day, energy content, and the presence of more than one type of food and the presence or absence of other people. Commonly-used dietary assessment methods are limited in their ability to assess meal patterns. Food frequency questionnaires do not provide data on how foods are consumed together in eating occasions. Many existing studies rely on the use of single questions or short questionnaires to assess meals patterns, which often have unknown validity and rarely combine measures of patterning, format and context. Only 24-hour recall methods or food diaries or records can provide the necessary data to examine meals or eating occasions. New technology, using principles of ecological momentary assessment allows real-time data collection in the settings in which meals are consumed and may provide new research opportunities. This presentation will provide an overview of the field of meal patterns research and the domains of meal patterning, meal content and meal context. It will outline future directions in examining meal patterns, diet quality and research examining the correlates or determinants of meal patterns.

Applying the HEI to Multiple Levels of the Food Stream

Susan Krebs-Smith [1]

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The Healthy Eating Index (HEI) is a measure of diet quality, independent of quantity, which can be used to assess compliance with the Dietary Guidelines for Americans. Individuals do not make food choices in isolation. Rather, their eating behaviors are influenced by a myriad of contextual factors, including what types of food are available to them where they live, work, and shop. The food stream refers to the flow of foods from agricultural production, through processing and distribution channels, to the food that ends up on our plates. Characterizing all the "levels" along the food stream allows researchers to build a better understanding of influences on consumer behavior. The HEI is especially valuable in this regard because it can be used to evaluate any mix of foods. Specifically, the index applies equally well to any set of foods along the food stream, including diets of individuals, because it employs a universal set of standards which are density-based. The benefits of using the same index at multiple levels of the food stream can be realized with the HEI, especially if the requisite supporting databases are made available. Collectively, such studies could add to our understanding of the food stream, the influence of different levels on food available to consumers, and the potential impact of environmental and policy changes at each level.

Lifecourse: Enriching knowledge of diet-disease relationships through appreciation of lifecourse influences in dietary pattern change

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Most of our knowledge relating food and nutrition exposures to long-term chronic disease risk comes from epidemiologic studies conducted in adults. Such studies typically assess diet only once, using an instrument that assessed intakes over the last few months or year, which requires an assumption that the reported intakes represent usual intake, at least on a relative scale, over a longer period of time. While knowledge from these studies have been invaluable in establishing food and nutrition guidelines for chronic disease prevention, key aspects of the evolution of dietary habits over the lifecourse suggest that more comprehensive assessment and evaluation will improve our knowledge of the effects of food intake and dietary patterns on long-term health. First, while it is generally accepted that dietary habits are established during childhood and adolescence, dietary patterns may nonetheless change in substantial ways over one's lifetime. Key events over the lifecourse that might result in marked changes in food intake with potential effects on health include the transition from breastfeeding or formula feeding to solid foods; entrance into the school system in childhood; moving from the parental home to an independent living situation during emerging adulthood; establishment of long-term relationships and families; and disease occurrence. In addition, dietary habits before disease may be more or less relevant to prognosis and outcomes than dietary habits after the disease occurs. Second, it is increasingly recognized that there may be key periods over the lifecourse during which susceptibility to the disease is heightened. For example, in breast cancer, exposures, including to nutritional factors, may be of particular importance in the period between onset of puberty and first full-term pregnancy. Finally, food intake assessments that integrate or compare changes over the lifecourse may provide important insights into disease causation. These considerations in variation in dietary patterns can build upon the substantial research in day-to-day or seasonal variation in food and nutrient intake that have informed interpretation of dietary data. Consideration of the lifecourse in health effects of dietary patterns may result in a more refined basis for dietary recommendations.

S07: Open Acess to High Quality Methods in Diet and Activity

The Australasian Child and Adolescent Obesity Research Network tools to guide dietary intake methodology selection

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The challenges of measuring dietary intake contribute to the limited reporting of nutrition data within child and adolescent obesity prevention and treatment research. The Food and Nutrition Stream of ACAORN developed an online decision tool with supporting resources, to guide researchers and practitioners in selecting appropriate diet assessment methods within the context of child obesity research and practice. Development was informed by a literature review and a 9-item

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online survey snowballed to nutrition researchers via existing research and clinical networks (n=69) to consider content and format preferences of end users of the tool. This informed a series of resources, located at www.acaorn.org.au/streams/nutrition/index.php. The tool includes a dietary assessment method selection guide, presented as a series of matrices (outcome of interest; practical considerations; population); quick reference guide detailing dietary assessment methodologies; case studies illustrating selection of dietary methods in different research or practice settings; glossary of common terms; frequently asked questions; and a database of validated dietary assessment tools. The website has had high utilisation and averages over 2900 page views per month to the ACAORN website with >1100 views/month to Food and Nutrition and >704 views/month to assessment methods. Monitoring over time will identify whether there are improvements in the quality of dietary intake assessment methods and reporting within the child and adolescent obesity literature in Australia. Future work will focus on development of an online decision guide for conducting validation studies of dietary assessment methods.

The National Cancer Institute's Dietary Assessment Primer

Susan Krebs-Smith[1], Sharon Kirkpatrick[2], Amy Subar[1], Anne Rodgers, Rebecca Schap[3], Jill Reedy[1], Magdalena Wilson[1], Frances Thompson[1]

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The efficacy of all dietary studies, whether aimed at monitoring a population's diet, understanding diet and health relationships, or evaluating the effect of an intervention, depends on appropriate assessment of intakes. Numerous approaches can be taken, but determining the most suitable dietary instrument for a particular study can be a challenge and is dependent upon a number of considerations, including the specific research question, dietary components of interest, study design, and target population. The Dietary Assessment Primer (http://dietassessmentprimer.cancer.gov/) was designed to provide guidance on the selection of appropriate assessment methodologies for characterizing the intakes of a group or groups and to outline various considerations for the use of each. It describes the major types of instruments that rely on self-report; provides guidance on using the instruments alone or in combination to address different research questions; compares key features of each instrument; explains validity, measurement error, and calibration in the context of dietary assessment; provides expanded information about particular key topics; and includes a Glossary of basic terms and an extensive list of References and Resources. User-centered design principles were applied to developing the web-based interface to ensure optimal usability. In the first 9 months post-launch, the site accumulated more than 8,000 visits (from more than 5,700 unique visitors) and about 27,000 page visits. The Primer can help researchers collect the highest quality dietary data possible given their study resources and constraints, with the ultimate goal of improving our capacity to monitor diets among populations and understand how diet affects health.

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The Population Health Sciences Measurement Toolkit: Easier access to better methods

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The Population Health Sciences Measurement Toolkit provides a web-based, 'one-stop shop' for researchers, actively facilitating uptake of best practice assessment methods across multiple measurement domains: dietary intake, physical activity, anthropometry and body composition, tobacco use, and alcohol consumption. The website provides concise and accessible guidance and decision tools, which enables the professional researcher to choose appropriate assessment methods and thereby maximise the effectiveness of their study design. A 'Methods Selector' tool directs users to validated assessment instruments, either through a series of filters or via a search engine. The database underpinning this facility uses information extracted from hundreds of validation papers and systematic reviews across all six measurement domains. In addition to its signposting functions, the Measurement Toolkit contains multimedia learning and training resources developed during the course of the project. These provide clear, accessible, and practical guidance on how to carry out precise measurements in situations where skill and technique are crucial, such as interviewing or anthropometry. Following a period of web-based peer review, the Measurement Toolkit will be freely available to all web users from October 2015 (beta version). It is hoped that the Measurement Toolkit will encourage better and more efficient knowledge exchange between methodological centres of excellence and the wider research community. Further measurement domains may be added in the future, such as functional measures of physical capacity and performance, nutritional status, or outcome measurements.

S08: Challenges and Opportunities for Measuring Physical Activity in Children

Compliance to objective monitoring protocols in physical activity interventions: Are we capturing enough days and participants to have confidence in our findings?

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Introduction

Poor compliance to objective physical activity monitoring protocols among adolescents is a challenge for researchers, especially those interested in the evaluation of interventions. The aim of this presentation is to describe the wear-time criteria, compliance rates, and characteristics of adolescents who adhere to monitoring protocols in recent school-based physical activity interventions.

Methods

Review of recent school-based physical activity interventions and secondary analysis of data from three Australian studies [i.e., Girls in Sport, Nutrition and Enjoyable Activity for Teen Girls (NEAT) and Active Teen Leaders Avoiding Screen-time (ATLAS)]. Girls in Sport was a school-based intervention designed to prevent the decline in physical activity typically observed during adolescence (N=1518 girls). NEAT and ATLAS were multi-component obesity prevention programs designed for adolescent girls (N=357 girls) and boys (N=361) attending schools in low-income communities. Demographic, psycho-social and behavioral predictors of compliance to monitoring protocols at baseline and posttest were examined using independent samples t-tests in SPSS.

Results

Seven recent school-based interventions targeting physical activity in adolescent populations were identified. Three days with ≥ 10 hours/day were the most common wear-time inclusion criteria. Approximately 50% of participants in adolescent physical activity interventions provide useable data at baseline and posttest. There were no consistent predictors of compliance to accelerometer protocols in the NEAT, ATLAS and Girls in Sport studies.

Conclusions

Compliance to accelerometer monitoring protocols in adolescent interventions is poor. Data appear to be missing at random, but strategies to improve compliance are clearly warranted.

Challenges and opportunities for measuring physical activity and sedentary behaviour in children and adolescents: What do we know and how can we improve compliance?

Dylan Cliff[1]

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Due to the unique behavioural and developmental characteristics of young children (0-5 years), a range of practical and methodological issues need to be considered when objectively monitoring their physical activity and sedentary behaviour. These include, for example, sporadic movement patterns, atypical postures, and the operationalisation of physical activity as including all intensities (light, moderate, and vigorous). This presentation will examine these issues and review recent studies to inform the evidence-guided application of activity monitoring in young children. Key questions include:

i) where should monitors be placed to achieve valid estimates of behaviour and maximise compliance?

 ii) how should sedentary behaviour and intensities of physical activity be defined, and is standing

considered physical activity?

iii) how many days and minutes per day are required to provide reliable estimates of behaviour? Although evidence for some issues has emerged, such as the number of minutes per day and days required for reliable estimates, or the most accurate cut-point-based definitions of activity intensity for common accelerometers, other issues such as the acceptability and accuracy of different body sites for monitor placement require further investigation, and additional evidence is needed: i) among <3 year-olds, and ii) for sedentary behaviour. Implications for the assessment of physical activity and sedentary behaviour in studies of young children will be discussed.

Adolescents' perceptions of the objective physical activity monitoring process: A qualitative exploration

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Background

Research into participants' perceptions of the physical activity measurement process is sparse. The primary aim was to explore adolescents' perceptions of pedometers and investigate their physical activity behaviours.

Methods

The sample included 123 adolescents (14.7 ± 0.5 years) from three secondary schools in NSW, Australia. Schools were randomized to one of three pedometer protocols: i) daily sealed pedometer group, ii) unsealed pedometer group and iii) weekly sealed pedometer group. Participants wore pedometers (Yamax CW700) and accelerometers (Actigraph GT3X+) simultaneously for seven days. Participants were grouped based on their activity level (Low, Medium or High active). Six focus groups, each involving four participants were completed.

Results

A large proportion across all groups purposely changed their levels of physical activity during the monitoring process and believed their peers did as well. The majority (87.5%) of participants reported shaking their pedometers to increase their step counts. In both boys and girls, more participants in the medium and high active groups reported changing their activity patterns than the low active groups.

Conclusion

Over 60% of participants reported changing their activity pattern during the measurement period. Participants in the Low active groups reported less reactivity and tampering than the Medium and High active groups.

Using the SenseWear Armband to assess physical activity and sedentary behaviour

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Purpose

The SenseWear Armband is a pattern-recognition monitor that determines free-living energy expenditure and physical activity. Researchers have used this monitor in child populations. However, as the inclusion criteria used were not evidence based, little is currently known about the reliability of these criteria and children's compliance with monitoring protocols. This study determined how many days of monitoring are needed to reliably estimate children's waking sedentary time and physical activity, and determine children's compliance with monitoring protocols.

Method

One hundred and fifty-two children (50% boys) aged 8-11 years from six schools wore a SenseWear Armband (BodyMedia Inc, USA) for 8 consecutive days. Hourly increments of valid day wear time criteria were examined (days/wk.; 8hrs/day-14hrs/day). Spearman-Brown prophecy formula was used to determine the number of days of monitoring needed to achieve reliability estimates of 0.7, 0.8 and 0.9. The proportion of children providing data for each criteria were identified.

Results

Typically fewer monitoring days were needed as the valid day (hours) criteria became more stringent for most outcomes, though associated decreases in compliance with the protocol were observed. For example, at least 4 days were needed to achieve a reliability of 0.7 for moderate- to vigorous-intensity physical activity, regardless of the definition of a valid day (hrs/day). Ninety-five children (90.2%) provided data using at least 8 hours/day compared to 70.6% for at least 14 hours/day.

Conclusion

Overall, a 7-day monitoring protocol in primary school aged children would provide acceptable reliability for the assessment of all SenseWear outcomes whilst maximising sample sizes.

Challenges and opportunities for measuring physical activity and sedentary behaviour in children and adolescents: What do we know and how can we improve compliance?

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Introduction

This study examined agreement between activPAL3 (AP) and ActiGraph (AG) wrist and hip cut-points for assessing sedentary behaviour (SB) among 5-12 year-old children using direct observation (DO) as the criterion.

Methods

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30 children (9.2±2.1y, 53.3% boys) wore AG on both wrists and the right hip and a thigh-mounted AP while completing 15 5min semi-structured sedentary, light, and moderate-to-vigorous-intensity activities. Posture was classified by AP and coded from video for DO (1s epochs) during activities and transitions (151.9min±36.6). SB was defined using AG wrist cut-points developed for the vertical axis (VA) and vector magnitude by Crouter et al. (CR) and Kim et al. (KI), and for the hip (AG_hip, 25 counts(c)/15s). Analyses examined equivalence of time estimates (equivalence testing), individual level bias (Bland-Altman plots) and misclassification (receiver operating characteristic (ROC) curves).

Results

Although none of the methods were equivalent with DO (68.5min: equivalence range=61.7-75.4), AP (64.5min: 90%CI=58.6-70.5), CR_VA $\leq$.35c/5s; 64.1min: 90%CI=58.7-69.4), KI_VA ($\leq$.1756c/60s) dominant (65.0min: 90%CI=59.4-70.6) and non-dominant (63.8min: 90%CI=58.1-69.6) demonstrated a small underestimation, while AG_hip overestimated SB (80.3min: 90%CI=73.0-87.6). Mean differences were smaller and 95% limits of agreement narrower for AP (4.0min: -9.7-17.7), CR_VA (4.5min: -14.0-23.0), KI_VA dominant (3.6min: -11.2-18.3) and non-dominant (4.7min: -11.6-14.2), compared to AG_hip (-11.8min: -30.0-6.5). Although area under the ROC curve for AP (0.995) and KI_VA dominant (0.884) and non-dominant (0.865) were higher than AG_Hip (0.853), CR_VA (0.787) was less accurate.

Conclusion

On group- and individual-level tests, the AG KI_VA wrist cut-point demonstrated similar agreement to AP and better agreement than AG_hip for estimating SB.

Machine learning approaches for activity recognition and energy expenditure prediction in youth: Are we making any progress?

Stewart Trost[1]

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Accelerometer-based motion sensors have become the method of choice for measuring physical activity (PA) and sedentary behaviour (SED) in children and adolescents. However, despite their widespread use in paediatric research, considerable uncertainty and controversy exists on how to convert accelerometer output into units of energy expenditure or estimates of PA type and intensity. Although machine learning approaches for activity recognition from sensor data are well-established and used extensively in engineering and computer science, the uptake of machine learning methods among exercise science and public health researchers has been slow. Diffusion of innovation theory provides a useful conceptual framework for understanding the process of developing and deploying new approaches to accelerometer data reduction methods. This presentation will review the application of machine learning methods for measurement of PA and SED in children and adolescents. Diffusion of innovation theory will be used to identify points of dissemination failure and potential solutions.

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S10: ISCOLE: Novel Methods for Measuring Physical Activity, Sedentary Behaviours and Sleep

Quality control program for standardizing accelerometry data across 12 countries: The international study of childhood obesity, lifestyle and the environment (ISCOLE)

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The International Study of Childhood Obesity, Lifestyle and the Environment (ISCOLE) is a large multi-national study of 9-11 year old children from low-, middle- and high-income countries. The total sample of ISCOLE includes 7,372 boys and girls, including at least 500 children from each of 12 countries. A unique feature of ISCOLE was the collection of data on physical activity, sedentary behavior and sleep using free-living, 24-hour waist worn accelerometry. The magnitude of effort underlying successful accelerometry data collection, management, and treatment in a large study is prodigious and complex. ISCOLE employed a rigorous data collection and quality control program that included certification of study personnel, web-based training modules and regional in-person training meetings. Further, remote source data verification and site monitoring visits were important components of the quality control program which identified potential inconsistencies in the implementation of the protocol so that corrective action could be taken quickly. As a final step, all accelerometry data collected in the field were uploaded to a central server for processing using standard analytical procedures. The novel tools and resources associated with these innovations are shared openly in an effort to support methodological harmonization and overall advancement of accelerometry in large epidemiological studies.

Novel methods for the assessment of physical activity, sedentary behaviour and sleep: Application in the international study of childhood obesity, lifestyle and the environment (ISCOLE). Patterns and day-to-day variability in accelerometer-determined physical activity in Portugal: Implications for future measurement protocols

Jose Maia[1]

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Using ISCOLE data from Portugal, the following issues will be addressed:
(1) the investigation of inter-individual differences and intra-individual variability in physical activity (PA) levels
(2) the complexities of describing PA patterns.
Using 777 5th grade boys and girls, as well as information at the child, school, family and environmental levels we will use an extension of the mixed-model, the mixed-regression location scale model, to better understand why children are more different than alike, i.e., heterogeneous, in their daily PA and sedentariness levels. Further, we will explore daily intra-individual variability and

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their possible correlates, and will try to identify those children who are more erratic in their PA and sedentariness across a full week. This means a change in focus - from differences between children to the children themselves. The second issue will be around the complexities of physical activity patterns. We will cover the idea of daily segmentation using averages, and will move to the following questions:

(i) what do we mean by PA patterns?

(ii) how can we best patterns using all available data, i.e., all minute-by-minute data?

Variations in graphical displays and their puzzling 'colors' of PA patterns will be presented, and approximate entropy will be presented as a global measure of PA patterns when a time series is used. Finally, global sequence alignments and random projections will also be shown to capture the complexities/subtleties inherent to PA patterns. We will close with a series of thoughts regarding future research in PA patterns and their potential meaning

The utility of time-stamped 24-hour accelerometry data for assessing context-specific physical activity in children

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Over the last decade, interest in activity patterns has broadened from a narrow focus on moderate-to-vigorous physical activity (MVPA) to all parts of the energy expenditure spectrum: sleep, sedentary behaviour (SB), light, moderate and vigorous physical activity. Researchers are aware that each has independent determinants and effects on health. For this reason, the International Study of Childhood Obesity, Lifestyle and the Environment (ISCOLE) used 24-h waist-worn accelerometry to capture the activity patterns of children from 12 countries. This presentation will highlight aspects of the use of 24-h accelerometry data:

-24-h data can capture nonlinear interactions between time spent in different energy expenditure bands, notably in the conjoint contributions of MVPA and SB to weight status.

-New analytical methods are being developed to take account of all energy expenditure bands and their interaction, including energy variation analysis (EVA), cluster analysis, and compositional analysis.

-In addition to the amount of time spent within each band, 24-h accelerometry also allows us to chart the timing of energy expenditure, which may be independently important. i.e. before school, in school or after school activity and associations with obesity.

-24-h accelerometry data also allow us to develop pattern recognition algorithms, which have the potential to identify types as well as volumes and intensities of behaviour.

Accelerometer paradata and implications of a 24-hour protocol for assessing physical activity, sedentary behaviour, and sleep

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A model for reporting accelerometer paradata (process-related data produced from survey administration) collected in the ISCOLE will be presented. ISCOLE employed a 24-hr waist worn 7-day accelerometer protocol using the ActiGraph GT3X+. Checklists, flow charts, and systematic data queries documented accelerometer paradata from enrollment to data collection and treatment. Paradata included counts of consented and eligible participants, accelerometers distributed for initial and additional monitoring (site specific decisions in the face of initial monitoring failure), inadequate data (e.g., lost/malfunction, insufficient wear time), and averages for waking wear time, valid days of data, participants with valid data (≥4 valid days of data, including 1 weekend day), and minutes with implausibly high values (≥20,000 activity counts/min). Paradata can be used to facilitate study management, improve the representative qualities of surveys, track study endpoint attainment, and ultimately anticipate and control costs. In addition, the issues related to separating sleep from other behaviours, daily wear time, and compliance with wear protocol will be discussed. An improvement in wear-time will be demonstrated.

S11: Use of Technology in Dietary Intake and Food Environment Assessment

Dietary biomarkers: State of the art and new approaches for discovery

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Biomarkers provide objective measurements of dietary exposure which may limit biases and errors often associated with the use of dietary questionnaires. They may also provide consumption estimates for foods absent or insufficiently documented in questionnaires and for food constituents for which no food composition table is available. Dietary biomarkers are commonly used to validate dietary assessment tools based on questionnaires, for biomonitoring dietary exposures in populations, and to identify dietary risk factors for chronic diseases. We recently developed Exposome-Explorer, a new database in which information on dietary biomarkers extracted from the scientific literature is systematically curated. Over 200 dietary biomarkers are documented together with information on their state of validation. This limited number of biomarkers cannot describe on their own the high complexity of the human diet. However considerable information on dietary exposures can be found in human biospecimens and still remains largely unexploited. More than 28,000 compounds have been described in various foods, some of them being specific of particular foods or food groups and many of them are absorbed during digestion and found in urine, blood and other biospecimens. They constitute altogether what we called the food metabolome. Recent progress in mass spectrometry and in metabolomics makes today possible the identification of a large diversity of novel dietary biomarkers. Examples will be given on discovery and implementation of such biomarkers in dietary intervention studies and in the European Prospective Investigation on Cancer and nutrition (EPIC) cohort.

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Momentary assessment using technology

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Ecological momentary assessment describes the reporting of experience as close as possible to the time of that experience. It is a method used in behavioural science to try and more accurately capture behaviour without the limitations of retrospective recall, which can be affected by memory, mood and environment. In psychology, application of these methods can be used more accurately capture moods or symptoms associated with mental health issues. Examples of this work will be presented with a summary of the strengths of EMA. However, the potential ability for EMA methods to better measure behaviour extends beyond psychological outcomes to a variety of behaviours including improving the accuracy of dietary assessment. Furthermore, capturing behaviour in real-time also provides the opportunity for just-in-time intervention. Portable technology has extended our ability to use EMA in a variety of settings and for large groups of people than ever. Examples of two apps our team has designed and developed will be used to illustrate how EMA and technology can come together to capture dietary behaviours close to the time of consumption, as well as providing immediate intervention for behaviours that may be problematic. One of these apps will also be used to illustrate the potential to capture both dietary intake and psychological data simultaneously, which may help us to further our understanding of key relationships between mood and intake.

Development of e-DIA Smartphone application for recording food intakes in young adults

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The electronic dietary intake assessment, e-DIA is a Smartphone application (app) that was developed for young adults. It was designed to capture prospective food records using weighed or household measures methods. It removes the burden of dietitian time because all nutritional analyses are completed by the automated system. Eighty participants aged 19 to 24 years-old (38% male) recorded all food and beverages consumed for 5 days. Nutrient and food intakes were compared with data collected using three 24-hour dietary recalls completed on random days during the study period. Food intake data from mixed dishes was apportioned to the respective eight food groups. These groups were fruit, vegetables, cereals, meat and alternatives, dairy and alternatives, discretionary food, discretionary non-alcoholic beverages and alcoholic beverages. Statistical comparisons were made for both nutrients and food groups using Bland-Altman and correlation coefficients on unadjusted, energy-adjusted, and de-attenuated values for nutrients. For macronutrients the de-attenuated correlation coefficients ranged from 0.67, for carbohydrate, to

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0.79 for protein, and for micronutrients from 0.60 for sodium to 0.76 for riboflavin. For food groups correlations ranged from 0.57 for discretionary non-alcoholic beverages to 0.83 for dairy and alternatives. Bland-Altman plots showed wide limits of agreement, but without obvious bias, for all nutrients and food groups with the exception of dairy foods. In conclusion, the e-DIA app shows potential as a dietary assessment research tool for young adults. However, as this group is technologically savvy, it cannot be assumed the findings would be replicated in different populations.

FoodTrack - Development of a systematic australian food composition database

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Current, accurate and comprehensive information on the composition of the Australian food supply is required to be able to monitor changes over time - an important initiative to guide strategies and interventions for public health nutrition. Some of the challenges of collecting such data are that it changes frequently, is time consuming, costly, and can result in poor data quality. To address these issues, CSIRO together with the Heart Foundation have developed FoodTrack: a technology-based tool for collection of information relating to products available in the Australian (retail) food supply. This tool was developed in 2014, and consists of an intelligent smartphone application (app), a cloud-based database, and a web-portal. The app is used to collect product data (e.g. brand, nutrition information panel(s), ingredients, front-of-pack, images, product information), from fresh and packaged foods in major Australia supermarkets. The tool also provides a high level of control throughout data collection, significantly lowers data acquisition costs, and ensures greater market coverage; data collection and auditing time has reduced from approx. 14 minutes per product (using paper-based collection) to approx. 6 minutes with FoodTrack. FoodTrack was first implemented in 2014; using this model we collected nutrition and product data for 13,000+ food products, across all major categories, in Australian supermarkets. The first round of collection was completed in early 2015, and we are currently in the second round of collection, which will be updated annually, allowing tracking of changes to food composition over time.

Measuring diet quality in large community groups

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Dietary guidelines recommend we eat a variety of healthy foods, from a range of food groups. Tools are needed that capture the quality of the whole diet, and not limited to a few food groups. Measuring intake in large samples can be challenging, but with the emerging use of technology, we are getting new and interesting sources of data to understand eating patterns. The CSIRO Healthy Diet Score is a freely available online survey comprised of questions assessing compliance with age-gender specific Dietary Guidelines. The survey asks about the

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(1) frequency and quantity of fruits, vegetables, grains, meat, and dairy; discretionary foods; beverages

(2) quality and variety of foods within food groups.

On completion, individuals receive their score (/100), where a higher score reflects greater compliance with Guidelines. To date 39,452 Australian adults (70% female, average age 42.9 years) have completed the survey, with an average diet quality score of 61. Compliance is greatest for water and variety, and lowest for discretionary foods and dairy. Females report higher diet quality, and quality increases with age. Construction and retail workers are among the lowest scoring, and those in the health industry, research/education the highest. Healthy weight individuals reported a higher diet quality than overweight or obese, and obese males report the lowest diet quality of all groups. It is important community members have access to scientifically developed dietary surveys. The online environment provides a platform to disseminate such tools, but until well established they only compliment more traditional methods of intake assessment.

S12: INFORMAS 1: Benchmarking Food Environments: Country Experiences

Benchmarking food environments: the INFORMAS approach

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The implementation of policies and programs to improve the healthiness of food environments has been slow and patchy despite the overwhelming evidence on the need to act to reduce obesity and diet-related non-communicable diseases (NCDs). Two lines of evidence can help strengthen accountability systems for implementing recommended policies - upstream monitoring of policy and program implementation and case studies of international exemplars for benchmarking progress. INFORMAS (International Network for Food and Obesity/NCD Monitoring, Research and Action Support) was established to help build these lines of evidence internationally and create the networks and tools for their translation for policy-makers. An initial group from 9 universities and 4 global NGOs worked with WHO and FAO to create the monitoring framework which includes 2 process modules (policies and actions of the public sector and private sector), 7 impact modules of food environments (composition, labelling, marketing, price, retail, provision, and trade and investment), and 1 outcome module (diet quality). The foundation papers have been published, module protocols have largely been developed and piloted, and measuring is underway or funded in 7 countries to date. The World Cancer Research Fund has also developed a repository of international exemplars of policies and actions using a framework (NOURISHING) which is very similar to the one used by INFORMAS. The philosophy of INFORMAS is to support countries to gain funding for food environments surveys, work with them on adapting protocols and implementing surveys, and communicate findings through a secretariat based at the University of Auckland and under the auspices of the World Obesity Federation. The ongoing accumulation of data across

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multiple countries will create a powerful evidence resource for accelerating action on improving the healthiness of food environments.

The first national study on food environments and policies in New Zealand

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Unhealthy diets are driven by unhealthy food environments. INFORMAS (International Network for Food and Obesity/non-communicable diseases [NCDs] Research, Monitoring and Action Support) has been established to reduce obesity, NCDs and their related inequalities globally. New Zealand is currently organizing the first, comprehensive national survey on the healthiness of food environments and the public and private sector policies influencing them, as a first step towards global monitoring of food environments and policies. A package of 11 sub-studies has been identified:
1) food composition, labelling and promotion on food packages
2) food prices, shelf space and placement of foods in different outlets (mainly supermarkets)
3) food provision in schools/early childhood education (ECE) services and outdoor food promotion around schools/ECE services
4) density of and proximity to food outlets in communities; food promotion to children via
5) television
6) magazines
7) sport club sponsorships
8) internet and social media
9) analysis of the impact of trade and investment agreements on food environments
10) government policies and actions
11) private sector actions and practices.
For the sub-studies on food prices, provision, promotion and retail, 'environmental equity' indicators have been developed to check progress towards reducing diet-related health inequalities. Food environment surveys are important because of the very 'upstream' approach they take and their direct policy relevance. The detailed protocols will be offered to and adapted for countries of varying size and income in order to establish INFORMAS globally as a new monitoring initiative to reduce obesity and diet-related NCDs.

Quantifying the world's packaged food supply: Challenges and opportunities

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A massive expansion in the supply of cheap, palatable, nutrient-poor, energy-dense foods, in conjunction with food distribution systems that make food more convenient and accessible has underpinned the shift in consumption patterns we see today. It has become more common that a large proportion of people's diets is increasingly obtained from manufactured sources, in both developed and now developing countries. These highly process foods are the primary drivers of increases in consumption of adverse nutrients as well as the obesity and non-communicable disease (NCD) epidemic. The monitoring approach seeks to systematically collect information on high-level contextual factors influence the composition of food, and assess the energy density, salt, saturated fat, trans fat, and portion sizes of highly processed foods for sale in retail outlets (primarily packaged foods from supermarket chains). The objective of this paper is to describe some of the opportunities and complexities faced in monitoring and evaluating the nutritional composition of food products and what it means for population health. Surveys have already been undertaken in several high- and middle-income countries, and the trends have been valuable in informing policy approaches. The purpose of collecting data is not to exhaustively document the composition of all foods in the food supply in each country, but rather to provide information to support governments, industry and communities to develop and enact strategies to curb food-related NCDs and create healthier food environments.

Benchmarking food environments: Thailand experience

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Background

Thailand has undergone a dramatic change in food environments and an increase in obesity and non-communicable diseases. However, there is no clear evidence to assist Thai Government to develop evidence-informed activities to promote healthy food environments. This study aimed to assess key characteristics of food environments in Thailand and implementation of food environment policies and actions by Thai Government.

Methods

This study adapted an INFORMAS protocol to the Thai context. The assessment of food environments in the study were broken down in four separate sub-studies:

1) survey on food provision and food retail in school setting
2) survey on food composition, food labelling, and food prices in major supermarkets
3) survey of advertising food products in free TV and digital TV children programs
4) desk review of impacts of international trade on availability of unhealthy food products.

The assessment of food environment policies and actions adapted the INFORMAS Food-EPI tool to assess the current level of implementation of government policies and actions in creating healthy food environments against international good practice benchmarks using rating workshop with non-government organizations and academia. A few additional steps were included: Thai experts' consultation on appropriateness of domains and indicators for Thai context, forward and back translation of the tool, and rating workshop with government organizations. Dissemination: Various strategies (e.g. academic publications, report, policy brief, press release and meetings) will be used

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to communicate the findings to Thai policy makers, stakeholders and public. Keywords: assess, food environments, policies, Thai Government, INFORMAS

Monitoring of food retail environment in Fiji: Piloting of protocol

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Introduction

An obesogenic food environment is an important factor in poor diets. In the Pacific Islands, understanding the environment is critical. This paper presents an approach to monitoring the store food aspect of environment, tailored for the Pacific Islands.

Aim

To pilot in Fiji a tool for assessing and monitoring the food retail environment.

Methods

The approach was based on an existing framework (INFORMAS). Two areas in Suva, Fiji were selected for the pilot. Density of retail outlets and product types available within largest retail outlets were collected based on 10 categories. Additionally, linear shelf space was measured for selected 'healthy and less healthy' food items in the largest supermarket in each of the census areas. Number and type of retail outlets were summarized, with information about its proximity to schools, parks and residential areas.

Results

Fruit and vegetable stalls (84), smaller grocery shops (44), and sweets and bean carts (28) were most common. Supermarkets were located closer to town centres, smaller shops were found more along residential areas. In both supermarkets, the ratio of 'less healthy' foods (e.g. Fizzy drinks, salted snacks) to healthy ones (e.g, water, fresh fruits and vegetables) was 1:2-1:3. Confectioneries, sugar sweetened beverages, cookies, chips, noodles were most common at the end of the aisle.

Discussions and Implications

This study has successfully tested a protocol that is appropriate and effective to use in Fiji for monitoring of food retail environment.

S14: New Developments in Statistical Modelling to Mitigate Effects of Diet and PA Measurement Error

Design and analysis of dietary validation studies when true intake is modeled as a time-varying process

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Most statistical methods that adjust analyses for dietary measurement error treat an individual's usual intake as a fixed quantity. However usual intake, if defined as average intake over a few months, varies over time. We describe a model that accounts for such variation and for the proximity of biomarker measurements to self-reports within the framework of a meta-analysis, and apply it to the design of validation studies and to the analysis of data on energy, protein, potassium and sodium from a set of five large validation studies of dietary self-report instruments using recovery biomarkers as reference instruments. We show that this time-varying usual intake model fits the data better than the fixed usual intake assumption. Using this model, we estimated attenuation factors and correlations with true longer-term usual intake for single and multiple 24 hour dietary recalls (24HRs) and food frequency questionnaires (FFQs) and compared them with those obtained under the 'fixed' method. Compared to the fixed method, the estimates using the time-varying model showed slightly larger values of the attenuation factor and correlation coefficient for FFQs and smaller values for 24HRs. In some cases the difference between the fixed method estimate and the new estimate for multiple 24HRs was substantial. With the new method, while four 24HRs had higher estimated correlations with truth than a single FFQ for absolute intakes of protein, potassium and sodium, for densities the correlations were approximately equal. Accounting for the time element in dietary validation is potentially important, and points towards the need for longer-term validation studies.

Time-varying models for longitudinal data measured with error, with application to physical activity and sleep

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Modern accelerometers provide interesting and objective longitudinal data on different characteristics of physical activity that may influence important health outcomes. Those characteristics may fluctuate over a short span of time due to life demands, and their dynamic nature at the individual level is often of principal interest. The current research is motivated by the problem of estimating the temporal effect of moderate and vigorous physical activity on sleep using accelerometry measurements. We analyze weekly data from the BodyMedia study of 3650 women and 1009 men who wore accelerometers continuously for 12 consecutive weeks. On an appropriate scale, we propose a joint multivariate linear mixed model when both the exposure and bivariate outcome (lying down minutes and sleep minutes) vary over time and are subject to measurement error. To accommodate the possibility that heterogeneities in person-specific trajectories in physical activity and sleep characteristics may be related, we allow random effects in the corresponding parts of the model to be correlated. This correlation leads to important differences among the individual-level (or within-person), between-person, and population-level (or marginal) effects, as is exemplified by our data. Our simulations also demonstrate that ignoring correlated random effects, as is common in the mixed model approach to longitudinal data that are subject to measurement error, leads to substantial biases in estimated exposure effects.

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Integrating metabolomics in the measurement error arena

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Statistical procedures to correct for exposure misclassification the relationship between diet and the risk of disease, like linear regression calibration (LRC), rely on the comparison between reference measurements, often 24-hour dietary recalls or weighed food records, and assessments of habitual intake, usually food frequency questionnaires. The accurate use of LRC is conditional on a number of assumptions, which in practice are not fulfilled. Based on evidence from the OPEN and the EPIC cross-sectional studies the performance of LRC to provide accurate estimates of risk association was evaluated. Under scenarios involving two or more error-prone variables, the bias could be substantial. Methods have been proposed to introduce objective measurements of intakes, like biomarkers of intake. Although extensive research, the list of concentration biomarkers remains rather limited. In this work metabolomics was used for biomarker discovery. The European Prospective Investigation into Cancer and Nutrition (EPIC) cross-sectional study offered the unique opportunity to measure the urinary excretion of 36 individual polyphenols measured using UPLC-ESI-MS-MS. A single 24-h urine sample was collected the same day of the 24-hour dietary recall (24-hdr) in 475 participants from 9 centres in 4 European countries (France, Germany, Greece, and Italy). Reduced rank regression models were used to relate mixtures of urinary polyphenols to the intake of specific 24-hdr food groups, for the identification of composite biomarkers. The level of agreement with 24-hdr and questionnaire measurements was evaluated in measurement error models, and findings and discussed. This strategy offers a promising way to identify biomarkers of dietary intake using information from a large number of metabolites. This analytical strategy finds natural applications in observational investigations, possibly beyond the use of urinary samples.

Measurement error, nutritional surveillance and epidemiology, and the evaluation of complex multivariate dietary pattern scores such as the HEI-2010

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Dietary pattern scores such as the Healthy Eating Index, the Alternative Healthy Eating Index and others represent summaries of complex, multivariate dietary patterns involving ratios to various dietary components, multivariate variables that equal zero with great frequency, complex patterns of inter-correlations, etc. Uncertainty in the measurement of diet (measurement error) in these

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situations can lead to many issues, including for example significant under-estimation of the percentage in a population of those with poor diets, underestimation of cancer risk, etc. We will describe a new framework for adjusting for these uncertainties, and point to flexible SAS software than can be used for both surveillance and epidemiology.

S18: INFORMAS 2: Benchmarking Food Environments: Key Challenges and Future Directions

Measuring cost and affordability of healthy and less healthy diets globally

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The INFORMAS food prices module proposes a step-wise framework to measure the cost and affordability of population diets. The price differential and tax component of healthy and less healthy foods, food groups, meals and diets will be benchmarked and monitored over time. Results can be used to model or assess the impact of fiscal policies, such as fat taxes or subsidies. Key methodological challenges include: defining healthy and less healthy foods, meals, diets and commonly consumed items; including costs of alcohol, takeaways, convenience foods and time; selecting the price metric; sampling frameworks; and standardizing collection and analysis protocols. The minimal approach uses three complementary methods to measure the price differential between healthy and less healthy foods. Specific challenges include choosing policy relevant pairs and defining an anchor for the food lists. The expanded approach measures the cost of a healthy diet compared to the current (less healthy) diet for a reference household. It requires dietary principles to guide the development of the healthy diet pricing instrument and sufficient information about the current intake of the population to inform the current (less healthy) diet tool. The optimal approach includes measures of affordability and requires a standardised measure of household income that can be used for different countries. The feasibility of implementing the protocol in different countries is being tested in New Zealand, Australia and Fiji. The impact of different decision points to address challenges will be investigated in a systematic manner. We will present early insights and results from this work.

Approach for monitoring the corporate political activity of the food industry

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Large companies in the food industry have significant economic power, and this translates readily into political influence. There is currently a risk that the political influence of the food industry results in public health policies that do not adequately balance public and commercial interests. There is thus a need to increase the transparency and accountability of governments and the food industry in relation to public health policies. Here we present a framework for categorising the corporate political activity of the food industry with respect to public health, and propose an approach to systematically identify and monitor it. The proposed framework includes six strategies used by the food industry to influence public health policies and outcomes: information and messaging; financial incentive; constituency building; legal strategies; policy substitution; opposition fragmentation and destabilisation. We propose that the corporate political activity of the food industry could be identified and monitored through publicly available data sourced from the industry itself, governments, the media and other sources. Steps for country-level monitoring include identification of key food industry actors and related sources of information, followed by systematic data collection and analysis of relevant documents, using the proposed framework as a basis for classification of results. We present initial results from implementing the approach in Australia and Fiji. This is supplemented by results from interviews with key informants in each country that aimed to assess the feasibility and value of the approach.

Measuring exposure of children to unhealthy food marketing through new media

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New media refers to digital technologies, including the Internet and mobile devices, which offer unmatched opportunities for food companies to engage with young people. The use of new media for marketing purposes has allowed companies to broadcast unprecedented volumes of branded information, enabled highly segmented target markets and customisation of messages, and blurred the line between commercial and non-commercial content. With advancement of the Web as a participatory space, brand messages are now co-created through user-generated content. This presentation will explore the emergence of food marketing using new media; the potential impact of this marketing on young people's food preferences and choices; and approaches to, and challenges of, collecting and assessing data on new media food marketing. A range of innovative approaches are available for systematic assessment of new media marketing exposure, but these are as yet untapped by public health researchers. Content analyses of social media and websites are most common, and indicate techniques used by marketers to engage young people. A recent assessment of Facebook food promotions will be discussed. Monitoring the extent and nature of food marketing through new media channels is an essential first step in identifying the potential scope of young people's exposure to these promotions, and for increasing the accountability of industry for responsible marketing and of governments for protecting children from the harmful effects of this marketing.

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The potential of crowdsourcing for monitoring food environments

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About one-third of children are now overweight or obese in New Zealand. The implementation of a comprehensive package of strong policies at the national level to reduce childhood obesity typically takes time and is particularly difficult when the political climate for it is not optimal. To date, the pressure for action to reduce obesity has been predominantly elite (i.e. health professional driven), not grass-roots (i.e. public driven), and this is part of the reason that there has been little policy action. While polls suggest that most of the public are supportive of policies to improve the healthiness of food environments, it is a quiet support, and strategies, tools and processes are needed to effectively convert that support into vocal demands for increased and stronger actions to reduce obesity. Foodback[©] is a new initiative to engage and empower people for healthier community food places. It involves the development of a smartphone app for crowdsourcing data on the healthiness of foods advertised and sold in local community settings (i.e., schools, hospitals, supermarkets, takeaways, sport clubs) and outdoors (i.e., around schools). The data will be fed back automatically to local 'change agents' (i.e., Council members, local members of Parliament, schools, retailers, sport clubs) in the form of star ratings, awards and comments. This way, settings and communities can be benchmarked against each other. Foodback aims to empower New Zealand people to encourage and support local 'change agents' to make positive, healthy changes to foods advertised and sold in their community and specific settings.

The challenges of achieving locally relevant but internationally comparable data on school food environments

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This INFORMAS module outlines a step-wise framework for monitoring foods and beverages provided or sold in publicly funded institutions, with the main focus on schools, although it was intended that the framework could also be applied to other publicly funded settings. The monitoring framework consists of two components: in component I, information on existing food or nutrition policies and/or programmes is compiled; while in component II, the quality of foods actually provided or sold is evaluated relative to existing national or sub-national nutrition standards or voluntary guidelines. Currently, nutrition standards and voluntary guidelines associated with school feeding programs vary widely globally and there are currently no globally accepted standards available to determine the optimal nutritional quality of foods that should be provided. In Canada, school food standards have been established by each province or territory, with standards ranging from non-existent to several which were quite comprehensive. In February 2014, the Provincial Ministers of Health jointly released a Guidance Document for Nutrient Criteria for Foods and Beverages in Schools. Criteria were established based on Canada's Food Guide and the IOM Dietary

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Reference Intakes, with additional restrictions on added sugars. Using the Informas approach, which includes measurement indicators within 'minimal', 'expanded' and 'optimal' approaches that can be used to monitor progress in meeting policy objectives, and facilitate comparisons between countries, component I or the policy analysis was completed for this national standard. Nutritional criteria components were then assessed relative to the *Health Canada Food Surveillance Tier System* and the *WHO Regional Office for Europe Nutrient Profile Model*. Results from this pilot study indicate the need for common nutrient profiling systems to evaluate the "rigour" of existing national programs and to facilitate internationally relevant comparisons which are still relevant to the national situation. Funding: Burroughs-Wellcome Foundation and Earle W. McHenry endowed research chair unrestricted research funds for "Food and Nutrition Policy for Population Health", University of Toronto (ML).

S22: Physical Activity Interventions: Limitations and Improvements

Assessing cardiopulmonary fitness in chronic disease populations

Ross Arena[1]

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Assessing cardiorespiratory fitness provides a wealth of information that can be used to:
1) Assess prognosis
2) Diagnose pathophysiologic mechanisms that limit exercise performance and the severity of such conditions
3) Gauge therapeutic efficacy
4) Develop an individualized exercise prescription.
The most accurate way to determine aerobic capacity in through exercise testing with ventilatory expired gas analysis, otherwise known as cardiopulmonary exercise testing (CPX). In addition to a precise determination of maximal/peak oxygen consumption, a wealth of other data is obtained including:
1) Degree of subject effort
2) Ventilatory efficiency
3) Pulmonary function
4) hemodynamics and electrocardiography
5) symptomatology
Currently, CPX is most commonly used in patient populations, oftentimes with suspected or confirmed chronic conditions; the heart failure population is well-characterized by CPX. Numerous investigations have demonstrated the robust prognostic value of CPX in patients with heart failure; aerobic capacity and ventilatory efficiency are amongst the strongest prognostic markers. Use of CPX to assist in defining the mechanism of unexplained exertional dyspnea is also commonplace in current clinical practice. We are starting to gain a fuller appreciation of the other patient populations where CPX is of high value including:
1) Suspected or confirmed pulmonary hypertension

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2) Suspected myocardial ischemia

3) Chronic obstructive lung disease or interstitial lung disease

4) Valvular disease/dysfunction

5) Numerous pre-surgical populations

Recent scientific statements have attempted to streamline CPX assessments in a way that is evidence-based and individualized to test indication. This presentation will highlight the value or CPX in chronic disease populations.

Cardiorespiratory fitness registry initiatives in the United States

Leonard Kaminsky[1]

1 Ball State University, Indiana, USA

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Cardiorespiratory fitness has long been considered a valuable measure of an individuals' functional capacity as it has been shown to be related to health and quality of life. In the past few decades, the evidence has expanded to support the importance of cardiorespiratory fitness for predicting adverse health outcomes. This was highlighted by a large meta-analyses showing significantly higher risk of mortality for those with low cardiorespiratory fitness. This growing evidence-base led the American Heart Association to issue a Policy Statement calling for the development of a cardiorespiratory fitness registry in the United States. This presentation will review the process followed to develop this registry and the current status of the registry. This registry is focused on data collected using cardiopulmonary exercise testing with directly measured peak oxygen consumption. An overview will be provided of the development of the registry board, the criteria for laboratories/centers contributing data, the specific variables to be included in the registry, the establishment of a core laboratory-data center, the process for data transfer, and the plans for assessment and reporting. A preliminary summary of data from >7500 exercise tests in adults ranging in age from 20-79 years, with cardiopulmonary measurements will be provided. The presentation will finish with an overview of potential uses of these data and plans for expansion of the cardiorespiratory fitness registry.

Cardiorespiratory fitness registry initiatives in Europe

Marco Guazzi[1]

1 Heart Failure Unit, University of Milano, Milano, Italy

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In western countries the burden of cardiovascular (CV) risk is continuing to increase with levels of cardiorespiratory fitness (CRF) that very well mirror the growing trend. Obesity and lack of physical activity are both major precipitating factors for low levels of cardiorespiratory fitness (CRF). Registries of cardiorespiratory fitness are a challenging task for the definition of best strategies to CV preventive interventions. Although currently there are no formal multicenter CRF database that provide a sufficiently representative sample of the EU population, some collaborative data on CRF in Europe are now been drafted. One of the most recent and comprehensive database is the EURO(pean) EX(ercise) Population-Based Study. This multicenter study is aimed at assessing CRF by

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cardiopulmonary exercise testing (CPX) expanding the assessment of maximal functional capacity beyond maximal oxygen consumption and looking at all ventilatory and metabolic measures that are integral part of the test and may become abnormal early before a loss in exercise performance and VO2 max. Specifically, the EURO-EX trial has the following multifold aims: a) to detect the level of CRF for different levels of CV risk in different sample of populations across Europe; b) to define the rate of potential abnormal exercise gas exchange phenotypes that may bear predictive insights; c) to compare the predictive ability of CPX-derived variables vs standard cardiovascular risk factors; d) to propose a new SCORE that would include VO2 and exercise gas exchange variables as risk predictors. This presentation will be focusing on available evidence so far accumulated prospecting planned new directions for the years to come.

Emerging assessments of cardiopulmonary fitness: Respiratory muscle performance

Lawrence Cahalin[1]

1 University of Miami, Miami, FL, USA

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Respiratory muscle performance (RMP) is an important determinant of physical activity (PA) and cardiopulmonary fitness (CPF) in health and disease. In fact, inspiratory muscle weakness (IMW) was found to be a significant independent risk factor for myocardial infarction and cardiovascular disease and a nearly significant independent risk factor for stroke in a large study of almost four thousand apparently healthy subjects age 65 and older at baseline. IMW remained a significant independent risk factor even after controlling for age, gender, smoking status, anthropometric indices, left ventricular mass, lipids, and systolic blood pressure. Furthermore, in this same study IMW was significantly correlated to C-reactive protein, fibrinogen, and white blood cell count in a negative direction and positively related to serum albumen. Additionally, a study examining the effects of habitual exercise on RMP in older adults found that a significant amount of elevated fitness may be accounted for by increased inspiratory strength and endurance. PA was also recently found to be significantly correlated to inspiratory muscle performance (IMP) in 120 apparently healthy subjects. Additional measures of inspiratory muscle performance (IMP) have been developed of which the sustained maximal inspiratory pressure (SMIP) appears most associated with PA and CPF in health and disease. Assessment of expiratory muscle performance has been limited, but a growing literature suggests that it is also related to PA and CPF. This presentation will highlight the value of examining RMP and methods to improve IMP with the goal of improving PA and CPF.

S25: Traditional Methods vs New Technologies: Dilemmas for Dietary Assessment in Population Surveys

Traditional methods vs new technologies: dilemmas for dietary assessment in population surveys

Carol Boushey[3], Birdem Amoutzopoulos[1], Toni Steer[1], Caireen Roberts[2]

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Technology is expanding the menu of assessment tools used by researchers and practitioners to assess exposures related to health and disease. This expansion in choices allows researchers to consider new options, traditional options, or a combination of options within the context of resources, target audience, and study aims. Tested and emerging applications developed as part of an interdisciplinary research team to improve dietary assessment methods using images and mobile devices will be highlighted. Just as methods being used for years have particular shortfalls, new technologies have unique challenges to consider prior to adoption.

Use of new technologies for dietary assessment in population surveys: Experience from the UK

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1 MRC Human Nutrition Research, Cambridge, UK
2 NatCen Social Research, London, UK

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Can new technologies for dietary assessment meet the needs of running population surveys? This is a challenging question to address when it comes to large population studies. In the UK, the National Diet and Nutrition Survey Rolling Programme (NDNS RP) provides the only source of high quality nationally representative data on the types and quantities of foods eaten by people aged 1.5 years and older living in the UK. Diet in the NDNS RP is currently assessed using a paper based 4-day estimated food diary. Recent technological advances are offering opportunities to possibly enhance the way in which dietary information is captured. However, new technologies have predominantly been used and validated in smaller intervention studies often in specific groups of the population. As little evaluation work has been carried out in large settings, it has so far, not been possible to make a decision on fully or even partially replacing the current method in NDNS RP with a new technology. Further research on feasibility, quality assurance, cost-effectiveness and validation on new technologies is required for this decision to be made. This talk will discuss the strengths and weaknesses of traditional dietary data collection methods vs new technologies used in population surveys, with a focus on the UK NDNS RP. Options for the way forward in this particular area of dietary assessment work will also be addressed.

New technologies for dietary assessment: An Australian Case Study

Clare Collins[1]

1 University of Newcastle, NSW, Australia

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n Australia National Nutrition Surveys have been conducted infrequently and have most commonly used 24hr-recalls. This resource intensive method provides the only high quality nationally

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representative data on the types and quantities of foods eaten by people living in Australia. Recent technological advances means it is possible to optimise the way in which dietary information is captured, while lowering the cost and analytic burden. Combination approaches could potentially be used in large population surveys as a strategy to reduce burden, contain costs and allow for more frequent assessment of population dietary data. Use of technology also provides the opportunity to streamline data collection processes, provide individualised feedback and potentially enhance user experience. We have developed a suite of food frequency questionnaires (FFQs) (adult, children/adolescent, toddler versions), generically called the Australian Eating Surveys (AES) and validated them against other methods of assessing dietary intake, including using biomarkers of fruit and vegetable intake, fat intake and total energy intake. We have automated the data capture, analysis and interpretation procedures by converting these tools to online versions and then providing personalised feedback reports in real-time. We have also validated a brief diet quality index, the Australian Recommended Food Score (ARFS) as a summary variable for use in research and have placed it online in a freely available version that provides brief real-time feedback on diet quality to users, in a format called the Healthy Eating Quiz. How these technological developments could be used at the population level will be discussed.

A Web-based tool for Dietary Assessment compared with paper-based pre-coded food records

Ellen Trolle[1]

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A Web-based Dietary Assessment tool was developed as part of a school-based intervention study (the OPUS project). It was well tested during development and extensively validated, using biomarkers and observation. The web-based tool was further developed for the National dietary survey among infants and young children 2014-15. Experience with implementing the tool and with the 7 day pre-coded paper-based food record used among infants and children in previous Danish national dietary surveys is compared. Using the new technology is not a way to cut expenses (interviewers, paper, processing personnel etc.). It might be a way to advance dietary assessment, in terms of standardization, more detailed choice of food and of portion size estimation (photos). However, using web-recording introduces changes in the work load, and in order to keep good data quality or improve it, important tasks will remain such as in-person contact for background interview and instructions in recording the food intake. Furthermore, the work on food lists and quantification tools changes. Careful food naming (incl. synonyms) is important to utilize the good searching facilities and automated prompts which substitute the overview of the pre-coded foods in the paper-record. In addition printing, distributing and collecting the paper-records are replaced with IT-support (hotline if participants get stuck), checking recording progress and providing reminders. The intensive work with scanning and justification of the paper-records is reduced to data checks and corrections of mis-recordings. Flexibility of the tool is important to make it easy and intuitive for different target groups.

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Challenges in dietary assessment in the Netherlands

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The current dietary assessment method in the Dutch food consumption survey (2012-2016) is based on two 24-hour dietary recalls on two non-consecutive days. For the youngest and older age groups this method is supported with diaries. The 24-hour dietary recalls are obtained with purpose-designed computer software (GloboDiet, previously known as EPIC-Soft). The survey provides insight into the consumption of foods, the intake of energy, macronutrients and micronutrients, exposure to potentially harmful chemical substances and also into dietary trends of a population. This is necessary to effectively develop and evaluate health, nutrition and food safety policy. Our method is in line with current European guidelines for harmonizing data collection on food consumption. In preparation of a new Dutch national food consumption survey in 2018 we started to explore our main challenges of possible scenarios for the future including new technologies for dietary assessment methods. We will share our main challenges and scenario's during ICDAM.

Free Communications

Theme 01: Measuring Diet in Children and Families

Children 3-10 years old can capture eating occasions using the mobile food record

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3 *School of Electrical and Computer Engineering Purdue University, Lafayette, USA*
4 *School of Public Health, Curtin University, Perth, Western Australia*
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Traditional dietary assessment methods for children are challenging related to developmental stages and abilities. Image-based dietary assessment methods, such as the mobile food record (mFR) may alleviate challenges. Two samples of children 3-10 years old attending summer camps in Guam used the mFR to capture images of eating occasions. Children in Sample 1 were tasked to use the mFR to capture one eating occasion at camp and complete a mFR feasibility and usability questionnaire. For Sample 2, children were tasked to record all eating occasions for two consecutive days at two time periods 2-4 weeks apart. Trained analysts evaluated images. In Sample 1, 70% (40/57) of children completed the task as instructed, i.e. including food and/or beverages and the fiducial marker in the before and after images. Majority of children positively responded to the mFR questionnaire. Children in Sample 2 captured 6.21±4.65 (mean±SD) image pairs for a mean of 2.4 (SD ± 1.2) days at Time 1 and 5.65±3.26 (mean±SD) image pairs for a mean of 2.8 (SD ± 1.1) days at Time 2. Seventy-five percent (47/63) of children took images at both times. Older participants and girls were more

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likely to use the mFR longer and more regularly, respectively. All children (126/126) in both samples returned mFR intact. This study is the first to evaluate the use of the mFR among young children as well as capture self-reported dietary intake among children this age. Results support the potential for children to independently self-record dietary intakes using the mFR.

Effect of model parameters on the development of food-based recommendations using linear programming

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Optifood is a tool developing food-based recommendations (FBR) by linear programming. Model parameters are based on dietary pattern, comprising common foods, portion sizes and consumption frequency. The effect of differences in model parameters between studies is unknown. Using repeated 24-h recalls of 62 Kenyan children (4-6y) median portion sizes were calculated. Minimum and maximum consumption frequencies were defined as resp. 5th and 95th percentile of the distribution. Optifood was used to develop FBR and identify problem nutrients. Model results using first recalls and foods consumed by >3% of the children were compared with repeated recalls and foods consumed by >10%. Using a single recall including foods consumed by >3% of the children, the FBR consist of starchy plant foods, vitamin A rich fruit, fortified milk, oil, and small fish each for 7 times/week. The food list contained 48 foods; problem nutrients were vitamin A and zinc. Using foods consumed by >10%, the food list reduced to 26 foods and additional problem nutrients were folate and fat. (Sub)food groups bread, starchy plant foods, fortified milk, vitamin C rich fruit and fish were not included. Using repeated recalls, the food list increased to 57 foods. No additional problem nutrients were identified. The subfood groups nuts and eggs were added. Maximum frequencies of (sub)food groups bread, starchy plant foods, fortified milk, vegetables, fruit and fish & eggs decreased. Compared to single recalls, portion sizes decreased for 19 foods and increased for 18 foods. Differences in defining model parameters affected food based recommendations identified through linear programming and should be further standardised.

Prevalence of energy intake mis-reporting in Malay children and their parents: Findings from the family diet study

Wai Yew Yang[1,2], Tracy Burrows[1], Lesley MacDonald-Wicks[1], Lauren Therese Williams[1,3], **Clare Elizabeth Collins[1],** Winnie Siew Swee Chee[2]

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3 *Griffith University, Gold Coast, Australia*

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The degree of energy intake mis-reporting among Malaysian population has rarely been investigated due to a lack of agreed methods for identification of accurate reporters. In the absence of direct measures of total energy expenditure, cut-points can be used to identify potential mis-reporters. This cross-sectional study aimed to identify the prevalence of energy mis-reporting in a sample of

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urban Malay families. The Family Diet Study was conducted at five national primary schools for Malay children aged 8 to 12 years and their main carer(s). Information on socio-demographic, dietary intake and anthropometric measures were collected. The Malaysian-specific basal metabolic rate equation and Black and Cole cut-points were applied to the data. Of the 315 families enrolled, 236 completed all measures (children, n=236; fathers, n=92; mothers, n=182). Up to 53% of mothers were classified as under-reports, followed by fathers (34%) and children (23%). Significantly more children and mothers from obese category were identified as under-reporters [p<0.001; children (46%), chi-squared=35.46; mothers (70%), chi-squared=26.7364]. Over-reporting of energy was most common in children (17%) compared to parents [fathers (7%); mothers (3%)], with child's energy reporting category not aligned to their parents (p>0.05). Results demonstrate that under-reporting amongst obese children and obese mothers is common within urban Malay families. Such findings could confound the interpretation of diet and obesity research in Malaysia. Further work is warranted in the area of dietary assessment to characterise reporting bias in this population and to minimise the impact of energy mis-reporting in research.

The youth compendium of energy expenditures: Review and update

Kate Ridley[1], Natasha Schranz[2], Janet Fulton[3], David Berrigan[4]

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Background

The Youth Compendium of Energy Expenditures (EE) was published in 2008. Despite the growing use of device based physical activity (PA) measures, self-report provides vital information about the type and context of PA. Converting self-reported PA to MET scores contributes to the analysis of PA data from diverse sources including surveys, epidemiological studies and time use research. The aim of this study was to conduct a systematic review of the energy costs of youth PA to expand and update the Compendium.

Methods

A systematic review undertaken in March 2013 located published studies that provided energy cost data on individual activities measured using criterion methods of EE in youth aged <18 years. Relevant demographic and energy cost data were extracted. All energy costs were converted to the common metrics of gross VO2 ml.kg-1.min-1 and child-specific METs (gross VO2 / RMR predicted from Schofield's age and sex specific equations).

Results

The search generated 11,606 articles for review. Walking, running and cycling formed separate datasets. An additional 71 eligible studies not included in the 2008 Compendium were identified. These studies reported energy costs in youth aged 4.7-17.3 years. Of the new studies identified, active video games (23% of new studies) and sedentary screen time (18%) were the most frequently measured activities.

Discussion/Conclusion

Despite a significant increase in published energy cost data, gaps remain. Many of the studies

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appearing in the last six years measured active video games. However, sporting and playground games have still not been adequately measured.

Correlates of food-item reporting accuracy by fourth-grade children in 24-hour dietary recalls

Albert F Smith[1], Suzanne D Baxter[2], David B Hitchcock[2], Caroline H Guinn[2], Julie A. Royer[2,3], Christopher J. Finney[2,3], Alyssa L Smith[2], Megan P Puryear[2]

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Some evidence shows that dietary reporting error is associated with such stable characteristics of respondents as sex, cognitive ability, socioeconomic status (SES), body mass index (BMI) percentile, and social desirability. In an experiment to investigate the manipulated effects of retention interval and prompts on children's dietary reporting accuracy, we measured or obtained values for these variables. (Academic achievement, from standardized test scores, was a proxy for cognitive ability.) Fourth-grade children were observed eating school-provided breakfast and lunch, and later provided 24-hour dietary recalls. Comparing reports about school meals to observation records yielded two error measures: Omission rate (unreported percentage of to-be-reported items) and intrusion rate (percentage of reported items not observed eaten). For data from 365 children, we used linear models to examine relationships of error measures to sex, academic achievement, SES, BMI percentile, and social desirability, controlling for the manipulated variables and certain other variables (school district, data-collection school year, race, and interviewer). Neither error measure was significantly related to BMI percentile. One error measure was significantly related to each of sex, SES, and social desirability: Intrusion rate was significantly related to sex (boys were more inaccurate than girls) and to SES (lower SES children were more inaccurate than higher SES children), and omission rate increased significantly with social desirability. Both error measures were significantly related to academic achievement: As academic achievement increased, omission and intrusion rates decreased significantly. Awareness of the relationship of reporting accuracy to respondent variables may be important to study design and dietary intake data interpretation.

Theme 02: Novel Methods for the Assessment of Diet & the Food Environment

Implementing the mutually responsive orientation observational approach to evaluate the influence of mother-child mealtime interactions on child weight and eating

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Objective

To implement the Mutually Responsive Orientation (MRO) observational coding system for evaluating the role of bidirectional mother-child mealtime interactions in the development of child eating and weight patterns.

Methods

Thirty-five mother-child dyads were filmed across two lunchtime home observations, set approximately 12-months apart (Time one [T1] and Time two [T2]). Mother-child responsiveness, mother-child positive affect, maternal control and child compliance were assessed using the MRO coding system. Child eating behaviours and Body Mass Index (BMI) was also measured. Correlations, t-tests, ANOVAs and ANCOVAs were used to explore cross-sectional and longitudinal relationships between MRO domains, child eating behaviour and child BMI.

Results

Inter-rater coding agreement was excellent. Mother-child responsiveness was associated positively with child enjoyment of food, and negatively with child food fussiness. Maternal control was associated positively with child food fussiness. Maternal control was also positively and negatively associated with child BMI, highlighting mixed results. Children of an unhealthy weight status had significantly lower child food fussiness and maternal control, compared to children of a healthy weight status.

Conclusions

Findings suggest the MRO coding system may be a useful tool for assessing observations of mother-child mealtime interactions implicated in the development of pre-schoolers' eating and weight development. Different aspects of mother-child mealtime interactions were related to particular types of children's eating behaviours and BMI, providing some support for their potential role as risk factors in childhood overweight and obesity.

Assessment of dietary intake by a mix of short and long term instruments via the internet

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Background

The considerable bias associated with the traditional tool of dietary assessment in large scale epidemiological studies - the food frequency questionnaire (FFQ) - might have contributed to some skepticism whether we understand the link between diet and diseases even in a broad sense. Thus, we developed a strategy to capture dietary intake for the German National cohort with 200,000 participants.

Methods

Information of the National Nutrition Survey II was used to identify those foods, contributing to the variation in intake of nutrients and major food groups. This information was applied to construct a simple food list asking about food use at the past day as web instrument, and also a web based FFQ. From the survey, the quantitative intake of a food if consumed was also modelled.

Results

The strategy of measuring diet in this cohort includes the filling out of several assessment of use of foods at the past day randomly over the year (8-12 minutes per occasion) and one FFQ (30 minutes), both preferentially by internet. Subsequently, the probability of use of a food is estimated from the 24-h food lists and FFQ for each subject and combined with the standard portion considering co-variate information. Simulation studies indicate that with even two food lists and one FFQ, correlation coefficients with true intake in the order of 0.6 to 0.7 can be achieved for most food items.

Conclusion

We can show that improved dietary assessment by combining instruments and using new techniques is feasible in large-scale studies.

Acceptability and relative validity of myfood24 among British adolescents against an interviewer administered 24 hour recall

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Purpose

myfood24 is the first UK online 24hour dietary assessment tool developed for use among all age groups. Limited information is available regarding the validity of using new technology in assessing dietary intake among adolescents. This study aims to assess the acceptability and validity of myfood24 against a face-to-face interviewer-administered 24hour recall.

Method

75 adolescents aged 11-18 years old were asked to complete myfood24 and provide an interviewer-administered 24hour recall on the same day for two non-consecutive days in a school setting. All participants then completed an acceptability questionnaire. Total energy intake and macronutrients recorded by the two methods were compared using intraclass correlation (ICC), Bland-Altman plots to assess agreement.

Results

Energy and macronutrients reported via myfood24 demonstrated strong agreement with the interview data; ICC = 0.88 (95% CI: 0.84, 0.91) for energy intake (EI). There was no significant bias between the two methods, the mean difference (myfood24 - interview) being -55 kcal (-230kJ) (95% CI: -117, 7.2 kcal, (-489.5 to 30.0 kJ)) with limits of agreement ranging between -39% (-797 kcal (3334kJ)) to 34% (687(2874KJ)) using multiple observations per each individual. myfood24 was well received by adolescents and they found it attractive and easy to use; the mean system usability score (SUS) was 74 /100 (95%CI 71, 77) and the average time to complete myfood24 was 16 (SD=5) minutes.

Conclusions

myfood24 has the potential to collect dietary data of comparable quality to that of an interview, with

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the advantages of supporting larger sample sizes and providing immediate results.

Accuracy of a novel 'handy' method versus household measures to estimate food portion sizes

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Accurate estimation of food portion size is critical in dietary studies. Yet, such information is notoriously difficult to obtain and the accuracy of current methods is poor, particularly for irregularly-shaped foods. The present study aimed to compare the accuracy of a novel portion size estimation method using a persons' hand (finger-width, fingertips and fists) as reference tools ('hand method') with volumetric household cups and spoons ('household method'), to the actual weight of the food. 67 participants (47 females, mean age 33 years) attended a one-hour session in which they estimated the portion sizes of 42 pre-weighed amorphous and irregularly shaped test foods, using both methods. Participants' hand measurements were taken using calipers and water displacement which was used in conjunction with geometric formulas to convert estimations using the hand method to volumes. Estimated food volumes from both methods were then converted to an estimated weight using food density factors. Accuracy was determined as the percentage difference between the estimated weight and the actual weight of the food. Estimations using finger-widths were significantly ($p<0.05$) more accurate than household cups for 21 of the 32 irregularly shaped test foods. No significant differences were found between methods for the remaining 11 irregularly-shaped foods. For amorphous foods, the household method was significantly ($p<0.05$) more accurate than fists for 8 of the 10 test foods. These results imply that the finger-width technique could compliment the current household method of food portion size estimations to improve the accuracy of estimations for irregularly shaped foods.

Design and characteristics of European adults interested in internet-based personalised nutrition: The Food4Me Study

Katherine Livingstone[1,2], Carlos Celis-Morales[1], Santiago Navas-Carretero[3], Rodrigo San-Cristobal[3], Clare O'Donovan[4], Hannah Forster[4], Clara Woolhead[4], Cyril Marsaux[5], Anna Macready[6], Rosalind Fallaize[6], Silvia Kolos[7], Christina P Lambrinou[8], George Mochonis[8], Magdalena Godlewska[9], Agnieszka Surwillo[9], Christian A. Drevon[10], Yannis Manios[8], Iwona Traczyk[9], Eileen R. Gibney[3], Lorraine Brennan[3], Marianne C Walsh[3], Julie A Lovegrove[5], J Alfredo Martinez[6], Wim H M Saris[4], Hannelore Daniel[7], Mike Gibney[3], John C Mathers[1]

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The Food4Me Proof of Principle Study is the largest scale, pan-European internet-based randomised controlled trial to investigate the effectiveness of personalise nutrition (PN) on health-related behavioural change. The aim of this paper was to describe the characteristics of the individuals interested in an internet-based PN trial. Individuals were recruited from seven European countries (UK, Ireland, Germany, The Netherlands, Spain, Greece and Poland). Screening questionnaires were used to collect data on demographics, anthropometrics, health and dietary intakes. Once deemed eligible, participants were randomised to receive either conventional, non-PN advice (control) or one of three levels of PN advice (based on dietary intake data alone, dietary intake and phenotypic data or dietary intake, phenotypic and genotypic data). A total of 5662 individuals expressed an interest in the study (mean age 40.0 ± 12.7; range 15-87y). Of these, 65% were female, 13% were smokers and 47% reported the presence of a clinically diagnosed disease. Furthermore, 47% were overweight or obese and 35% were sedentary. 46% of individuals consumed at least three portions of wholegrains daily, 36% consumed more than one portion of oily fish weekly and 66% consumed less than three portions of red meat weekly. 37% consumed less than 5.8g/d of salt and 2% consumed less than 10% energy from sugars. Our data indicate that individuals volunteering to participate in an internet-based PN study are not limited to a specific group; most individuals had adequate dietary intakes but would benefit from improved diets and greater physical activity.

Misreporting of energy intake in a new web-based food record for children and adolescents

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Background

Misreporting of energy intake is well known from traditional dietary assessment methods, and assessment among the youngest is especially challenging. Web-based tools are increasingly popular. However, little is known whether these web-tools improve the recording accuracy.

Objective

To assess the accuracy of children and adolescent's energy intake estimated from the first Norwegian web-based dietary assessment tool for children and adolescents, the Web-based Food Record (WebFR). This was done by comparing energy expenditure (TEE) calculated from accelerometer counts to energy intake (EI). Established Goldberg cut-offs for EI:BMR using measured individual physical activity levels, were also applied for comparison.

Design

In total 253 Norwegian children (8-14 years), were instructed to complete four consecutive days of registration in the WebFR and to wear a validated accelerometer (Actigraph GT3X+) for seven days the same week.

Statistics

Acceptable-reporters were defined as children within the 95% confidence limits of EI/TEE agreement. Results: A total of 33% were acceptable-reporters (AR), 11% over-reporters (OR) and

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56% under-reporters (UR). Mean EI/TEE was 0.81, and mean EI-TEE was -397kcal/day (SD 538). Under-reporting was positively associated with age, overweight/obesity, low parental education level, non-Norwegian parents/guardians, and living in a household without both biological parents. When applying the Goldberg cut-offs, 74%, 0% and 26% were AR, OR and UR, respectively. However, subjects characteristics associated with UR were similar for both methods.

Conclusion

Even though under-reporting of energy is a concern in this study, we argue that the WebFR is a promising tool for dietary assessment in the younger age groups.

Evaluation of the Dutch web-based 24-hour recall tool Compl-eat

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Repeated self-administered web-based 24-hour recalls (WEB-24HR) allow the use of an open-ended dietary assessment method in large-scale dietary studies because of the low costs. Within the Nutrition Questionnaire plus (NQplus) study in the Netherlands the so-called WEB-24HR tool Compl-eat was developed to assess dietary intake in participants with a Dutch food pattern. The aim of the present study was to evaluate this new tool against the telephone-based 24HR method on energy, nutrients and food groups. A subgroup of participants of the NQplus study (20-70 y, n=514) completed three self-administered web-based as well as three telephone interviews by a dietician. Compl-eat as well as the dieticians guided the participants to report all foods consumed the previous day using the multiple step approach. For energy and all nutrients the WEB-24HR estimated lower mean intakes than the telephone-based recalls. The extent of underestimation varied from -16.1% for vitamin B12 to -0.4% for alcohol. The agreement between both methods, estimated using Lin concordance coefficients (LCC), varied from 0.15 for vitamin B1 to 0.70 for alcohol intake (mean LCC 0.38). The lower intakes of energy and nutrients reported by the WEB-24HR can be mainly explained by lower estimations of the intake of the food groups fats and dairy. Although the results on group level appear to be acceptable, most associations are only fair. The performance of the tool may be improved by adding an option to automatically select the type of frequently used foods and to include reminders on consumption of fats and dairy.

Healthy Food Intake Index (HFII): Validity and reproducibility in a gestational-diabetes-risk population

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Dietary indices have taken space from single nutrient or food analysis. The current study aimed to develop and validate a food-based dietary index for measuring adherence to healthy diet according to Nordic Nutrition Recommendations. The subjects belonged to a lifestyle intervention Finnish Gestational Diabetes Prevention Study (RADIEL). The 443 subjects of the study (61% of those invited) were pregnant and either obese or with gestational-diabetes (GDM) history. The Healthy Food Intake Index (HFII) included 11 components. Statistical methods were weighted kappa coefficients, intra-class correlation, corrected item correlation, principal factor analysis, general linear models, and logistic regression. The average HFII was 10.2 (SD 2.8, range 2-17). The intra-class correlation coefficient of two HFII-measures 3 months apart was 0.85 (CI 0.79 to 0.90). Three factors (by factor analysis) explained most of the distribution (59%) of the HFII. Most components independently contributed to the total score (corrected item correlation coefficient<0.31). The higher the HFII the closer the intake of the most relevant nutrients to the recommendation (p for linearity ≤0.03 for all nutrients tested). Educational attainment (P =0.005), body mass index (P =0.01), smoking (P =0.007), and physical exercise (P =0.038) showed linear trends across the HFII categories. HFII showed predictive validity; the higher the score the lower the GDM incidence (p for linearity=0.034). The HFII has good reproducibility, moderate content, and good construct, criterion, and predictive validity. Thus, it is suitable for studying adherence to healthy diet among pregnant women at high risk of GDM and studying the diet-disposed risk for GDM.

A novel processed food classification system applied to Australian food composition databases

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Background

The nutritional quality of foods can depend on the extent of food processing. Australian food composition databases do not consider the level of food processing which means that foods varying in nutritional quality may be considered together in food groups. Categorising foods by their level of processing emphasises the differences in nutritional quality between foods within the same food group and is useful for determining dietary processed food consumption.

Aims

To categorise foods within Australian food composition databases based on the level of food processing using a tripartite processed food classification system. To assess the variation in the levels of processing within food groups.

Methods

A processed food classification system was applied to the 2007 and 2011-13 Australian Food and Nutrient Databases (AUSNUT), whereby each food was classified as a minimally processed (MP), processed (P) or ultra-processed (UP) food.

Results

The proportions of foods classified as MP, P and UP within AUSNUT 2007 (n = 3874) and AUSNUT 2011-13 (n =5740) were 34%, 34%, 32% and 40%, 32% and 28% respectively. Within AUSNUT food

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groups, the proportion of foods classified as UP varied from 2% to 100%. For example, in AUSNUT 2011-13 15% of cheeses and 87% of breakfast cereals were classified as UP.

Conclusion

There is wide variation in the level of processing within each food group and a tripartite processed food classification could be useful for identifying the dietary quality of various dietary patterns.

Neighbourhood food outlets: how they pattern and associations with children's eating behaviours

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Background

Studies of the neighbourhood food environment and diet typically include a narrow range of food outlets and rarely consider how food outlets pattern. This study examined associations between different patterns of food outlets in local neighbourhoods and eating behaviours in children.

Methods

Parents of 5-6 and 10-12 year-old children (n=801) completed a 56-item food frequency checklist about their child's diet. Latent Class Analysis identified patterns of food outlet availability near home (800m) based on objectively-measured availability of cafes/restaurants, fast food, major supermarkets, small supermarkets/grocery stores, convenience stores, greengrocers and butcher, seafood or poultry retailers. Associations between class membership and (transformed) frequency of consumption of fruits, vegetables, dairy products, bread products, meats, sweet and savoury snacks and high-energy beverages, were determined using linear regression, adjusting for maternal education and clustering by school attended.

Results

Three neighbourhood 'classes' were found: 1) few types of outlets (46%); 2) cafe/restaurant, fast food and convenience store (36%); and 3) range of outlets, including staple food stores (18%). Compared to 'Class 1', 'Class 2' was associated with less frequent bread product and more frequently savoury snack consumption among boys, and more frequent bread product and less frequent savoury snack consumption compared to 'Class 1' among girls. Compared to 'Class 1', 'Class 3' was associated with more frequent consumption of dairy products, sweet snacks and meat among boys, and less frequent consumption of savoury snacks among girls.

Conclusions

Associations between neighbourhood food outlets and eating behaviours are complex and appear to differ between boys and girls.

Monitoring the Scottish diet using UK food purchase data

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The Scottish Dietary Goals (SDG) encompass intakes of food (fruit and vegetables, oily fish and red meat) and nutrients (energy, energy density, total fat, saturated fat, trans fatty acids, non-milk extrinsic sugars (NMES), salt and fibre (non-starch polysaccharides (NSP)) and were set in recognition of the burden of obesity and diet-related disease in Scotland. Progress towards the SDGs is monitored using a combination of surveys, but principally using the secondary analysis of the Living Costs and Food Survey (LCFS), the annual UK food purchase survey. This survey collects household food purchase and eating out data over a 14 day period from approximately 500 households per annum. The estimation of food consumption and nutrient intakes takes into account the proportion of different components (e.g. fruit, vegetables, meat) in composite foods; the proportion of food in a food grouping (where it bridges more than one food grouping); raw to cooked weight (where appropriate) and proportion of inedible waste. In addition adjustment is made for edible waste using published figures for the UK population. Data are analysed with weighting to the Scottish population and taking account of sampling methods to allow meaningful comparisons to be made between years and by deprivation quintiles. Results to date show that there has been little progress towards meeting the goals over the period 2001-2012 and that in particular those living in the most deprived areas consumed significantly less fruit and vegetables than those in the least deprived areas (205g vs 311g for 2010-2012, P<0.001).

Theme 04: Advances in Technologies for Deitary Assessment

Evaluation of the eatscore: A tool to evaluate diet quality in the Netherlands and provide targeted advice

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We developed a web-based tool, the so-called Eatscore, to evaluate to what extent people meet the dietary guidelines. This tool monitors the intake of healthy individuals and patients, evaluates the intake against Dutch dietary guidelines and gives targeted advice. The individual is asked to fill out a short questionnaire of 34 food items, which takes 5-10 minutes. The food list of the questionnaire, generated by the Dutch FFQ-tool, covers at least 70 % of the level and of the variation of intake of the Dutch population for eight components: vegetables, fruit, fish, alcohol, dietary fiber, saturated fat, Trans fat, and alcohol. It also contains questions on moderate physical activity. For scoring of the responses, the Dutch Healthy Diet index (DHD-index) is used. The Eatscore provides a total score between 0 and 90, and subscores of 0 (no agreement with the guidelines) to 10 (maximum agreement). In 1235 participants, the DHD-index based on the Eatscore was acceptably correlated (r=0.56) with that according a 180-item FFQ. In addition, the Eatscore was evaluated in 27 transplanted kidney patients, and in 57 patients with bowel related diseases. Both patient groups were divided into an intervention group, receiving advice by the Eatscore, and a control group only

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filling out the questionnaire. In both studies, the scores in the intervention groups significantly increased by 3 and 6 respectively as compared to the controls. Although the Eatscore should be adapted to specific target groups it appears a promising tool to be implemented in health care practices.

Theme 05: Dietary Biomarkers

Discovery of biomarkers for whole grain rye intake in free-living subjects using non-targeted metabolic profiling

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Whole grain (WG) intake is associated with decreased risk of developing type 2 diabetes and its comorbidities. However, traditional dietary assessment of specific WG intake is challenging. We have used untargeted metabolomics to discover urinary biomarkers to reflect WG rye intake under free-living conditions. Intake was estimated by 3 day weighed food records and 24h urine collected by 59 healthy men and women on 2 occasions 2+ months apart were analysed by LC-QTOF in 4 modes (RP/HILIC; ESI Pos/Neg). Repeated double cross-validated partial least squares regression (rdCV-PLS) against reported WG rye intake was performed using the full feature set (16392 features, i.e. unique mass/retention time entities) and on a set obtained from sparse PLS prefiltering (1133 features). Both models produced similar results. Multivariate prediction estimates correlated strongly (r>0.67, p<0.001) and with high specificity with WG rye intake. Among the 20 features that best reflected WG rye intake selected from rdCV-PLS modelling, four metabolites were tentatively identified: hydroxy-hydroxyphenyl acetamide (HHPAA) sulfate, 3, 5-dihydroxyphenylpropionic acid (DHPPA) sulfate, caffeic acid sulfate and hydroxyphenyl acetamide (HPAA) sulfate. The two biomarker candidates with the highest medium term reproducibility (intraclass correlation>0.7) were attributed to the carnitine metabolite class, possibly related to betaine metabolism, which represents a novel finding. With this untargeted approach, we confirmed the specificity of alkylresorcinol metabolites as biomarkers for WG rye intake and discovered other compounds that should be further evaluated in future studies. Consequently, this workflow has strong potential as a tool to discover biomarker candidates also for other reported food categories.

Evaluation of d13C in fingerstick blood as a biomarker of sugar-sweetened beverage intake in children and adolescents: Preliminary findings

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Excessive sugar-sweetened beverage (SSB) consumption is a major concern in children and adolescents due to the displacement of nutrient-dense foods from the diet, and the association of SSB intake with weight gain and obesity. A common research limitation is the reliance on self-reported dietary intake, which is particularly challenging when studying children. We previously reported the validity and reliability of the d13C in fingerstick blood as a predictive biomarker of AS and SSB intake in adults. The objective of this preliminary study was to evaluate the validity and reliability of d13C in fingerstick blood as a biomarker of SSB intake in children and adolescents. Individuals aged 6-18 years (n=140; 54% male; mean age 13.2±0.2 yrs) completed four laboratory sessions, which included providing two fingerstick blood samples to determine d13C values, and completing a food-frequency questionnaire to assess habitual beverage intake (BEVQ-15). Biomarker validity was assessed by comparing the d13C value with reported SSB intake (mean=117±11 kcal), and reliability was assessed by comparing d13C values on two occasions. d13C was associated with SSB intake (r=0.35, p<0.0001), and d13C values were significantly different in those consuming >1 cup/d of SSB compared to those consuming <1 cup/d of SSB (-19.28±0.08° vs -19.74±0.08; p<0.0001). d13C values at the two time points were not different (-19.53±0.06 vs -19.54±0.06, p=0.24) and were strongly associated (r=0.99, P<0.0001), demonstrating test-retest reliability. These preliminary findings suggest that d13C in fingerstick blood is a promising, minimally invasive biomarker of SSB intake in children and adolescents.

Comparative validity of vitamin C and carotenoids as indicators of fruit and vegetable intake: a systematic review and meta-analysis of randomised controlled trials

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Circulating vitamin C and carotenoids are used as biomarkers of fruit and vegetable intake in research, but their comparative validity has never been systematically reviewed and meta-analysed. PubMed, EMBASE, CENTRAL, CINAHL and Web of Science were systematically searched to December 2013 for randomised controlled trials of fruit and vegetable provision reporting changes in blood concentrations of carotenoids or vitamin C, in accordance with PRISMA guidelines. Evidence quality was assessed using the GRADE system. Random effects meta-analysis was used to combine estimates and meta-regression was used to test for sub-group differences. Nineteen fruit and vegetable trials (n=1382) measured at least one biomarker, of which nine (n=667) included five common carotenoids and vitamin C. Evidence quality was low and between-trial heterogeneity was generally high (I2-74%). Increased fruit and vegetable intake resulted in increased blood concentrations of vitamin C, a-carotene, b-carotene, b-cryptoxanthin, and lutein but not lycopene. However, no clear evidence of a dose-response effect was observed. Vitamin C showed the largest difference in standardised mean change (0.94, 95% CI 0.66, 1.22), followed by lutein (0.70, 95% CI

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0.37, 1.03) and a-carotene (0.63, 95% CI 0.25, 1.01). Blood concentrations of vitamin C and four common carotenoids increase when general fruit and vegetable intake is increased with no single biomarker being more responsive. High heterogeneity and a lack of dose-response suggest that individual-level biomarker responses to fruit and vegetables are highly variable. Group-level compliance to fruit and vegetable interventions can be indicated equally well by vitamin C or a range of carotenoids.

Applying urinary biomarkers to calibrate sodium and potassium intakes in the hispanic community health study/study of Latinos (HCHS/SOL)

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Hispanics/Latinos in the US are prone to hypertension and related co-morbidities, but measurement error in self-reported dietary intake distorts associations of nutrients with these and other chronic diseases. We investigated measurement error in self-reported intakes of sodium and potassium in a population-based cohort study of Hispanic/Latino adults aged 18-74 yr from diverse backgrounds in, Bronx, Chicago, Miami and San Diego. In 447 participants, 24-hr urinary sodium and potassium served as objective biomarkers for sodium and potassium intakes. Self-report was captured from two 24-hr dietary recalls. We examined bias in self-reported sodium and potassium intake and its association with participant characteristics. We then developed calibration equations using backward model selection for linear regression. Age-adjusted geometric means (95% CI) were 2373 (2275-2475) mg/day for potassium and 3566 (3402-3737) mg/day for sodium intakes as measured by urinary biomarkers. Self-reported diet data underestimated potassium intake by 1.3% in men; 4.6% in women and underestimated sodium intake by 19.8% in men; 20.8% in women. For potassium intake, a higher body mass, a lower restaurant score (indicating lower consumption of away from home foods: restaurants, fast food outlets, etc.), and more supplement use were associated with significant under-estimation. For sodium intake, being older, having higher body mass index, and lower restaurant score were associated with significant under-estimation of sodium intake. Systematic underestimation of sodium varied by Hispanic/Latino background (p=0.04). These calibration equations correct for subject-specific diet data errors derived from self-reported intake and can be applied to reduce bias in diet-disease associations in the HCHS/SOL.

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Alkylresorcinols in Adipose Tussue as long-term biomarkers of whole grain wheat and rye intake

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Alkylresorcinols (AR) have been suggested as biomarkers of whole grain (WG) wheat and rye intake. Plasma AR concentrations have a short half-life, so long-term biomarkers are needed. Two studies were undertaken to evaluate if AR concentrations in adipose tissue (AT) could be used as such. In study I, responsiveness of AR in AT biopsies from 27 participants of a 12 wk. WG/refined-grain dietary intervention was studied. In study II, determinants (WG products, BMI, age and energy intake) of AR concentrations were studied in men (n=149) and women (n=110) from the Cohort of Swedish Men and the Swedish Mammography Cohort, respectively. WG intake was estimated by food frequency questionnaires. AR were measured by gas chromatography - mass spectrometry. In study I, AR concentrations were significantly higher after WG diet than after refined-grain diet (P<0.05) and were highly correlated with WG intake, r=0.60-0.84, (P<0.05, n=16) for total and individual AR homologues concentrations. In study II, crisp bread was the main dietary determinant and was associated with 86/64% (women/men) higher total AR concentration per 100 g bread (95% CI= 33-139/34-94%). Approximately 10-24 % of the total variation in AR concentration (depending on AR homologue and cohort) was explained by determinants investigated. For women, age was inversely associated with AR concentrations. In summary, AR concentrations in adipose tissue responded to reduced intake of WG over 12 wk. Crisp bread (rich in WG rye) was a main determinant of AR concentrations in Swedish men and women. The impact of non-dietary determinants needs further investigation.

Theme 06: Dietary Patterns

Fruit and vegetable consumption in Vietnam, and the use of a 'standard serving' size to measure intake

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Aims
To provide nationally-representative data on fruit and vegetable consumption in Vietnam, and to assess whether reported numbers of 'standard servings' consumed have evidence of construct validity.

Methods
Data analysed using complex survey methods were from a nationally-representative population-

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based survey including 14706 participants (46.5% males, response proportion 64.1%) aged 25-64 years in Vietnam. Measurements were made in accordance with the World Health Organization (WHO) STEPS protocols.

Results

Approximately 80% of Vietnamese people reported having less than five servings of fruit and vegetables daily in a typical week. Fruit and vegetable intake reported in 'standard serving' sizes was positively correlated with levels of education completed and household income (p<0.001 for trend). The correlations between summary values for each province were plausible because they reflect some known demographic, geographical and climatic characteristics of the country. For example, provinces at higher latitude had higher mean servings of vegetables (r=0.90), and provinces with higher proportions of urban population had higher mean servings of fruit (r=0.40).

Conclusions

Around eight-in-ten Vietnamese people aged 25-64 years did not meet WHO recommendations for daily consumption of at least five servings of fruit and vegetables. Self-reported information on quantities of fruit and vegetables consumed in terms of standard serving sizes had some evidence of construct validity, but with seasonal variation in reporting identified together with a limitation on the usefulness of the information for associative analyses.

Dietary factors and low-grade inflammation in post-menopausal women of the Malmö Diet And Cancer (MDC) Cohort

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Objective

To examine the associations between dietary factors and six biomarkers of low-grade inflammation, in middle-aged Swedish women.

Methods

This cross-sectional study examined the controls (n=910) from a nested case-control study within the MDC cohort, consisting of women 55-73 years of age, free from cancer at baseline (i.e., 1991-96). We analysed the plasma concentration of; oxidized low-density lipoprotein, interleukin (IL)-1beta, IL-6, IL-8, tumor necrosis factor (TNF)-alpha; and the white blood cell (WBC) count. A modified diet-history method of high relative validity was used to collect dietary information. We examined 43 log-transformed food group variables (as continuous). Stepwise regression with backwards removal and forwards inclusion adjusting for age, date at baseline, and total energy, identified dietary variables significantly associated with each biomarker. A model (I) was fitted for each biomarker including its related dietary factors, and basic adjustments. In a second step, we also adjusted for physical activity, BMI and smoking status (model II).

Results

Twenty one dietary factors were associated with the inflammation markers. Fruits were negatively associated with all biomarkers (P<0.05), except IL-1beta. Associations remained in the second model for IL-6 and IL-8. Sausage was positively associated with IL-1beta, red meat with WBC, sweets with TNF-alpha, and soft drinks with IL-6 (all P<0.05). The variance of the biomarker explained by model II

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varied from 4% (IL-1beta) to 26% (IL-8).

Conclusion

Our findings suggest that healthier food choices were associated with lower inflammation levels, and unhealthy choices with higher levels.

Following the 2015 Dietary Guidelines for Americans (DGA) leads to a more nutrient-dense diet and lower risk of obesity

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Analysis of single foods or nutrients was long considered the sole means of examining the role of diet in risk of chronic diseases. However, examining dietary patterns is more relevant as individuals consume varied meals with complex combination of foods, rather than single nutrients. In this study we updated the Dietary Guidelines for Americans Adherence Index (DGAI), an a priori 20-score measure of diet quality, to reflect changes in the 2015 Dietary Guidelines for Americans and the 12 accompanying USDA food patterns. Data from 19,837 participants aged >2 years in the Canadian Community Health Survey 2.2 was used to evaluate the construct validity and reliability of the DGAI 2015 in weighted multivariate analyses. The distribution of DGAI 2015 score was wide with median score of 8.8±0.6. Principal Component Analysis confirmed multi-dimensionality and importance of each component in DGAI 2015 and Cronbach's Alpha was 0.76, demonstrating the reliability of this tool as an indicator of diet quality. Moving from the first to the fourth DGAI 2015 quartile, there was a trend towards decreased calories (2206(54.4) kcal vs. 2028(35.1) kcal) and 'nutrients of concern' (e.g., sodium), as well as increased intakes of 'beneficial nutrients' (p<0.0001). After adjusting for age and sex, being in the 1st to the 3rd quartile of the DGAI 2015 was associated with 1.87 (95%CI:1.43-2.46), 1.83 (1.37-2.44) and 1.34 (1.00-1.79) times higher risk of obesity, compared to the 4th quartile (p-trend:<0.0001). The updated DGAI 2015 provides a meaningful measure of diet quality among Canadians and could be used for population monitoring.

Dietary pattern, food groups and the contribution of dietary component in relation with nutritional status among adults in urban Indonesians

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The study aimed to examine dietary pattern and contribution of different dietary component toward calorie intake and its association with nutritional status among urban adult Indonesians. It was a cross-sectional study in urban Indonesian cities on apparently healthy adult aged 18-45 years, selected randomly. Dietary intake was assessed using single 24-hour dietary recall and food frequency questionnaire. Dietary patterns was identified using Principal Component Analysis. Totally

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867 subjects were included, but only 844 had dietary data. Males and females were equally distributed with mean age of 32.0±8.3 years. Significantly higher numbers of males were underweight than females (15.3%vs8.7%), while females had higher obesity prevalence than males (29.6%vs 17.4%). Median total calorie intake was 1974 KCal/day, and it was significantly 350 Kcal higher in males than females (p<0.05). Mean contribution of carbohydrate, fat and protein to total calorie intake was 51.4%, 34.2% and 14.5%, respectively. The five major food contributors of calorie intake were rice-based foods, meat, legumes, noodles and fish/other seafood. Sugar sweetened beverages contributed 6.5% of total calorie, in which it was high on coffee and tea (consumed by 56% of population with 5.7% contribution to total calorie). Carbonated soft drink was consumed by 1.9% population with 0.4% contribution to total calorie. Three dietary patterns was revealed: heavy-carbohydrate-with-sweetened-drinks, typical-home-made-food and heavy-carbohydrate-snack. However, they were not associated with nutritional status. Instead, after adjusting for confounding factors, more frequent consumption of noodles, chips and sweetened tea was associated with obesity among males; while among females, chips and non-milk sugar sweetened beverages was. The association of these specific foods with obesity require further studies to confirm the result.

Associations between dietary patterns and blood pressure in a sample of Australian adults

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Background

Investigating effects of whole diets on blood pressure (BP) can contribute to development of diet-based recommendations for health. Our aim was to assess the relationship between dietary patterns and BP in a sample of free-living Australian adults.

Methods

Dietary intake was measured using two 24-h dietary recalls. Dietary patterns were derived from 24-h recall data using factor analysis with principal component analysis extraction and varimax rotation based on weight of food consumed. Home BP was measured daily, for seven days and a mean used.

Results

Data from 251 participants (112 males; mean age 55.1(9.1) (SD)years) was included. Three dietary patterns were identified (Traditional Australian Diet, Convenience Diet and Modern Diet). Only the 'Convenience Diet' was positively associated with systolic BP ($\hat{I}^2$ = 1.88, 95% CI 0.16, 3.60) after adjusting for age, sex, BMI, anti-hypertensive medication, smoking, education, physical activity and energy intake. This dietary pattern was characterised by high consumption of low-fibre bread, unprocessed cereals, meat, poultry and egg dishes, mixed cereal dishes, seeds and nuts and low consumption of milk and yoghurt (low-fat), vegetable juice, vegetables and high-fibre bread. The 'Convenience Diet' was positively associated with intakes of energy (P=0.002) and sodium (P=0.005) and inversely associated with potassium (P=0.002). After adjustment for energy, only the inverse association with potassium remained (P<0.001).

Conclusion

A 'Convenience Diet' was associated with higher BP and thus chronic disease risk, supporting the

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evidence that diets low in potassium, from vegetables and dairy, and high in energy and thus sodium, are detrimental to cardiovascular health.

Comparable dietary patterns describe dietary behavior across ethnic groups in the Netherlands, but different elements in the diet are associated with HbA1c and fasting glucose concentrations

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Background

Ethnic minority populations in Western societies suffer from a disproportionate burden of type 2 diabetes (T2D). We explored the association between dietary patterns and biomarkers of T2D in five ethnic groups living in Amsterdam, the Netherlands.

Methods

3776 men and women aged 18-70 yrs of Dutch, South Asian Surinamese, African Surinamese, Turkish and Moroccan origin were included. Diet was assessed using ethnic-specific food frequency questionnaires. Dietary patterns were derived separately per ethnic group. First, food group based dietary patterns were derived using Principal Components Analysis (PCA) and the association with HbA1c and fasting glucose was assessed using multivariable linear regression. Second, biomarker-driven dietary patterns, based on HbA1c and fasting glucose concentration, were derived using Reduced Rank Regression (RRR).

Results

Two comparable PCA dietary patterns were identified in each ethnic group; 'meat and snack' and 'vegetable' patterns. The 'meat and snack' pattern was associated with HbA1c and fasting glucose in Dutch origin participants only (β (95% CI): 0.09 (0.00; 0.19) and β (95% CI): 0.18 (0.09; 0.26) respectively). RRR dietary patterns differed between ethnic groups, e.g. among Dutch origin participants red meat was prominent while among ethnic minority groups, ethnic specific foods (e.g. roti, couscous) characterised this dietary pattern.

Discussion

Although similar PCA dietary patterns were derived in all ethnic groups, the 'meat and snack' pattern was less clearly associated with HbA1c and fasting glucose in the ethnic minority groups. Together with the finding of ethnic differences in RRR dietary patterns, our results indicate that addressing T2D risk requires ethnic-specific approaches.

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The development and validation of a tool to assess breakfast eating habits in young New Zealand women

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Background
Benefits of consuming breakfast include improved mental alertness, ability to concentrate, feeling of fullness and sustained energy levels. There are few validated tools available to quickly assess foods and combinations of foods consumed at breakfast time.

Aim
To develop and validate a Breakfast Eating Assessment Tool (BEAT) that assesses the usual breakfast eating habits of New Zealand (NZ) women, including the types of foods consumed, food combinations and timing of breakfast.

Methodology
An online self-administered eating habits questionnaire (EHQ) was developed and validated against a 4-day weighed food record (4dwFR) in women aged 16-45 years (n=108), living in Auckland, NZ. The BEAT was a focused tool within the EHQ used to assess usual breakfast eating habits. Validity was assessed using cross-classification analysis.

Results
Agreement between the BEAT and 4dwFR for typical breakfast foods on weekdays were grains (87.1%, P<0.001), dairy (84.2%, P<0.001), and tea & coffee (66.7%, P=0.007); and on weekends were eggs (83.4%, P<0.001), grains (74.1%, P<0.001) and dairy (71.3%, P<0.001). Agreement between popular combinations on weekdays were dairy + grains + fresh fruit (87.9%, P<0.001) and dairy + grains (75.9%, P<0.001); and on weekends were bread-based foods (75.9%, P<0.001) and dairy + grain (69.5%, P<0.001). Breakfast was mostly consumed earlier on weekdays (6-8am) than weekends (8-10 am), and was comparable between the BEAT and 4dwFR on both weekdays (76.9%, P<0.001) and weekends (59.5%, P<0.001).

Conclusion
The focused BEAT is a simple tool to successfully describe and evaluate breakfast eating habits of New Zealand women.

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The Glycemic Index of beer and its contribution to dietary glycemic index and glycemic load In The Netherlands

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Introduction

Diets high in glycemic index (GI) and glycemic load (GL) have been associated with a higher risk of diabetes. Beer explained a large proportion of variation in GI in two studies; however, beer has not been tested according to ISO methodology. We tested the GI of beer and estimated its contribution to dietary GI and GL in the Netherlands.

Methods

GI-testing of Pilsner Urquell was conducted at the University of Sydney according to ISO international standards with glucose as reference food. Next, GI and GL values were assigned to 2,556 food items in the 2011 Dutch food composition table using a six-step methodology and consulting four databases. This table was linked to dietary data 2,106 adults from the Dutch National Food Consumption Survey 2007-2010. The amount of explained variance in dietary GL was estimated with stepwise linear regression.

Results

The GI value of Pilsner Urquell was 89 ± 5. On average, beer made an absolute contribution of 2.4% to dietary GL. It ranked seventh after potatoes (8.3%), 3 different breads (13.3%), sugar (3.1%), and rice (2.5%). Beer consumption explained much inter-individual variation in dietary GL (5%), i.e. third highest after sugar (12%) and cola (9%).

Conclusion

Beer is clearly a very high-GI food. It has a relatively low carbohydrate content (~4-5 g/100 mL), but still made a contribution to the absolute GL (2.4%). Furthermore, beer captured a large proportion of between-person variability in GL in the Dutch diet. Contrastingly, moderate beer consumption is related to a lower diabetes risk.

Theme 08: Dietary Interventions: Limitations and Improvements

Approaches in managing ambiguous and incomplete responses to a food frequency questionnaire measuring calcium and vitamin D intake in older people

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Background

Food frequency questionnaires (FFQs) although validated, may be prone to measurement errors associated with how well the questionnaire is completed by participants.

Objective

Here we present a systematic approach to managing incomplete or ambiguous responses in a validated, self-completed, semi-quantitative FFQ for calcium and vitamin D (a modified version of Calquest [1] used in The Vitamin D supplementation trial in Older People (VDOP [2], n= 375 men and women, ≥70 years old).

Method

VDOP is a UK-based trial, in which the FFQ was used at baseline, 6 and 12 months. Intakes were calculated based on the frequency of consumption, portion size and number of occasions. A logical systematic approach to decision-making was developed based on published literature and on data checks and internal discussions based on extensive experience. For missing number of portions, a default amount based on the weighted means of the study population was assigned. Foods with missing frequencies were considered not consumed.

Results

Of 1060 FFQs returned, 896 had queries to follow up. Twenty types of issues were identified, mainly: unanswered/multiple-answers in food selection, portion size, and frequency. FFQs with more than six unanswered questions were excluded. Adopting this systematic approach to deal with the queries resulted in 1010 of the 1060 FFQs being considered usable for analyses.

Conclusion

The use of a systematic approach can minimise the exclusion of individuals' records and thereby maximise the representativeness of the data. Acknowledgement: This study was funded by AR-UK (grant number 19544) and the Medical Research Council programme numbers U105960371 and U105960384. 1. Nelson et al, J Hum Nutr Diet, 1988; 1:115-127. 2. Schoenmakers et al, Trials, 2013; 14:299.

Dietary weight loss intervention designs could be improved by incorporating early outcome assessments

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Determining predictors of weight loss success are crucial for appropriately designing dietary weight loss interventions. The aim of this study was to quantify the role of early weight loss and demographic variables in predicting weight loss success. Data was pooled from four previously published dietary weight loss trials. Mixed effects logistic regression, was used to determine which of the variables (treatment group, percent weight loss at 1 month, age, gender and baseline BMI) predicted weight loss success, defined as ≥5% weight loss at 3 Months. The sample included 257 subjects, 72% female, with a mean age of 47±9 years. Fifty two percent of those completing the

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studies to 3 months were successful. Percent weight loss at 1 month was the only significant predictor of weight loss success. For every one percent increase in weight loss at one month the odds of achieving ≥ 5% weight loss was 3.01(2.28, 3.97) (P<0.001). This effect was independent of treatment arm (1.27 95%CI 0.66, 2.41,P=0.473). Greater early weight loss, independent of treatment arm, is a significant predictor of trial success in weight loss trials. As just over half the participants were successful in achieving a clinically significant loss there is a need to reconsider weight loss trial design. Improvements could be made by incorporating early weight loss into the design. Using novel adaptive trial designs or sequential multiple assignment which incorporate this information should be considered.

Do front of pack labels influence portion size decisions?

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Big portions increase consumption and portion size interventions were suggested as a promising strategy to fight the obesity epidemic. Besides product choice, front of pack labels might also have the power to influence consumer's portion size decisions and meal composition. However, to date this has not been investigated. This study tested whether presenting information on the energy content and the 'Health Star' label influenced self-selected portion size of individual foods and meals. 116 adults (M=24, SD=0.5 years) were invited to serve what they perceived as an adequate portion of breakfast cereal, fruit salad (healthy snack) and chocolate (unhealthy snack), as well as a three component meal (chicken, fries and mixed vegetables). They were randomly assigned into one of three experimental conditions. Participants viewed either a kJ/100g label, the 'Health Star' rating label or they did not receive any information on the nutrient contents. Served portion and meal weights were compared between experimental groups using ANOVA. The results show that neither energy labels nor the 'Health Star' label influenced the portion sizes of foods or meal components that individuals served themselves. However, the average self-served portion sizes of all foods, except vegetables, were significantly greater than the recommended portion sizes. Although labels may help consumers to make better product choices, these findings indicate that presenting food label information related to energy content and healthiness does not affect consumer's portion size decisions. Future public health efforts should focus on the design of nutrition information labels that help consumers choose appropriate portion sizes.

A randomised cross-over intervention study of the effect of milk consumption on hormone levels

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We conducted a randomised cross-over intervention study to evaluate whether milk consumption affects sex steroid hormone levels and whether any effect may depend on the fat content (1.5% vs.

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3.5%). We aimed to minimize drop-out rate, collect complete biospecimens, and optimize compliance. We recruited 110 postmenopausal women, anticipating a 10% attrition rate. To minimize drop-out we collected 24-hour urines on five occasions rather than five blood samples. We obtained all five 24-h urine samples from 109 participants (99%); one woman was excluded because she missed one urine sample. Compliance was assessed with a food list especially designed for this study. The milk was found to have high progestagene levels, with level in whole milk (9.65 ng/mL) almost double that of semi-skimmed milk (4.56 ng/mL), and while estrogen levels were less high. We did not find substantial differences in either progesterone or estrogen urine levels associated with milk consumption, with two exceptions: Semi-skimmed milk (but not whole milk) was associated with a statistically significant increase in 2-hydroxyestrone levels (p<001), while whole milk was linked to an unexpected decrease in estrone levels (P=0.006). Our study suggests that (a) collecting repeated 24-hour urine samples to assess biomarkers may be associated with better study participation than repeated blood samples, (b) compliance with dietary regimens can be assessed with a simple food list, and (c) short-term diet intervention studies can be conducted with high validity. Despite high progesterone levels in the milk consumed in this study, ingestion was not associated with an increase in urine levels.

The representativeness and quality of food purchasing data in a supermarket-based randomized controlled trial

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Background
Supermarket store loyalty cards have advanced research by providing objective food purchasing data, however the representativeness and quality of these data remains unclear. This study assessed the representativeness and quality of food purchasing data within a randomized controlled trial conducted in one supermarket chain.

Methods
642 women were randomized into: 1) Control, 2) Price reductions on fruits and vegetables (FV), 3) Skill-building, or 4) Combined price reductions and skill-building. Participants self-reported the proportion of FV purchased in study supermarkets and patterns of loyalty card use at baseline and post-intervention (3 months). Fisher's exact tests and multinomial logistic regression assessed differences in these parameters among groups at baseline and post-intervention, and change over time.

Results
At post-intervention, just 49% of participants purchased ≥ 50% of their FV in study supermarkets, while 72% used their loyalty card every time they shopped. The reported proportion of FV purchased in study supermarkets and patterns of loyalty card use did not differ among groups at baseline or post-intervention. Compared to all other groups, the price reduction group was more likely (RRR:1.8-2.2) to have increased proportionate purchasing of FV while the combined group was

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less likely to have increased food purchasing for non-household members (RRR:0.30-0.36) in study supermarkets from baseline to post-intervention (p<0.05).

Conclusions

Self-reports suggest loyalty card purchasing data from a single supermarket chain may not represent the majority of household FV purchases, and may be biased due to differential changes in shopping behaviours and card usage across intervention groups over time.

Theme 09: Using Images for Dietary Assessment

Examination of plausible reporting with the image-based mobile food record in young adults

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Image-based dietary assessment methods may reduce under-reporting. Using the number of recorded eating occasions (EO) as a proxy for plausible reporting, our objectives were to assess whether BMI category was associated with EO, and to ascertain if indicator food groups could explain differences in EO by BMI. A population-based sample of young adults (18-30y) used the mobile food record (mFR) application to complete 4-days of records. EO was defined as any food or beverage excluding water and were extracted from the images and metadata. Indicator food groups were: vegetable serves, fruit serves, energy-dense nutrient-poor (EDNP) foods, and sugar-sweetened beverages (SSB). Multivariate regression and hierarchical modelling were performed. BMI was distributed among the 240 young adults as underweight (n=21), healthy weight (n=142), overweight (n=47), and obese (n=30). The EO mean was 4.90(SD 2.1). BMI was significantly (P=.007) associated with EO: underweight, 4.67; healthy, 5.09; overweight, 5.17; and obese, 3.71. Significant differences (adjusted for sex, age, cognitive restraint) were found for EO between healthy weight and obese (P=.001) and overweight and obese (P=.006). With hierarchical modelling, the relationship between healthy weight and obese was attenuated with the inclusion of vegetable serves and fruit serves. The relationship between overweight and obese was attenuated similarly, as well as with EDNP foods. These results would suggest that the lower EO among the obese group was partially explained by less reporting of vegetables, fruits, and EDNP foods. Image-based methods may differ from traditional methods as to which groups and foods contribute to implausible intakes.

Evaluating the feasibility of a mobile food record to assess healthy and sustainable dietary behaviours in young adults

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There are no dietary assessment methods to accurately assess multiple elements of a healthy and sustainable diet on an individual level. Using before and after eating images of eating occasions has the potential to provide the data necessary to explore these behaviours. The purpose was to evaluate the feasibility of using data collected with the mobile food record (mFR) to assess specific healthy and sustainable dietary behaviours. Participants, aged 18 to 30 years (n=247), collected a 4-day mFR. Food serve sizes were classified according to the Australian Guide to Healthy Eating (1 serve beef=65grams, 1 serve energy-dense nutrient-poor foods and beverages (EDNP) =600kJ). The mean daily intake of meat, poultry and fish was 2.3±1.2 and 1.7±0.9 serves for men and women, respectively. Men were significantly more likely to consume >2 serves of meat, poultry or fish per day compared with women (p=0.004), as were participants with a BMI of <25kg/m2 (p=0.005). Men and women consumed 4.6±2.7 and 4.1±2.0 serves of ultra-processed EDNP foods per day, respectively. Participants with a BMI of ≥25kg/m2 were significantly more likely to consume 3≥ serves of ultra-processed EDNP foods (p=0.03). There was no association between the intake of meat and highly processed EDNP foods, both identified as eating behaviours that negatively impact the environment. Future analysis will explore other factors such as individual packaging, seasonality and plate waste. This study supports the feasibility of using the mFR for the assessment of healthy and sustainable dietary behaviours and it allows assessing these behaviours at the individual level.

Factors associated with 'willingness to record' with an image-based mobile food record in young adults

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Image-based dietary assessment methods have the potential to address the burden associated with recording and improve engagement in the task of recording. There is a need however, to evaluate the usability and acceptability of mobile applications. The objective of this study was to assess factors associated with the willingness of young adults (18-30 years) to take images of food and beverages using a mobile food record (mFR) application running on an iPod touch. A population-based sample of 240 young adults completed a 4-day mobile food record. Exclusions included those dieting, extreme exercisers or who had studied nutrition. A usability questionnaire was administered and participants were asked - how long in days/weeks/months would you be willing to record what your eat using the mFr App. A single item on a validated questionnaire asked - Which statement best describes how you feel about your diet? Participants selected from 4 options. Participants reported they would be willing to record for 14.0 days (median; CI 95% 4.0 180.0 days), with no significant difference by gender or psychosocial factors associated with body weight. BMI was associated with willingness to record (r=0.215; p<0.001). The proportion of individuals willing to record 14 days or

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more progressively increased from underweight to obese: underweight, 10/21 (48%); healthy weight, 76/142 (53.5%); overweight, 29/47 (62%); obese, 23/30 (77%). The greater willingness of overweight and obese individuals to record dietary intake with images needs further examination to determine if this translates to more accurate estimates of energy intake.

The mobile food intake visualization and voice recognition system (FIVR) for dietary assessment

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Food records, often deemed the most accurate of the self-reported methods, are often viewed as tedious, may require weighing and recording intake over several days, making them prone to non-compliance. Food diaries may also be subject to reporting bias; the act of recording intake may actually influence the respondent's usual food choices during the recording period. Perhaps the most significant issue facing all self-reported dietary assessment methods is inaccuracy in the resulting data. Underreporting dietary intake is the most common error in dietary assessment. The Mobile Food Intake Visual and Voice Recognizer (FIVR) System is a novel combination of innovative technologies including computer vision and speech recognition to measure dietary intake using a mobile phone. FIVR uses a mobile phone's camera to capture a short video of foods to be consumed, which is then verbally-annotated on the mobile phone by the user. These video and audio files are processed through a real-time backend server speech and image recognition engine for food recognition and portion size measurement. FIVR is a low user-burden method for accurately capturing, storing, analysing, and reporting dietary behavioural measures. Tests were done on a box of known dimensions and on a plate with strawberries and pineapple. Results were very accurate, with less than a 5% average error in most trials. Currently, the mobile tool is trained to recognize 146 different food types, tested with 322 plates and achieved as little as 5% error in volume estimation in tests. FIVR is currently being expanded to thousands of foods.

Theme 10: What Should We Measure and Why?

Subject perception of dietary intake on a recall day

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Using multiple-pass 24 hour dietary recall data from the 2011-12 Australian National Nutrition and Physical Activity Survey (NNPAS), analyses were conducted examining the relationship between response to a short question relating to the relative amount eaten, and the number and type of eating occasions and total energy intake. Using weighted data for 12,150 subjects, 77.4% stated that their food intake yesterday was the same as usual, 7.2% stated that it was 'much more' than usual and 15.4% stated that it was 'much less' than usual. There was little difference in these percentages

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between children and adults, while females were a little more likely than males to report that yesterdays intake was much more than usual (8.0% vs 6.4%, p=0.005). Obese adult subjects were more likely to report yesterdays intake as much more than usual compared to normal weight adults (8.4% vs 7.1%, p=0.03) despite more apparent under-reporting of intake in this group. In linear regression, after controlling for age, sex, and body mass index, a response of eating much more than usual on the day of the survey was positively associated with total dietary energy intake (P<0.001), but a response of much less than usual on the day of the survey was not (p=0.51). Subject perception of their dietary intake on the day of recall is twice as likely to be that they consumed much less than usual than it is that they consumed much more than usual.

Is portion size an appropriate target for managing gestational weight gain during pregnancy?

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Background
Excessive gestational weight gain (GWG) is associated with adverse maternal-infant health outcomes. Managing total energy intake and GWG versus optimizing intakes of nutrients important during pregnancy can be challenging. This prospective longitudinal study investigated the associations between maternal diet portion size, nutrient intakes and GWG.

Methods
Prospective data from 179 women enrolled in the Women and Their Children's Health Study. A validated 74-item food frequency questionnaire was used at 18-24 and 36-40 weeks gestation to quantify diet and portion size during the previous 3 months of pregnancy. Nutrient intakes were compared to Australian Nutrient Reference Values (NRVs). GWG was measured up to 36 weeks and compared to Institute of Medicine weight gain recommendations (WtAdh).

Results
In multivariate regression models, portion size factor (PSF) was positively associated with GWG in women with high socio-economic status (SES; $\hat{I}^2$=0.20, P=0.04) and those with an overweight/obese pre-pregnancy BMI ($\hat{I}^2$=0.28, P=0.04). PSF uniquely accounted for 8.2% and 3.7% of the variability in GWG for women with high SES and overweight/obese pre-pregnancy BMIs, respectively. Nutrient intakes and PSF were similar regardless of WtAdh. Women achieved NRVs for calcium and zinc in all PSF categories. Most women with large PSF failed to achieve the NRVs for folate (95.7%), iron (89.6%) and fibre (85.5%).

Conclusion
Targeting portion size alone is insufficient to manage GWG, but may prove a valuable tool in pregnant women of high SES and/or those overweight/obese pre-pregnancy. Further research to identify the optimal strategy to prevent excessive GWG is required and remains a priority.

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Diet of Surinamese, Turkish, Moroccan and ethnic Dutch residents of Amsterdam - Results of the HELIUS-dietary pattern study

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Background

Insight into the diets of ethnic minorities living in Western countries is warranted given their disproportionately high levels of diet-related chronic diseases. We aimed to describe the diets of the largest ethnic minority groups living in Amsterdam, the Netherlands and to compare these to the diets of their Dutch origin peers.

Method

Data on habitual diet was collected using ethnic-specific food frequency questionnaires. Included were African Surinamese (n=997), South Asian Surinamese (n=841), Turkish (n=539), Moroccan (n=458) and ethnic Dutch (n=1365) participants in the Healthy Life in an Urban Setting (HELIUS) prospective cohort study; a random population sample of Amsterdam residents aged 18-70 years.

Results

Compared to the Dutch origin group, the ethnic minority groups had higher intakes of fruit, fruit juices and sugar-sweetened beverages while consumption of dairy products and alcoholic beverages was lower. Surinamese participants consumed more rice, noodles and fish and less vegetables and fat. Turkish and Moroccan participants had a high consumption of low fibre bread and meat and meat products. Fruit consumption was highest in Turkish participants. Turkish women had the highest vegetable intake while vegetable intake was lowest in the Moroccan group. Intakes of dietary fibre, calcium and vitamins A & D were lower in the ethnic minorities compared to the Dutch group.

Conclusion

The study provides insight into the diets of the largest ethnic minority groups in the Netherlands and can be used to stimulate healthier dietary patterns. Nutritional status research is recommended to verify our results.

Acknowledging the multi-dimensional nature of diets through food group analysis and integration of nutrient analysis: A pilot study in men with prostate cancer

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A reductionist approach has long been used to analyse the rich dietary data collected through scientific research. Nutrient analysis, which is a valuable part of the dietary analysis hierarchy, fails to acknowledge the complex and multi-dimensional nature of diets. We conducted a pilot study to

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assess the diet quality of men with prostate cancer (PCa) using an alternative dietary analysis, notably food group analysis. A 7-day diet history was collected by a dietician for 41 men with PCa. The food groups were based on the categorisation convention from the National Nutrition and Physical Activity Survey (NNPAS), which includes 24 major food groups and 132 sub-major food groups. The median food group intake of men with PCa was compared with the food group intake of age-matched men from NNPAS. Men with PCa consumed 21 of the major food groups, with 'cereals and cereal products' contributing the most to their energy intake. Compared to age-matched men from NNPAS, men with PCa consumed more 'vegetables products and dishes' and less 'alcoholic beverages', 'meat, poultry, game products and dishes', 'fish and seafood products and dishes', and 'fats and oils'. Men with PCa consumed more foods high in saturated fats than foods high in unsaturated fats. Through integration of nutrient analysis into food group analysis, we identified: (i) food choices that could benefit from immediate nutrition education through practical recommendations, (ii) food choices to be targeted in future dietary intervention studies, and (iii) dietary trends that could form the basis of hypotheses for future work.

An examination of brief diet screeners to determine diet quality and intake

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Brief measures of dietary assessment, or diet 'screeners' are often used to assess overall dietary intake or quality, as they have low participant and investigator burden. However, the brevity of screeners and ability to assess only a limited number of dietary components carry the possibility of systematic bias. The objectives of this review were to identify diet screeners used in research and to examine the criterion validity of these tools. A literature review was conducted using Medline research database incorporating three concepts: food/diet, tool/survey and brief/short. Reference searches and a search of the National Cancer Institute's Register of Validated Short Dietary Assessment Instruments were also conducted. Inclusion criteria included articles describing the validation of a tool with fewer than 20 items, and assessed at least two components of diet. This review identified 22 tools that assessed dietary patterns developed for research or surveillance purposes (n=17), clinical purposes (n=4) or both (n=1). Screeners used between 8 and 20 items, and time to complete ranged from 4 to 10 minutes. Most tools either provided summary scores assessing diet quality (n=11) or assessed nutrient intakes (n=9). Studies described 'moderate to good' levels of relative validity compared to longer assessment methods, with most correlations between 0.4 to 0.7; only three studies had been validated using concentration biomarkers. A number of diet screeners are available. While the brevity and efficiency of screeners are beneficial for some applications, this should be weighed against the potential for bias, and the limitations of screeners should be acknowledged.

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Theme 11: Measuring Physical Activity in Children

Relationship of locomotive and non-locomotive physical activity among elementary school children in Japan: A cross-sectional study

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Physical activity (PA) is an essential component of health and wellness in schoolchildren for prevention of obesity and other chronic diseases. The aim of this investigation had twofold: firstly to evaluate the relationship of locomotive and non-locomotive PA patterns and secondly, to document relationship of locomotive and non-locomotive activities between MVPA. A total of two hundred twenty four elementary school-going children aged from 6 to 12 years old (boys: 118; girls: 106) were voluntarily recruited from four primary schools in Tokyo Metropolis. The PA was assessed by a triaxial accelerometer (Active Style Pro HJA-350IT) during waking hours for 7 days that distinguishes locomotive and non-locomotive PA using 10s epoch length. The mean age of the subjects was 9.3±1.7 and BMI (kg/m2) were 16.7±2.8. The results revealed that there was significant relationship on time spent on loco- and non-locomotive activities were evident when compared with LPA (r=0.16; p>0.05), MPA (r=0.28; p<0.001) and VPA (r=0.79; p<0.001) after controlling for age. Correlation between locomotive MVPA vs non-locomotive LPA was poor and not statistically significant (r= -0.09; p>005). While, total MVPA vs locomotive LPA revealed a strong correlation (r=0.67; p<0001). Total MVPA vs locomotive MVPA had a strong correlation (r=0.94; p<0001). In conclusion, locomotive and non-locomotive PA revealed the actual activeness of the children objectively. Data of locomotive and non-locomotive PA among children is vital for distinguish the actual habitual physical activity and such data will provide an evidence for appropriate PA intervention in order to prevent lifestyle disease in their later age.

Differences in accelerometer-derived physical activity and sedentary time among toddlers between two procedures for removing naps

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Background
Measuring physical activity and sedentary time in the early years (0-4 years) with accelerometers presents unique challenges due to daytime naps. Currently, an established procedure to determine daytime naps from accelerometer data in this age group does not exist. The purpose of this study was to examine differences in physical activity and sedentary time in a sample of toddlers between two procedures to remove naps.

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Methods

This study includes 89 toddlers (19.7±5.5, mean±SD) from Edmonton, Canada. Participants wore ActiGraph accelerometers for 7 consecutive days during daytime hours. Procedure one removed naps through a regular non-wear time (NWT) data reduction procedure (≥20 min of consecutive zeros) and procedure two removed naps through NWT combined with parental log (NWT+log). Sedentary time (<25 counts/15 s), light-intensity physical activity (LPA; 25-420 counts/15 s), moderate- to vigorous-intensity physical activity (MVPA; >420 counts/15 s) were derived after each procedure and paired t-test compared measures.

Results

Mean h/day of MVPA, LPA, sedentary time, and total wear time when using the NWT procedure were 59.3±22.4, 236.4±40.1, 319.0±70.2, and 614.7±88.4, respectively. Mean h/day of MVPA, LPA, sedentary time, and total wear time when using the NWT+log procedure were 57.6±22.0, 229.2±40.3, 294.9±69.7, and 581.8±88.3, respectively. There were significant mean differences in MVPA, LPA, and sedentary time between the two procedures (P<0.001).

Conclusions

Different procedures for removing naps impact physical activity and sedentary time estimates. Future development of an accelerometer algorithm to determine daytime naps could reduce the burden of parental logs and overcome precision issues associated with them.

A novel computer-based physical activity assessment tool to assess habitual physical activity levels in children: A validity and reproducibility study

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A novel computer-based assessment tool to assess physical activity (PA) levels in any populations has been increasingly introduced in epidemiological studies. However, the utility of this assessment tool in children and adolescents is still limited, taking into account the differences in type, intensity and frequency of PA both in the school and during the after-school period. The aim of the present study was to assess the developmental stages, validity, reproducibility and cost-effectiveness of the new computer-based PA assessment questionnaire (cPAQ) to estimate habitual PA levels in Malaysian adolescents. A total of 425 adolescents participated in the study and, Polar heart rate monitor (HRM) and a 7-days physical activity logbook (PALog) were used as objective and subjective criterion, respectively. The mean estimated weekly total PA level measured by cPAQ was 16.5 17.5 h and 13.1 16.9 h for boys and girls, respectively. A gender-specific Pearson correlation coefficient between cPAQ and both objective and subjective criterion showed that r values ranged from 0.61 to 0.92 (p<0.001). The degree of agreement between cPAQ and HRM, and PALog, as determined by the Bland-Atman plot analysis, showed that most cPAQ-derived PA measures fell within the mean 2SD. Reproducibility of the cPAQ was re-examined after two-weeks, showing that intra-class correlations (ICC) for most PA measures in boys and girls were considerably higher with a mean r value of 0.72, except for the light intensity activity of Malay girls. Completion of the cPAQ required a significantly shorter assessment time compared to the manual paper-administered PAQ in adolescents (p<0.001) and the majority of participants (93%) were satisfied with the new cPAQ. The present findings suggest that the cPAQ is a valid and reliable method to assess the habitual PA level of adolescents.

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The instrument also proved to be highly effective, based on time to complete and the overall appearance of the questionnaire.

How many are we missing? Attrition and non-compliance in randomized controlled trials using accelerometers to measure children's physical activity

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Background

Compliance with accelerometer protocols is known to be limited. In addition to the participants who completely drop out of a study, non-compliance adds to the overall 'missingness' of data, which can be defined as the participants who enter a study but are not included in the final results. For trial quality and transparency, 'missingness' should be reported. The purpose of this review was to examine the 'missingness', from both attrition and non-compliance, during physical activity RCTs among children which have used accelerometers to measure physical activity.

Methods

Using a previously published search strategy, an updated search of the literature was performed in the MEDLINE database for articles published from 1996 to February 2015 identifying physical activity RCTs in children (ages 2-18) measuring physical activity using accelerometers. Rates of attrition and non-compliance were extracted from identified articles.

Results

Twenty-three independent studies provided complete attrition and non-compliance data and were included. The mean attrition rate was 11.5% (SD 10.1%, range 0-30.9%). The mean accelerometer non-compliance rate at baseline was 22.7% (SD 16.4%, range 1.7%-67.8%) and 29.6% (SD 19.4%, range 3.3%-70.1%) at follow-up. The mean total study 'missingness' was 37.4% (SD 20.2%, range 3.3%-75.4%) and ranged from 3.3% to 75.4%. There was large variation in how 'missingness' was accounted for between studies. There were no statistically significant differences in 'missingness' between study characteristics including sample size, participant age, intervention setting and duration of follow-up.

Conclusions

'Missingness' appears to be common among RCTs using accelerometry in children, but may not be adequately reported or accounted for in study designs and analyses.

Implementation of the SHAPE Act in Georgia: An evaluation of FITNESSGRAM administration

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The SHAPE Act mandates that children in Georgia schools have annual fitness assessments. Researchers assessed the degree to which teachers accurately administered FITNESSGRAM and explored the perceptions of participants. A certified FITNESSGRAM test administrator observed testing. Differences between scores recorded by teachers and those recorded by trained recorders were assessed. Total observations for each test component were: curl up (n=334), PACER (n=809), push-ups (n=854), sit and reach (n=296), and BMI (n=300). Eleven focus groups with 56 students and 57 PE teachers were conducted. Data were analysed using NVivo. Observations showed that required instructions for the following test components were communicated to students by the teacher correctly as follows: push-ups 77.6% (range 28.6%-100%); PACER 73.8% (28.6%-100%), back saver sit and reach 66.7% (44.4%-100%), curl ups 56.4% (9.1%-81.8%). Scores were also analysed across categories of teacher training the tester received. Scores for correct testing direction were as follows: Level 1 (highly trained teachers) 75.4%, Level 2 47.5%, and Level 3 (least trained) 33.3%. Observations of testing to assess reliability between teachers and trained experts showed agreement in scores as follows: curl up 43.7%, PACER 60.3%, push up 37.5%, sit and reach 78.7%, BMI 100%. Agreement based on +/-1 were as follows: curl up 62.3%, PACER 79.3%, push-ups 52.3%, sit and reach 82.4%, BMI 100%. Overall agreement with the Healthy Fitness Zone designation was as follows: curl-up 96.3%, push-ups 87.5%, sit and reach 98%, aerobic capacity 97.3%. Findings from raise questions about fidelity to testing protocols and accuracy and usefulness of data collected.

Playability of the school environment and after school physical activity among 8-10 year-olds: Influence of time and distance from school to home

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Introduction
Physical Activity (PA) occurs in several contextual domains (e.g., sports, active transport), and is therefore affected by distinct environmental factors. By combining children's school schedules with accelerometry, one can perform time-specific analyses that separate daily PA into more contextually meaningful domains. We used an ecological design to investigate playability of 21 school environments and its relationship with after-school PA. We also examined to what extent time of the day and distance from school to home influenced this relationship.

Methods
PA was measured in 611 children aged 8-10 years by accelerometers, and separated in two-hour time periods after school. We geocoded schools and children's residences, and classified each child to be in a 400, 800, or 1600 meters buffer of their school. We also identified the shortest walking route from school to home using Google Maps. For each school environment, we computed playability scores based on neighbourhood scans in an 800 meters buffer. We tested their influence with stratified analyses and interaction terms.

Results
From all variables derived from neighbourhood scans, playability was the strongest predictor of especially light PA and MVPA. Playability explained approximately 30% of the total environmental variance of PA after school. Time and distance had its a-priori hypothesized influence.

Conclusion

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This study demonstrated that playability is a strong, independent predictor of especially light PA, and that this relationship was influenced according to our hypotheses. By combining school schedules with accelerometry, one can define a homogenous point in time and location where children's environment-PA relationships can be investigated.

Decision tree models for detection of physical activity intensity in ambulatory youth with cerebral palsy

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Aims

Develop and test decision tree (DT) models to classify physical activity (PA) intensity from accelerometer output and Gross Motor Function Classification System (GMFCS) level in ambulatory youth with CP; and 2) compare the classification accuracy of the decision tree models to that achieved by previously published cut-points for youth with CP.

Methods

51 youth with CP (GMFCS Levels I - III) completed a series of activity trials with increasing PA intensity while wearing a portable metabolic system and ActiGraph GT3X accelerometers. DT models were used to identify vertical axis and VM count thresholds corresponding to SED (< 1.5 METs), LPA (>1.5 and <3 METs) and MVPA (> 3 METs). Models were trained, tuned, and cross-validated using the 'rpart' and 'caret' packages within R.

Results

For the vertical axis (VC_DT) and VM decision trees (VM_DT), a single threshold differentiated SED from LPA, while the threshold for differentiating LPA from MVPA decreased as the level of impairment increased. The average cross-validation accuracy for the VC_DT was 81.1%, 76.7%, and 82.9% for GMFCS levels I, II, and III, respectively. The corresponding cross-validation accuracy for the VM_DT was 80.5%, 75.6%, and 84.2%, respectively. Within each GMFCS level, the decision tree models achieved better PA intensity recognition than previously published cut-points. The accuracy differential was greatest among GMFCS level III participants, in whom the previously published cut-points misclassified 30-40% of the MVPA activity trials.

Conclusion

GMFCS-specific cut-points provide more accurate assessments of MVPA levels in youth with CP across the full spectrum of ambulatory ability.

Validation of the activPAL3 activity monitor In 5-12 year-old children

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Introduction

This study validated the activPAL3 for assessing postural allocation and breaks in sitting against direct observation (DO) in 5-12 year-old children.

Methods

29 children (9.2±2.2y, 55% boys) completed 15 5min semi-structured sedentary (Resting, TV, handheld game, computer game, writing), light (slow-walk, getting ready for school, standing activity, tidy-up), and moderate-to-vigorous-intensity (brisk-walk, dancing, basketball, soccer, running, obstacle course) activities. Posture and breaks were classified by the thigh-mounted activPAL3 (1s epochs) and coded as sit/lie, stand, and stepping using DO during activities and transitions. Analyses examined equivalence of time estimates (equivalence testing), individual level bias (Bland-Altman plots), misclassification (confusion matrix) and difference in numbers of breaks (paired t-test).

Results

Minutes (mean±sd) spent sitting/lying, standing and stepping were 76.0±11.2, 26.0±7.1 and 66.5±4.2, respectively. Mean differences and 95% limits of agreement (LoA) for stepping time were small (3.6min, LoA: -1.5, 8.7). However, wider LoAs and consistent overestimation and underestimation were found for time sitting/lying (4.3min, LoA: -9.6, 18.2) and standing (-7.8min, LoA: -22.1, 6.5), respectively. Group estimates of time stepping were found to be equivalent to DO (p=0.002), but not for sit/lie (p=0.15), or stand (p=0.99). 6.0% of sitting/lying and 12.1% of stepping was misclassified as standing, and 15.6% of standing was misclassified as stepping. The number of breaks did not differ (activPAL3:12.9±3.3; DO: 13.8±3.5, p=0.12).

Conclusion

The activPAL3 was accurate for measuring breaks in sitting but consistently overestimated and underestimated time sitting/lying and standing, respectively. However, the difference for sitting/lying was relatively small.

Physical activity and its association with body composition and insulin resistance among Malaysian children

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Objectives

This presentation aims to determine the physical activity level, screen time and sedentary behaviours among Malaysia children; and to describe the relationship between physical activity, body fatness and metabolic markers of children aged 9 -14 years.

Methodology

A cross-sectional study was conducted among 253 Malay children (131 boys, 122 girls) in metropolitan Kuala Lumpur. Weight, height, waist circumference (WC) and blood pressure (BP) were measured. Body composition was assessed through deuterium dilution. Fasting blood glucose (FBG), triglycerides (TG), high-density lipoprotein (HDL-C), low-density lipoprotein (LDL-C), total cholesterol (TC) and insulin were determined in an overnight fasting blood sample. Homeostasis model assessment (HOMA-IR) method was used to calculate insulin sensitivity. Physical activity was determined using electronic pedometers on two weekdays and one weekend day.

Results

Boys attained higher means steps/day 9879 (95% CI: 9242, 10500) compared to girls 9010 (95%CI: 8397, 9624). Girls have significantly higher sedentary time compared to boys [5.9 hours (95%CI: 5.5, 6.5) vs 4.9 hours (95%CI: 4.3, 5.5)]. Only 26.9% (32.1% boys and 21.3% girls) met the pedometer-based cut-off points while 85.8% children had more than 2 hours of screen time per day. Regression analysis showed no significant association between weight status, screen time, sedentary time and socio-economic status with physical activity. However, girls were found to be more likely to not achieve pedometer steps recommendation compared to boys (OR=2.2, 95%CI: 1.1, 4.3). Children who have body fat above 95th centile (OR=0.4, 95%CI: 0.19, 0.90) and who have insulin resistance (OR=0.3, 95%CI: 0.1, 0.8) was found to be less likely to achieve pedometer recommendation.

Conclusion

Physical activity was found to be significantly associated with sex, body fat and insulin resistance. Strategies in promoting physical activity among children are needed in order to prevent adverse health outcomes.

Theme 12: Novel Methods for Measuring Physical Activity, Sedentary Behavious and Sleep

Accelerometry data treatment of interruption in physical activity bout analysis to estimate cardiorespiratory responses under free-living conditions

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Background

The purpose of the present investigation was to clarify the impact of the treatment of interruptions of the physical activity (PA) bouts at the point of view of the cardiorespiratory responses under free-living conditions.

Methods

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Twenty young women wore an accelerometer (Lifecorder) and the heart rate (HR) monitor (Polar) under free-living conditions. Based on the time series data, we defined MVPA bouts as PA that was maintained at no less than 3 METs completely for 10 minutes or longer with or without allowing for a one-minute or a two-minute break (<3METs). Furthermore, all subjects performed a submaximal graded test in order to determine the individual relationship between METs and the HR response.

Results

The duration of the continuous MVPA bouts lasting longer than 10-min were significantly lower and shorter compared with that in the non-continuous MVPA bouts allowing a one- or two-minute interruption ($P<0.05$). The average HR during the continuous MVPA bouts was significantly differ according the treatment of the interruptions ($P<0.05$), and the average HR in the non-continuous MVPA bouts allowing a two-minute interruption was significantly lower than the actual HR corresponding to 3METs determined by the submaximal graded test ($P<0.05$).

Conclusion

The treatment of interruptions for the setting of the accelerometer affects the estimation the cardiorespiratory responses under free-living conditions. The MVPA bouts allowing a two-minute interruption may underestimate the cardiorespiratory responses.

Time spent in short-unbroken bouts of sedentary time has differential associations with health than time spent in prolonged unbroken bouts: A study in older adults

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Sedentary behaviour is detrimentally associated with physical functioning and cardiometabolic risk factors. Recent evidence suggests the way sedentary time is accumulated (i.e., breaks in and prolonged-unbroken bouts of sedentary time) has important health consequences. In a sample of 307 older adults (age=84±6 years) we divided total sedentary time into two components; time spent in short (1-19 minute) and long (>19 minute) bouts. Using linear mixed models, we examined the association between 30 minute increments of time spent in short and long bouts with physical functioning, using the Short Physical Performance Battery (SPPB), as well as markers for physical and mental health. Time spent in short bouts was positively associated ($\hat{I}^2$=0.612, p=0.013) with SPPB while time spent in long bouts was negatively associated ($\hat{I}^2$=-0.627, p<0.001). Similar results were observed for systolic blood pressure (short bouts $\hat{I}^2$=-1.024, p=0.084; long bouts $\hat{I}^2$=0.221, p<0.513) and diastolic blood pressure (short bouts $\hat{I}^2$=-0.567, p=0.072; long bouts $\hat{I}^2$=0.371, p=0.039), only long bouts with diastolic blood pressure was statistically significant. There were no significant relations observed for self-reported depressive symptoms or stress. Among this sample of older adults, we observed differential associations between time spent in short bouts and time spent in long bouts with short-bout sedentary time beneficially associated with physical functioning and physical health and long-bout time detrimentally associated with them. Studies using total sedentary time to measure sedentary behaviour may be underestimating the deleterious effects of prolonged

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sedentary time because it includes short-bout time which appears to be beneficially associated with some indicators of health.

Usage and acceptability of the LUMOback activity tracker

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Wearable activity trackers are rapidly advancing in their sophistication, however, few measures or provide behavioural support for reductions in sitting time. This study evaluated the usage and acceptability of the LUMOback - a waist-worn belt with associated mobile application that enables users to self-monitor their daily sitting, standing and moving time, and set sitting and posture alerts in real-time. In a randomised intervention, participants (n=59) were allocated a LUMOback with written set-up and wear instructions. Wear was self-directed. In intervention compliers (n=42), LUMOback data (n=36), questionnaires (n=34) and telephone interviews (n=22) gauged usage and acceptability. During the 12-week intervention period, only 40 participants (68%) wore their LUMOback; two participants activated theirs afterwards. Wear ranged from 2 to 57 days (median=17). Usage peaked in the first two days of wear and was sporadic thereafter. Posture alerts were used at least once by 85% (29/34) of participants (11/34 used them at least 'often'). Sitting alerts were seldom used (used by 17/34 at least once and 6/34 at least 'often'). Most participants found the LUMOback 'comfortable' or 'somewhat comfortable' to wear (25/34, 74%), and 'very easy', 'easy' or 'somewhat easy' to set up (30/34, 88%). Reasons for non-wear included no time to set up (n=6), not interested (n=3), technical problems (n=3), pregnancy (n=1), or unknown (n=4). Uptake and usage of the tracker were low. Pre-activation and a brief tutorial on the tracker's functions may improve initial usage. Strategies to support sustained use of the tracker (i.e. team competitions) need to be explored.

Associations between physical activity, sedentary time, sleep and cardiometabolic biomarkers of children and youth using compositional analyses

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Background
Time spent in 24h movement behaviours (physical activity, sedentary behaviour, sleep) is finite and collinear. Using standard regression to examine relationships between movement behaviours and

health indicators can produce inaccurate results. Alternatively, composition analyses can be used. The purpose of this study was to examine the collective relationships between movement behaviours and cardiometabolic biomarkers in children and adolescents using compositional analyses.

Methods

This cross-sectional study includes 2548 children and adolescents, aged 6-17 years from the 2003-2006 National Health and Nutrition Examination Survey. Sedentary time, light-intensity physical activity (LPA), moderate- to vigorous-intensity physical activity (MVPA), and non-wear time (NWT), as a proxy for sleep, were accelerometer-derived. Cardiometabolic biomarkers, including waist circumference, BMI z-score, HDL-cholesterol, C-reactive protein, and blood pressure were measured. Triglycerides, glucose, insulin, and LDL-cholesterol were also measured in a fasting sub-sample (n=666). The composition of movement behaviours was entered into linear regression models via an isometric log ratio transformation to examine relationships with each biomarker.

Results

After adjusting for confounders, the composition of movement behaviours was associated with all biomarkers (p<0.0001), apart from LDL-cholesterol (p=0.51). Time spent in MVPA relative to other movement behaviours was negatively associated with waist circumference (p=0.03), BMI z-score (p=0.01), and insulin (p=0.03). Time spent in LPA relative to other movement behaviours was negatively associated with diastolic blood pressure (p=0.01). Time spent in NWT relative to other movement behaviours was positively associated with waist circumference (p=0.03).

Conclusions

Compositional analyses provide an appropriate means for understanding the collective health implications of finite, 24h movement behaviours.

Measurement of workplace sitting, standing, and stepping time by self-report: the occupational sitting and physical activity questionnaire

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Background

Replacing workplace sitting with standing or stepping may have health benefits. Valid and responsive self-report methods for measuring such changes are needed.

Methods

Office workers (mean age 45 years, 65% women) were recruited into a two-arm cluster randomised trial (Stand up Victoria; 73 control, 106 intervention participants). Proportion of work time spent sitting, standing and stepping was assessed via activPAL3 monitors and the Occupational Sitting and Physical Activity Questionnaire (OSPAQ) at baseline and after 3 months of intervention. Relative validity of the OSPAQ against the monitor at baseline was assessed using Spearman's correlation

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with 95% confidence intervals (CI). The ability of the OSPAQ to evaluate change in workplace sitting, standing and stepping compared with the monitor was assessed by difference in responsiveness index (RIdiff) and Pearson's r (change scores).

Results

At baseline, the correlation of the OSPAQ and activPAL-derived estimates of sitting, standing and stepping was ρ^2=0.33 (95%CI: 0.19, 0.45), 0.27 (95%CI: 0.13, 0.40) and 0.31 (95%CI: 0.17, 0.43) respectively. All measures were responsive to change. The activPAL was significantly more responsive than the OSPAQ only for changes in sitting (RIdiff: 1.71; 95%CI: 1.19, 2.22). Correlations in change scores between OSPAQ and activPAL were strong for sitting (r=0.71, 95%CI: 0.60, 0.79) and standing (r=0.71, 95%CI: 0.60, 0.80), but weak for stepping (r=0.20, 95%CI: 0.01, 0.38).

Discussion

Despite modest ability to measure sitting, standing and stepping in the workplace at baseline, the OSPAQ showed promise as a self-report instrument for assessing change.

Relative validity of a self-reported multi-context sitting time questionnaire with monitor-assessed overall sitting time: AusDiab3

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Introduction

In addition to measuring total sitting, questionnaires can measure sitting in multiple behaviourally relevant contexts. Valid measures of total sitting time and identification of particular contexts that are strongly associated with total sitting are needed.

Methods

A subsample of participants of the third wave of the Australian Diabetes, Obesity, and Lifestyle (AusDiab3; n=700, age 36-89 years, 45% men) study wore activPAL3TM monitors (7 days, 24 h/day protocol) and reported their sitting time in five contexts. Associations with monitor-assessed overall sitting time were examined for self-reported sitting time in each context, the composite total sitting time, and various combinations of contexts (Spearman's ρ).

Results

Monitor-assessed sitting time was most strongly correlated with the work context (ρ=0.25, 95% confidence interval [CI]: 0.17, 0.31), followed by TV viewing (ρ=0.16, 95%CI: 0.09, 0.24) and computer use (ρ=0.14, 95%CI: 0.06, 0.21) and had non-significant correlations with transport (ρ=0.07, 95% CI: -0.01, 0.14) and 'other' sitting (ρ=0.06, 95% CI: -0.02, 0.13). The composite total self-reported sitting time had a correlation with monitor-assessed sitting time of ρ=0.44 (95%CI: 0.38, 0.50). This was not significantly improved by removing weakly correlated items from the total (e.g., ρ=0.45, 95% CI: 0.29, 0.50; excluding 'other').

Conclusion

This multi-context questionnaire provides a total sitting time measure that ranks participants well for

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the purposes of assessing health associations. Work was the context most strongly correlated with overall monitor-assessed sitting time and, therefore, may be particularly important to include in multi-context questionnaires for general adult populations.

Empirically derived cut-points for sedentary behaviour during working and non-working hours: how important is the context in which we sit?

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Introduction

Sedentary behaviour (SB) is associated with a number of health outcomes, independent of physical activity. Studies that have used accelerometers to define SB tend to use a <100 counts per minute (cpm) threshold to define SB across all domains; however, this cut-point was not empirically derived. It is not known whether accelerometer cut-points for SB differ depending on the context in which it occurs. The aim of this study was to empirically derive accelerometer cut-points for working and non-working time.

Methods

A convenience sample of 30 university employees (10 males, 30 females; age 40.47±10.95 years; BMI 23.93±2.46 kg/sq.metre) wore the ActiGraph GT3X+ and activPAL devices simultaneously for seven days. Data were downloaded in one minute epochs and non-wear time (derived from an activity diary) was removed. Generalised estimating equations (allowing for the correlation of cpm with adjacent minutes) were used to make minute by minute comparisons of sedentary time from the two devices, using sitting from the activPAL as the criterion measure.

Results

After data reduction, 29 participants provided 42,847 worktime and 19,649 non-worktime minutes. Derived cpm for sedentary time during worktime was significantly lower compared to sedentary time during non-worktime (52 [95%CI 50-54] vs. 93 [84-104]). Compared to the 100cpm threshold, the empirically derived cut-points performed better; higher area-under-the-curve and lower mean differences were found for both working and non-working times.

Conclusion

Cut-points for SB depended on domain: SB at work was less active than SB at home. Thus, the nature of sitting does depend on the context.

Relationship of a comprehensive sedentary behaviour measure (SIT-Q) with activity energy expenditure assessed via doubly-labelled water

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Introduction

For most adults, over 95% of waking hours are spent in either light-intensity physical activity or sedentary behaviours. The aim of this study was to determine the extent to which self-reported sedentary behaviour is correlated with doubly labelled water (DLW)-derived activity energy expenditure (AEE); and whether imputing non-sedentary waking time as light activity can generate a reasonable estimate of AEE.

Methods

106 weight stable residents of Calgary, Canada, aged 33 - 60 years, completed a 14-day DLW protocol between 2009 - 2011. The SIT-Q, a past-year recall measure of sedentary behaviour across multiple domains, was administered approximately nine months post-DLW. Spearman's rank correlation estimated the strength of the association between sedentary behaviour and AEE_DLW. Intraclass correlation coefficient (ICC) and Bland-Altman plots examined agreement between SIT-Q estimate of AEE (AEE_SIT-Q = [[1.5 * SIT-Q h/d * mass kg] + [2.5 * LIPA h/d]] - [1.0 * mass kg * [SIT-Q h/d + LIPA h/d]]) and AEE_DLW.

Results

Complete data were available for 80 participants. Correlation between sedentary behaviour and AEE_DLW was negative and weak: $\ddot{I}\bullet$ = -0.13 (95% CI: -0.34, 0.09). The mean difference between AEE_DLW and AEE_SIT-Q was only 19 kcal/day (95% CI: -105, 143), however the ICC = 0.17 (95% CI: -0.05, 0.38). Only participants with very high AEE_DLW fell outside the limits of agreement in the Bland Altman plots.

Conclusion

The weak correlation sedentary behaviour and AEE_DLW might be due to the 'active couch potato' phenomenon, whereby highly sedentary individuals also engage in high volumes of moderate-vigorous activity.

Comparing objective measures of activity in the women health initiative study

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Purpose

The study aims were: 1) to propose an improved version of Activity Intensity (AI) to summarize raw tri-axial accelerometry data; 2) to compare AI and Activity Count (AC) with regard to distinguishing between different activities and predicting energy expenditure.

Methods

200 postmenopausal women performed 9 lifestyle activities in the laboratory, each wearing an

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accelerometer (Actigraph GT3X+) on the hip. 30 Hz tri-axial accelerometry data, as well as oxygen consumption during each activity were recorded. AI and AC was computed using the raw data, and Metabolic Equivalent of Task (MET) was computed using oxygen consumption. AI and AC were then compared on their performance of distinguishing between different activities and predicting MET.

Results

AI was showed to have a similar scale as AC does, but with a higher consistency. AI was also found to be more sensitive to sedentary and light activities, and therefore able to better distinguish between them. AI was showed to be better associated with MET and to have greater ability to differentiate activities with different levels.

Conclusion

The improved AI proposed here provides a novel and valid way to summarize densely sampled acceleration into activity level in any chosen epoch. AI not only provides consistent values which helps better distinguish between different activities, but also better associates with energy expenditure.

Marauder's map - Tracking patterns of movement and occupant activity levels inside buildings

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Background

Over 90% of our time is spent indoors and occupational physical activity has fallen in recent decades. It would be beneficial to increase incidental physical activity while at work. A trend is emerging in contemporary office building architecture that addresses this issue with spatial configurations that purportedly prompt more incidental physical activity and active occupancy than in conventional building designs. However, to date these active design claims have not been empirically verified. This project describes research collaboration between academics from Architecture, Medicine and Science addressing this knowledge gap. This project represents a novel application of the in-built smartphone capability to track patterns of occupant movement, and to quantify incidental physical activity throughout an office building. New iBeacon technology (Bluetooth low-energy, wireless technology providing high resolution spatial-location information) is combined with smartphone accelerometer data.

Method

This proof-of-concept study integrated simultaneous, real-time data from the iBeacon with data from the iPhone accelerometer and altimeter. iBeacon transmitters placed about 20 m apart on the interior walls of the building geolocated each participant's smartphone on the floor plate in real-time by a triangulation algorithm. These data were combined with information from the accelerometer in their smartphones by an app, developed in-house, that estimates the spatial and temporal patterns and incidental physical activity of office building occupants. The data is also used to create 'heat maps' to overlay on the building floor-plan.

Conclusion

This project has provided proof-of-concept for a novel method of collecting physical activity data. This method can be used to measure distance and speed of movement by each participant inside the building, as well as identifying areas of the building used by occupants as a group. It is hence possible to identify movement patterns within the space and assess the effectiveness of spatial configurations that are intended to increase incidental physical activity.

Differentiating lying down from sitting using a single ActivPAL3 monitor

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Introduction

Devices which collect data from three orthogonal axes of acceleration (e.g. activPAL3, ActiGraph) can distinguish sedentary and upright activity. A thigh-worn device could provide information on thigh rotation as well as inclination. In lying, it is usual for the individual to roll over and therefore it could be possible to distinguish between sitting and lying. This study developed and tested an algorithm that automatically classified sedentary events into sitting events and lying events using the activPAL3.

Methods

Seven-day free-living activity from 14 UK workers was recorded using the activPAL3 monitor. Participants recorded when they went to bed and when they got up. All 'in bed' sedentary events were assumed to be lying and 'not in bed' events sitting. An algorithm used a threshold on the y-axis to detect rotation of the thigh which then classified each sedentary event as either lying or sitting. Classification accuracy of the algorithm was compared to self-reported classification.

Results

The algorithm correctly classified 96.7% of the sedentary time 'in bed' as lying and 92.9% of the time 'not in bed' as sitting. Most 'out of bed' sedentary events which were classified as lying were long and were close to the time the individual reported to have gone to bed, and it is likely that these were actually lying events such as lying on a couch.

Conclusion

Triaxial accelerometer data recorded from a single site on the thigh can be used to classify sedentary events into the postures of sitting and lying.

An alternative to energy expenditure estimation: Quantifying physical behaviour

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Introduction

It has been suggested that physical activity is about 'the relationship between human beings and their environment' and the 'strengthening of that relationship'. However the primary physical activity outcome has invariably been energy expenditure, with definitions of different aspects of physical activity (sedentary behaviour, MVPA, compliance with guidelines etc.) based on levels of energy expenditure. It is proposed that the pattern of robustly defined activities, Physical Behaviour, can provide an alternative construct to energy expenditure estimation.

Methods

Continuous seven-day data were collected from two different populations, using the thigh-worn activPAL accelerometer. The populations were active commuting and non-active commuting sedentary workers (n= 60). From the acceleration signals the primary activities of lying, sitting, car transportation, and standing, walking and cycling were classified. Physical behaviour of these populations was assessed by quantifying both the volumes and patterns of these activities.

Results

There were differences in the overall volumes of physical activity, which are related to energy expenditure, between these groups. While these differences were significant it was the patterns of these activities that provided the context (location, transport to work etc.) and which described the relationship between these populations and their environment.

Conclusion

Quantifying Physical Behaviour can provide an understanding of the relationship between people and their environment. This potential alternative to energy expenditure estimation may have important consequences for the provision of guidelines and could also provide information for behaviour change interventions.

Behavior-based machine learned algorithms applied to accelerometer data and relations with biomarkers of cancer risk

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Background

Traditional intensity-based accelerometer cutpoints can misclassify behaviours which are important for public health recommendations. New machine learned algorithms, to improve classification of specific behaviours, have mostly been developed in laboratories and may not be applicable to free living cohorts.

Aims

To apply behaviour-based machine learning algorithms, developed from free living training data, to overweight women in a weight loss trial.

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Methods

Machine learned algorithms were developed on 36 overweight women (mean age=55, SD 16.0) wearing accelerometers and SenseCams over 7 days of free living. Algorithms performed with 84% accuracy against known behaviours. Algorithms to predict sitting time and walking/running time were applied to 7-day baseline accelerometer data from 243 overweight women (mean age=50, SD 9.97) participating in a 12 month weight loss trial. Sitting and walking minutes were associated with cancer risk biomarkers and self-reported quality of life (SF-36) in linear regression models adjusting for wear time and age. Sitting models also adjusted for walking time.

Results

Every additional 10 minutes of walking predicted a significant decrease in insulin (p<.01) and C - reactive protein (p<.002) and increase in the self-rated health subscale (p<.05). Every additional 60 minutes of sitting time resulted in a significant increase in insulin (p<.007) and decrease in the emotional well-being subscale (p<.03).

Conclusion

The machine learned predictions were significantly related to the biomarkers and quality of life measures in the expected direction. Sitting associations were independent of walking time. Larger studies with machine learned behaviour predictions may provide useful information for behaviour-based health recommendations.

Isolating out-of-bed wear from non-wear and in-bed wear periods in young adults hip-worn accelerometer data (continuous wear protocol)

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Background

The published literature shows no automated method valid for isolating adults out-of-bed wear in continuously worn (24h/day) accelerometer data. We developed an automated algorithm (AA) for continuous hip-worn protocol Actigraph (GT3X+) data that separates out-of-bed wear from in-bed wear and non-wear periods.

Methods

In 95 participants of the Raine study (mean±SD, 21.9±0.57 years, 54% female), we examined agreement with a referent method (i.e., 'getting into' and 'getting out' of bed times visually identified by two independent raters, R1 and R2).

Results

The mean difference (AA - R1) in out-of-bed wear was 7 min/day (95% Limits of Agreement: 220 to 234 min) on days valid by both methods. Agreement for the classification of each minute as out-of-bed wear (yes/no) was excellent ($\hat{I}^o > 0.75$) for 89% of participants (AA vs R1) and poor ($\hat{I}^o < 0.4$) for only 1%, with a median $\hat{I}^o = 0.86$, comparable to the agreement between raters R1 and R2 (median $\hat{I}^o = 0.94$). Here, the AA performed better than previous algorithms validated in children (median $\hat{I}^o = 0.77$) and adolescents ($\hat{I}^o = 0.66$) in our dataset. Agreement in classification as in-bed wear (yes/no)

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for AA vs R1 was excellent for only 51% of participants (median Î² =0.80). Out-of-bed minutes were identified as such 94% of the time while 9% and 11% of in-bed worn minutes were classified as non-wear and out-of-bed wear, respectively.

Discussion

The algorithm is useful and better than existing automated alternatives, for isolating out-of-bed wear but requires improvement to specifically isolate in-bed wear periods.

Using multi-modal web and smartphone methods to improve estimates of light-to-moderate intensity physical activity

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Background

Potential health benefits of light and moderate intensity physical activity (LMPA) in daily life are understudied in part because existing questionnaires have limited ability to provide valid estimates. We explored a multi-method approach involving web-based 24-hour PA recalls and the Global Physical Activity Questionnaire (GPAQ) to derive improved LMPA measures.

Methods

18 adult cancer survivors (mean 56.7 ±1.8y) completed the GPAQ and the National Cancer Institute's Activities Completed over Time in 24 Hours (ACT24). Kendall rank correlations were used to assess the validity of estimated time in PA of varying intensity from each instrument vs. smartphone-based accelerometry (CalFit). Multivariable linear regression was used to identify predictors of reporting error, defined as differences in PA estimates vs. accelerometry.

Results

Participants completed a mean of 8 days of recalls and accelerometry. Light PA contributed 94% and 77% of non-sedentary time to accelerometry and recall data, respectively, and were unavailable for the GPAQ. Occupational and home activities accounted for 60% of ACT24 estimated light PA. Correlations vs. accelerometry for light, moderate, LMPA and vigorous PA were 0.37, 0.33, 0.50 and 0.26 respectively for ACT24, and 0.01 and 0.40 for moderate and vigorous for the GPAQ. Respondent age, gender, number of reporting/recording days, and type of job (standing vs. sitting) predicted PA reporting error on one or both self-report instruments.

Conclusions

Findings suggest that incorporating web-based PA recalls can considerably improve measures of LMPA in adults, and identified characteristics associated with reporting error potentially relevant for calibration-adjustment models to reduce measurement error.

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Automated identification of waking wear time in continuously worn activPAL3 data: two algorithms

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Background

The activPAL3 activity monitor, often worn 24h/day, provides almost perfect classification of sitting/lying posture. However, excluding sitting/lying while asleep or not wearing the monitor is burdensome in the absence of validated low-burden automated methods. We therefore created a STATA program and a SAS program that implement similar, but not identical, decision rules (algorithms) to automatically classify activPAL3 activity bouts (sitting, standing, stepping) as sleep/non-wear (yes/no), based on user-chosen thresholds.

Method

In AusDiab 2011/12, a subsample of participants (n=741, 44% male, aged >35 years, mean=58.5, SD=10.4 years) wore the activPAL3 (7 day, 24 h/day protocol). Both algorithms were tested for agreement against a monitor-corrected, diary-based referent method in their classification of each bout, weighted for bout duration (Kappa, κ), and average waking wear time per day (wake to wake), on days valid by automated and referent methods.

Results

For the SAS and STATA algorithms respectively, agreement was 'almost perfect' (κ >0.8) for 84%/ 87% of participants, with a median kappa of 0.91/0.94. Agreement varied significantly ($p<0.05$) by age (worsens with age, both $p<0.001$) but not by gender. Mean differences in waking wear (algorithm - referent) were significant ($p<0.05$) but small (21 and 29 min/day) with 95% Limits of Agreement of -97 to 139 and -100 to 157 min/day.

Discussion

Both algorithms showed excellent agreement with the referent method in Australian adults on average but not for all individuals and with variable accuracy by age. A semi-automated process that includes checking and amending errors or optimising the thresholds may improve classification.

Theme 13: Measurement of Energy Expenditure: Prediction Equations

The accurate prediction of RMR in athlete populations: which methodologies and technologies are required?

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Effective energy prescription requires an accurate assessment of the athletes' daily energy expenditure. Whilst the use of published prediction equations using RMR and an activity factor is common practice; there is little evidence to validate their use with athletic groups. This study compared measured resting metabolic rate (RMR) using indirect calorimetry to RMR using 17 prediction equations. Anthropometric and metabolic data was collected for 23 male rugby athletes and a literature review was conducted for evidence relating to the measurement and prediction of RMR in athlete populations. Paired samples t-tests and root mean square prediction error (RMSPE) were used to compare measured and predicted RMR and the Bland-Altman procedure was used to assess the bias for each prediction. While prediction equations significantly and systematically underestimated RMR in rugby players for all equations (p=0.001), there are several sources of error that need to be addressed. The validation of population-specific prediction equations in athlete groups requires standardised and accurate assessments of body composition (including fat and fat-free mass) and RMR by indirect calorimetry. While there is a strong, linear relationship between lean mass and RMR, research is also needed to identify the unique characteristics of athletes that can act as covariates.

Theme 14: Advances in Technologies for Physical Activity Assessment

The development and validation of a portable radio frequency identification system for determining indoor movement location

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Data collected from GPS devices and accelerometers is routinely used for objective measurement of outdoor location-based physical activity. However, there is currently no alternative method to provide indoor location data. We examined the accuracy of a portable Radio Frequency Identification (RFID) system for indoor movement tracking. A portable RFID system was centrally located in a university building and calibrated by moving RFID wrist tags throughout the building to determine signal field. A researcher walked four RFID tags in a nine room circuit (six in and three out of signal range) in time intervals (1, 2, 5 minutes and mixed) recording room entry and exit times. Data analysts, blinded to tag condition, were tasked with predicting accuracy of the RFID system by comparing their predicted time in and out of the signal field, with the experimental conditions. Eight hours and 41 mins of data were collected. Accuracy for time spent in and out of range was high for most conditions. For the two minute condition absolute error was highest at 14%, while 6% for one minute and 5% for five minutes. In the mixed condition overall absolute error was 4%, and 7%

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overall. With no gold standard for objectively assessing indoor location, portable RFID technology shows promise. In a controlled situation our system was highly accurate in determining the presence of tags within its signal field. Further research is underway to examine room level location predictions, and use in combination with movement data in real-world settings including childcare centres and homes.

Theme 15: Active Transport and the Built Environment

Using a qualitative approach to generate insights into the measurement of the physical activity environment among rural adults

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Physical activity environments are correlates of physical activity in urban settings, but limited research has investigated which environmental features might be important for physical activity in rural settings. Furthermore, there is little evidence to guide the selection of appropriate measures of the physical activity environment in rural populations. The aim of this study was to explore with rural adults the salience of physical activity environment constructs commonly used in urban populations. Using a qualitative design, 49 semi-structured interviews were conducted with men and women (18-55 years) living in three diverse rural areas of Tasmania, Australia. Participants were recruited using common purposive sampling techniques. Interviews explored functional characteristics (e.g. lighting, footpaths, and roads/verges), road and personal safety, availability and accessibility of places to be active, destinations, and aesthetics. All analyses were conducted using QSR NVivo software (version 10). Similar to urban populations, availability and accessibility of places to be active (e.g. recreational facilities) and functional characteristics (e.g., footpaths) were important considerations. However, the constructs of personal safety related to crime, destinations within walking distance (e.g. shops, schools, parks) and aesthetics had limited relevance to or influence on physical activity. Issues related to road safety were important but operationalised differently to urban populations. In conclusion, while some urban constructs appear appropriate for rural settings, many require reconsideration and modification to ensure their relevance. These findings have implications for the design of measures of the physical activity environment and for health policy and practice in rural areas.

Use of multiple data sources to evaluate the impact of a new cycleway

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Few studies have evaluated the impact of new cycling infrastructure on cycling behaviour in

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Australia. This study examined the impact of a new segment of cycleway in Brisbane (Veloway 1 [V1]), on cycle behaviour using intercept surveys, GPS tracking data, and bicycle traffic counts. Users of a pre-existing bicycle/pedestrian path (South East Freeway Bikeway [SEFB]) linking southern suburbs with the city centre completed intercept surveys in 2009 (pre-V1) and 2013 (post-V1 opening). V1 users completed the survey in 2013. GPS tracking information on cycle trips near the SEFB and V1 were collected from Strava app users pre- and post-V1 opening. Bicycle traffic counts were recorded pre- to post-V1 opening just north of where the SEFB and V1 intersect in the direction of the city centre. Between surveys the proportion of cyclists originating from suburbs to the North, East and South of the SEFB and V1 decreased on the SEFB (p<0.001). Likewise, cycling from a non-Western suburb increased the likelihood of riding on the V1 compared with the SEFB in 2013 (p<0.001). Gender, trip destination and cycling pattern (single; in groups) were not significant in survey analyses. The GPS tracking data further indicated decreases in cycling on the SEFB and a nearby arterial road pre- to post-V1 opening, and there was a positive change in the upward trend in monthly bicycle traffic counts pre- vs post-V1 opening (p=0.02). The use of the three data sources provides a relatively low-cost method of collecting data for evaluating the impact of new cycleways.

Bicycle data collecting, analysing and reporting - a transport practitioner's guide

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With the evidence of active transport's health benefits now well-established, the interest from physical activity researchers in measuring active transport has grown. The aim of this presentation is to help researchers understand best practice in measuring cycling in particular. The presentation will address bicycle data collecting, analysing and reporting from a practitioner's point of view. It will provide 'how-to' guidance based on the experience (and lessons learned), from a Senior Advisor (Cycling and Walking) from the Queensland Department of Transport and Main Roads with 10+ years' experience in Bicycle and Pedestrian Transportation. This presentation will:
- Highlight available tools and techniques;
- Describe data sources commonly available in developed countries;
- Overview available data and what to do when the data does not exist;
- Describe collection techniques: current guidance, types, costs, value, and biases;
- Suggest analysis techniques: current guidance, ease of interpretation and common pitfalls; and
- Present the 'Best Buys' for data: comparing options available and how to get the best return with limited resources. The guidance presented will provide researchers with the knowledge to work with government transportation departments to effectively collect analyse and report on bicycle data.

Sedentary and active transport in 10-12 years old children from Maputo, Mozambique

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Growth of urban population associated to an increase of physical inactivity levels has been observed in Mozambique. The objective of the study was to describe sedentary behaviour and mode of transport used by school-age population in Maputo. A total of 692 children (10 to 12 years) from public schools (312 boys and 380 girls; 337 urban and 335 sub-urban) participated in the study. Children answered a questionnaire and used a pedometer (STEPMAX MVX) for 7 consecutive days. Time spent in moderate to vigorous physical activity (MVPA) was estimated and children classified as Active and Inactive. From the total sample 49.8% walk to and from school (Urban=12.7%; Suburban= 85%). The average daily time (in minutes) spent in MVPA was higher in the suburbs zone than in urban area (Urban =42.7±29.0 min; Suburban = 57.8 ± 30.4; p = 0.000) while average time in MVPA was higher for boys than girls in both regions (p<0.001). The estimated average number of steps per day confirmed on the same profile (Urban =11,155±4,591, Suburban=14,577±6,776; p=0.000). The percentage of individuals that spent more than one hour per day in MVPA were 57.3% and 23.5% at suburban area and 28.9% and 9.4% at urban area respectively fort boys and girls. It was concluded that physical inactivity level is already high in the school population of this age group. The inactivity seems to be higher in the urban areas compare to suburbs.

Examining park features that encourage park visitation and physical activity among adolescents

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Little is known about specific park features that may encourage adolescents to visit or be physically active in parks. This research involved two studies using novel methodologies to identify critical characteristics of parks that are associated with adolescents' use of parks and willingness to be physically active within these settings. Secondary schools located in low, mid and high SES areas of metropolitan Melbourne, Australia were recruited and students aged 13-16 years were invited to participate. Study 1 involved the development of a computer application that included 44 images of park features. The application was downloaded to iPads, and enabled participants to rate each image individually according to how likely they would be to visit and be active in the park depicted in the image using a 10-point Likert scale. To obtain more detailed insights, participants used symbols to indicate characteristic(s) in each image that had the greatest positive and negative influence on their rating. Study 2 involved choice-based conjoint analyses to provide a ranking of the ten park features identified in Study 1 as being most likely to encourage visitation. Ninety-nine adolescents (mean age 13.3 years (SD=0.87), 52.6% female) participated in Study 1 and 95 adolescents participated in Study 2. Physically challenging and adventurous play and sports equipment such as large slides, swings, flying foxes and table tennis tables are likely to encourage adolescents to visit and be active in parks. Skate bowls, steps, toilets, signage with rules, and graffiti are likely to discourage park visitation.

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Passive' data collection a novel method for determining cycle route volumes over long periods of time

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The technique of 'Passive' data collection is a novel method for determining cycle route volumes over long periods of time. The aim of this study was to identify the likely changes in travel behaviour that have come about as a result of a new 2.3 km bicycle path providing a connection from southern suburbs of Brisbane to the city centre. Stage C of Veloway 1 (V1) is a 3-metre wide, bicycle-only concrete path that was completed in June 2013. For the evaluation, cycle trips across the area covered by two parallel routes (V1 and South Eastern Freeway Bikeway [SEFB]), approximately 2.27 km long) were provided by Strava Inc. Data was collated and analysed for May 2013 and July 2013. Strava Metro uses raw GPS data and provides it back in a usable format that allows for detailed analysis to be performed. The output from the Strava Metro data includes heat maps and 'traffic' volume maps. The heat maps show instead 'densities' of use across an area. In conclusion, the Strava data supports the hypothesis that when the V1 Stage C was opened, more cyclists migrated over to the V1 rather than heading north towards Brisbane's city centre along a major roadway to the city. This is evident in both the heat maps and volume maps. The technique of 'Passive' data collection method offers promise for analysis of spatial trends at a local level and applicability for comparing cities or states in terms of policy and infrastructure implementation.

Theme 16: Physical Activity Interventions: Limitations and Improvements

Trends in accelerometry methods applied in physical activity intervention studies, 2000-2014

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Purpose
Examine accelerometry trends in physical activity intervention studies and evaluate the quality of methodologic reporting in articles.

Search Strategy
Articles published in English from January 2000 through July 2014 were identified by searching PubMed. Reference lists were checked to identify additional articles.

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Selection Criteria

Intervention studies that used accelerometers and examined physical activity as a primary outcome were eligible. Articles that reported study plans or process evaluations were excluded, as were articles that only utilized an accelerometer step count function or measured only short time windows (e.g., only recess). 179 articles were included and were comprised of studies involving child, adult, and older adult populations.

Data Analysis

Articles were scored for completeness of reporting in three areas: equipment and deployment methods, data processing, and participant compliance and equipment failure.

Results

Completeness of reporting varied by element. Nearly all (99%) studies reported the type/brand of accelerometer; 48% reported monitor placement. Similarly, 50% reported the number of monitoring days required, and 51% reported the number of minutes per day required. Last, 84% reported how monitor data would be interpreted. Use of accelerometers in intervention studies increased in waves from 2000 through 2014, with large jumps observed between 2006-2007 and 2010-2011. There was no significant improvement in reporting quality from 2000 through 2014.

Conclusions

The increases in accelerometer use in intervention studies coincide with improvements in accelerometer cost and usability. However, even as more researchers are using accelerometers, there have not been substantial improvements in the quality of methodologic reporting.

Effectiveness of a combined activity tracker and organisational support intervention to reduce sitting and increase activity in the office workplace

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Through providing real-time feedback and facilitating self-monitoring of behaviour, wearable activity trackers can potentially be a powerful intervention tool; however, there is minimal evidence on their effectiveness to reduce sitting in key settings, such as the office workplace. This study reports on activity changes following three months of a workplace intervention with a wearable activity tracker component. Nine teams (59 participants) of office workers from an international property and infrastructure group, recruited from two Australian cities (Brisbane and Sydney) were allocated an activity tracker (the waist-worn LUMOback) in addition to organisational support (management support, information booklet, workplace emails). The key intervention message was to 'Stand Up, Sit Less and Move More'. Time spent sitting, sitting in prolonged (≥30 min) bouts and stepping were measured with activPAL3 activity monitors (7 days, 24h/day protocol) at the workplace and overall. Cluster-corrected changes from baseline to 3-month follow-up in these activities, standardised to a 16-hour waking day or 10-hour workday (which was average for this sample), were examined using

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mixed models (SPSS, v22). Per 10 hours at work, participants (n=36) significantly reduced sitting and increased stepping time by 17 min (95%CI:-30,-3; p=0.016) and 6 min (95%CI: 1,11; p=0.031), respectively, and showed favourable but non-significant changes in prolonged sitting time (-23 min; 95%CI:-51,5; p=0.098). Changes in sitting per 16-h day (n=40) were favourable but non-significant (-21 min; 95%CI:-42, 1; p=0.060). Workplace activity profiles significantly improved following a workplace intervention with an activity tracker component. The specific benefit of the activity tracker component remains to be established.

Similar compliance but different results: Comparison of hip- and wrist-worn Actical accelerometers during a randomised crossover trial of an active video game intervention in children

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Purpose
To compare the compliance and intervention outcomes between hip- and wrist-worn accelerometers worn simultaneously by children during an active video games intervention.
Methods
As part of a larger randomized crossover trial, participants (n=73, age 10-12 yrs.) simultaneously wore two Actical accelerometers for 7 days, one on the hip and one on the wrist following three conditions: 1) traditional video games 2) active video games 3) no electronic video games. Compliance, estimates of time in sedentary and moderate-to-vigorous physical activity (MVPA), and intervention effects were compared between hip and wrist. Differences in results were explored by minute-to-minute agreement.
Results
There were no statistically significant differences at any time point in percentage compliance between hip (77-87%) and wrist (79-89%). The mean bias in minutes of wrist-measured MVPA was 10.7 minutes per day higher in wrist (95%CI: 8.6, 12.7) compared to hip with limits of agreement of -21.4, 42.7. There were no statistically significant differences in sedentary time between intervention conditions for hip or wrist. Participants had higher levels of wrist-measured MVPA during the active video games condition compared to the traditional video games condition (mean difference of 5.9 minutes per day, 95%CI: 1.02, 10.7). There were no significant differences in hip-measured MVPA between any of the conditions (mean difference between active and traditional video games -0.8 minutes per day, 95%CI: -4.5, 3.3).
Conclusion
Compliance was similar between simultaneously worn hip and wrist accelerometers. Using hip- or wrist-worn accelerometers may lead to different conclusions from an intervention trial.

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Multilevel community based intervention promotes physical activity and prevents age associated decline in activity over a year in older men

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Background

Older men are typically hard to reach in physical activity interventions. Multi-level interventions may be more effective than single-level individual or group focused interventions because they provide support at different levels of the ecological model.

Aims

To evaluate a multi-level physical activity intervention in older adults living in continuing care retirement communities.

Methods

Sites were randomized to an intervention or attention control condition; 307 older adults (mean 84 years) were enrolled and 44 male and female peer leaders trained. Intervention components included individual-level phone counselling & self-monitoring, interpersonal-level education sessions and neighbourhood walks, and community-level maps and advocacy projects. Physical activity was measured by 6-day accelerometry at baseline, 3, 6, 9 and 12 months. Mixed models (adjusting for demographics, wear time, and individual and group nesting) explored time x condition x gender interactions.

Results

Physical activity levels increased by 36% in men in the intervention group compared with 19% in the women. Over 12 months the intervention and control women declined their activity levels to 3% below baseline levels. The intervention men did not drop below baseline levels whereas physical activity in the control men declined by 23% below baseline over the year.

Conclusions

This multilevel intervention greatly impacted older men's physical activity and prevented an age associated decline in activity. The provision of both individual and group support and focus on neighbourhood walking may have appealed to older men. GPS data will allow us to explore if men were more likely to walk in the neighbourhood.

Influence of obesity on energy expenditure during brisk walking in adults

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Physical activity guidelines of 150 minutes each week of moderate intensity activity are designed to expend 1,000 kilocalories/wk. in healthy-weight adults. If energy expenditure increases with obesity,

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then obese adults could be overdosing on exercise reducing the safety and effectiveness of the intervention. The purpose of this observational study was to quantify how indices of obesity, primarily body mass, BMI, waist circumference and body composition, influence energy expenditure during brisk walking in adults. A sample of 62 adults (males=18, females=44, BMI-19.7-62.6kg/m2) was recruited. The energy cost of walking (kilocalories/minute) was determined using indirect calorimetry whilst walking on a treadmill at 4.8km/h for 15 minutes. Bivariate Pearson's correlation tests and linear regression analysis (p<0.05) were used to establish whether indices of obesity are associated with energy expenditure. Preliminary results show energy cost of walking was strongly correlated with body mass, BMI, waist circumference and fat mass (r=0.77 to 0.86, p<0.001). Moderate correlation was observed with body fat percentage and fat-free mass. Regression equations for the strongly correlated outcomes were: predicted kcal/min =0.638+0.065x (weight (kg)); predicted kcal/min = 1.197+0.162x (BMI (kg/m2)); predicted kcal/min =3.981+0.072x (fat mass (kg)); and, predicted kcal/min =-0.962+0.075x (waist circumference). Our results show that the energy cost of walking increases as obesity level rises. As physical activity prescription is based on expending 1,000kcal/wk. there is potential for a significant overdose of activity amongst obese adults. Our data could be used to accurately prescribe a safe and effective individualised dose of exercise for obese adults.

Theme 17: Measurement Error and New Statistical Modelling

Validity and calibration of the food frequency questionnaire used in the Melbourne collaborative cohort study

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The performance of the Food Frequency Questionnaire (FFQ) administered to participants in the Melbourne Collaborative Cohort Study (MCCS; wave 3) was validated using data from the Dietary Calibration Study (DCS): a random sample of MCCS wave 3 participants, stratified by sex, age and ethnicity, who completed two FFQs one year apart and three 24-hour dietary recalls over the same year. The DCS included 619 participants (272 Australians, 347 Greeks/Italians). The FFQ showed good repeatability across the 23 nutrient intakes with intra-class coefficients ranging from 0.66 to 0.80 (Australians) and 0.51 to 0.74 (Greeks/Italians). Validity coefficients ranged from 0.37 to 0.73 (Australians) and 0.28 to 0.64 (Greeks/Italians) for absolute nutrients and were higher for nutrient densities for Australians (0.46-0.83 for Australians; 0.21-0.64 for Greeks/Italians). Calibration coefficients for absolute nutrients ranged from 0.26 to 0.60 (Australians) and 0.27 to 0.53 (Greeks/Italians), and for Australians were generally higher using nutrient densities (0.39-0.74), but not consistently so for Greeks/Italians (0.18-0.54). Calibration coefficients for nutrient densities were

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higher for Australians compared with Greeks/Italians for all nutrients. The FFQ used in the MCCS at wave 3 is suitable for estimating energy-adjusted nutrients for Australians and the calibration coefficient can be used to correct for measurement error in investigations of diet-disease associations. However, its performance for estimating intakes is less satisfactory for Greeks and Italians and alternative approaches should be used if dietary data are to be collected in similar demographic groups.

Using a betabinomial distribution to estimate the prevalence of adherence to the physical activity guidelines

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Background

Prevalence of adherence to physical activity guidelines in the population is generally estimated by averaging individual probability of adherence based on the number of days people are meeting the guidelines and the number of days they are assessed. Given this number of active days and inactive days (days assessed minus days active), the conditional probability of meeting the guidelines used in the past is a Beta (1 + active days, 1 + inactive days) distribution assuming the probability p of a day being active is bound by 0 and 1 and averages 50%. A change in the assumption of the distribution of p is required to better match the discrete nature of the data and to better assess the probability of adherence when the proportion of active days in the population differs from 50%.

Methods

Using accelerometry data from the Canadian Health Measures Survey, the probability of adherence to physical activity guidelines is estimated using a conditional probability given the number of active and inactive days distributed as a Betabinomial(n, alpha + active days , bÃªta + inactive days) assuming the distribution of p is randomly distributed as Beta(alpha, bÃªta) where the parameters alpha and bÃªta are estimated by maximum likelihood.

Results and interpretation

The Betabinomial distribution has several advantages over the previously used Beta distribution to estimate probability of adherence to physical activity guidelines. It is a discrete distribution and better takes into account the information available from the data.

Evaluation of dietary assessment tools: What does 'validated' actually mean?

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Evaluation of the extent to which self-report dietary assessment instruments accurately capture true intake is a critical step when developing and utilizing new tools. Such evaluation is challenging due to the lack of unbiased reference measures for intake, forcing reliance on other self-report (and thus error-prone) measures as comparators. Depending on the type of instrument, evaluation is also complicated by the need to test tools in different settings and populations. This presentation will focus on challenges in evaluating dietary assessment tools and the ways in which the findings of validation studies are interpreted. We draw upon a scoping review of Canadian studies of free-living adult populations that included an assessment of dietary intake to illustrate the extent and ways in which validity of tools are addressed. Of 58 studies that used a frequency questionnaire or screener to assess diet, tools were reported to have been validated for the given study sample in a small proportion. In close to two-thirds, authors reported that the tool has been validated, in some cases with few details on how it was evaluated and in what population(s). In close to a third, there was little attention to whether tools used have been tested. Given that self-report instruments cannot be expected to perfectly capture true intake, more nuanced discussions of what it means for a tool to be 'valid' as well as the implications of limitations in tools for study results appear warranted. Such discussions are key to improving the quality of self-reported dietary intake data.

Using an objective biomarker of activity-related energy expenditure to develop a calibrated measure of physical activity in the hispanic community health study/study of Latinos (HCHS/SOL)

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Introduction

We used an objective measure of activity-related energy expenditure (AEE) to develop a calibrated physical activity (PA) measure for adults in the HCHS/SOL cohort. Our study represents a unique opportunity to understand the relationship between different measures of PA, as well as reporting error, in an under-studied Hispanic/Latino population.

Methods

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Total energy expenditure (TEE) from doubly-labelled water and resting energy expenditure (REE) from indirect calorimetry were successfully measured in 445 men and women aged 18-73 years in the Study of Latinos: Nutrition & Physical Activity Assessment Study, a substudy of HCHS/SOL (N=16,415). Repeated measures were obtained 6 months later on a subset (N=86). AEE is calculated as 0.90xTEE-REE. We derived a calibration equation by regressing AEE on self-reported time in sedentary, moderate and vigorous activities and Actical accelerometer measures of percent time in these intensities, along with personal characteristics. This equation adjusts for systematic error in the accelerometer and self-report, as well as temporal biological variability. Inverse probability weighting was used to account for missing accelerometery data.

Results

Actical measures of activity and wear time were significant predictors of AEE (group level p=0.04). Self-reported PA was not independently associated with AEE. The model's R-squared coefficient was 0.25, which became 0.50 after adjustment for within-person variability of AEE.

Conclusion

The calibration equation successfully explained fifty percent of variation in average AEE and can be used to better estimate PA and the relationship between PA and health outcomes in HCHS/SOL by adjusting for measurement error.

Informing physical activity interventions using a Bayesian multilevel model

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The Center for Disease Control (CDC) in the United States issues guidelines with recommended levels of physical activity for children, adults, and older adults. In light of the current obesity levels in America, it is hypothesized that compliance with these guidelines is low. Additionally, not all activities are equal and it is widely believed that bouts of physical activity lasting less than ten minutes should not count towards one's physical activity total. We propose a Bayesian multilevel model to estimate an individual's daily usual (or long-run average) minutes of physical activity that occurred in bouts of at least ten minutes in relation to their demographics. Based on this model we can identify portions of the population least likely to meet the CDC guidelines and therefore inform future physical activity intervention efforts. We illustrated our method with data from the Physical Activity Measurement Survey conducted in Iowa (NIH Grant HL091024).

Comparison of duplicate portion and 24h recall as reference methods for validating a food frequency questionnaire using urinary markers as the estimate of true intake

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As Food Frequency Questionnaires (FFQs) are subject to measurement error, associations between self-reported intake by FFQ and outcome measures should be adjusted using correction factors obtained from a validation study. Whether the correction is adequate depends on the characteristics of the reference method used in the validation study. Preferably, reference methods should 1) be unbiased and 2) have errors uncorrelated with those in the FFQ. The aim of the present study was to assess the validity of the duplicate portion (DP) technique as a reference method for protein, potassium and sodium intake and compare its validity with that of a commonly used reference method, the 24 hour recall (24hR) using urinary biomarkers as the unbiased reference method. For 198 subjects, two DPs, two FFQs, two urinary biomarkers and between one and fifteen 24hRs (web-based and/or telephone-based) were collected within 1.5 years. Multivariate measurement error models were used to estimate proportional scaling bias, error correlations between FFQ and DP or 24hR and attenuation factors of these methods. The DP was less influenced by proportional scaling bias(0.58 for protein, 0.72 for K and 0.52 for Na) and correlated errors between DP and FFQ were lowest (protein 0.28, K 0.17 and Na 0.19) compared to the 24hRs. Attenuation factors (protein 0.74, K 0.54 and Na 0.43) also indicated that the DP performed better than the 24hRs. Therefore the DP is probably the best available reference method for FFQ validation for nutrients that currently have no generally accepted recovery biomarker.

Theme 18: Big Data

Analysis of the feasibility of using bicycle GPS tracking data (Strava)

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The aim of this project was to evaluate the feasibility of using bicycle GPS tracking data to measure population-level cycling participation and behaviour. Cycling data collected by a GPS tracking data system were compared with bicycle traffic count data, bicycle intercept surveys, National Cycling Participation Survey data, Household Travel Survey data, and Census Journey to Work data. The analysis revealed that bicycle GPS tracking data was suitable to provide significant state-wide coverage and give a high level indication of cycling activity. Moreover, it was found to be suitable for Cyclists Route Choice Analysis (at high volume sites), providing an overview of bicycle network usage (state-wide, on and off-road), incentivising cycling (gamification), research using Revealed Preference data, wayfinding and focal point mapping, and location identification for behavioural studies. However, limitations of using these data were found: poor level of detail, user biases, unsuitability of gamification for novice cyclists and shortcomings in the method of GPS data collection (GPS signal drift). Analysis of these data is also limited, by the number of bicycle traffic monitoring stations located in a given area, the need to account for on-road and on-footpath cycling, the lack of on-road bicycle traffic monitoring stations, and the lack of rural/regional bicycle traffic monitoring stations. This data are not suitable for year-on-year analysis (trend analysis) and system-wide scale ups are

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not possible as the number of users' changes every year. In conclusion, GPS tracking data supplement, but do not replace, existing transport and behavioural surveys.

Theme 20: Measuring Diet and Physical Activity During the Life Course

Assessment of dietary intake in three cohorts of advanced age in two countries: Methodology challenges

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Robust dietary intake information is key to understanding nutrition-related outcomes. Intake changes with age and older people are at increased risk of malnutrition. We applied the 24 hour multiple pass recall (24h MPR) dietary assessment method in three cohorts of advanced age in the UK and New Zealand (NZ). The Newcastle 85+ study (UK) recruited people aged 85 years during 2006-7. 24h MPRx2 days was conducted by trained assessors. LiLACS NZ recruited Maori aged 80-90 and non-Maori aged 85 years in 2010 with adaptation of pictorial resources and language used in Newcastle MPR for the NZ and Maori contexts. In the Newcastle 85+ study, 805 (95%) consented to the MPR, with 793 (99%) completing two 24h MPR; in LiLACS NZ, 579 (82% of Maori and 92% of non-Maori) consented and 203 (93%) Maori and 353 (98%) non-Maori completed two 24h MPR. Mean time to complete a single 24h MPR was 22 minutes (Newcastle 85+ study), 45 minutes (LiLACS NZ Maori) and 39 minutes (LiLACS NZ non-Maori). Dietary assessment of participants in residential care and those requiring proxy respondents were included successfully in both studies. Most participants (83-94%) felt that the 24h MPR data reflected their usual dietary intake. This method was successful in capturing detailed dietary data, including information on portion size and time of eating, for over 1300 octogenarians in the UK and NZ (Maori and non- Maori). Of currently available options, 24hr MPR is an acceptable and potentially preferred method, of dietary assessment in this age group.

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Dietary intake and food sources in the very old: Analysis of the Newcastle 85+ study

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Dietary intake data are scarce in very old adults (85 years and older) - one of the fastest growing age segments of western societies. Our primary objective was to assess energy, macronutrient, micronutrient intake and respective food sources in 793 eighty-five year-olds (302 men and 491 women) living in North-East England and participating in the Newcastle 85+ Study. Dietary information was collected at baseline using a repeated multiple pass recall (2x24hr-recalls) and estimated using McCance and Widdowson's sixth edition food composition tables. Median energy intake was 6.65 (IQR: 5.49-8.16) MJ/day, with 46.8% from carbohydrates, 36.8% from fat and 15.7% from protein. Median vitamin D, calcium and magnesium intakes were 2.0 (IQR: 1.2-6.5) µg/day, 731 (IQR:554-916) mg/day and 215 (IQR:166-266) mg/day, respectively. Cereals and cereal products were the top contributors to energy intakes and most macronutrients (carbohydrates, non-milk extrinsic sugars, non-starch polysaccharides (NSP) and fat) and micronutrients intakes (folate, iron and selenium). Participants with higher education, in higher social class and who were more physically active had diets which were more nutrient-dense in micronutrients and NSP. Only 20% of participants (n=157) met the estimated average requirement for energy (9.6 MJ/day for men and 7.7 MJ/day for women) and less than 10% (n=71) complied with the dietary reference value (DRV) for NSP (≥18g/day). At least 20% of the participants were below the lower reference nutrient intake for magnesium (n=175), potassium (n=238) and selenium (n=418). This study highlights the paucity of data on dietary intake and the uncertainties about DRVs for this age group.

Validity and responsiveness to change of two self-report occupational sitting instruments

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Background
Occupational sitting is a potential health risk behaviour for chronic diseases and is of particular concern for workplaces characterized by high amounts of sitting, such as offices. It is, therefore, important to develop measures that are valid and responsive to change for evaluating sitting reduction interventions.

Methods
Participants were office-based workers (N=42; 86% female; mean age 38 ± 11 years) from the Stand@Work study, a randomized controlled crossover trial with waitlist control condition and rolling recruitment in Sydney, Australia. Participants used a sit-stand desk for four weeks in the

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intervention condition. In the time-matched waitlist control condition, participants received nothing, and then crossed over to the intervention four weeks later. Participants completed Occupational Sitting and Standing Questionnaire (OSPAQ) and Workforce Sitting Questionnaire (WSQ), and wore an ActivPAL3 monitor during their working week three times: at 6 weeks and 2 weeks pre intervention, and 3 weeks post intervention. Outcomes of interest were occupational sitting and standing (min/day) assessed by self-report and objectively.

Results

At 6 weeks pre intervention, Spearman correlations of the OSPAQ estimates with ActivPAL3 measured sitting and standing were 0.37 ($p<0.05$) and 0.20 ($p>0.05$), respectively. WSQ estimated sitting at work showed weaker correlations with ActivPAL3 ($rho=0.25$, $p>0.05$). Responsiveness to intervention-induced changes varied: OSPAQ showed large responsiveness to changes in both sitting (responsiveness index = -1.39) and standing (responsiveness index = 1.75), while the WSQ showed moderate responsiveness for sitting at work (responsiveness index = -0.70).

Conclusion

The OSPAQ would be a suitable self-report instrument for measuring changes in occupational sitting and standing. The WSQ showed modest validity and responsiveness to change for measuring sitting at work.

Lifestyle behaviours and the transition to retirement: what changes?

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Background

Retirement brings change in time use, social contact networks, and income. Transitioning into retirement may therefore be fertile ground for promoting positive behavioural change. Identifying lifestyle risk measures which may, or may not, be sensitive to change as people transition from the workforce into retirement is useful for research informing health promotion strategies and service provision.

Method

We longitudinally examined the effect of incident retirement on traditional (smoking, alcohol use, physical activity (PA), and diet) and emergent (sedentary behaviour, sleep) lifestyle risk behaviours, in a sample of 27257 Australian adults. Lifestyle was assessed by single measures and as a combined lifestyle risk index, and analysed by demographic moderators and reason for retirement.

Results

During the 3.3 years follow-up 3106 respondents retired. Retirement was associated significantly with reduced odds of smoking (for women, AOR=0.53), physical inactivity (AOR=0.73), excessive sitting (AOR=0.34), and unhealthy sleep patterns (AOR=0.81). Walking and moderate PA increased amongst retirees but vigorous PA did not. There was no significant association between retirement and alcohol use or fruit and vegetable consumption. Higher education and urban residence showed stronger inverse effects for retirement on risk of excessive sitting. Change in the lifestyle risk index score differed by reason for retirement.

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Conclusion

In general, retirement was associated with positive lifestyle risk behaviour changes. The single measures and combined index showed differential change across some demographic subgroups and reason for retirement demonstrating the value of global and specific measures. Emerging risk factors were also sensitive to change in lifestyle risk among retirees.

Can abdominal-to-height ratio (AHtR) be a useful index for physical fitness in Japanese elderly?

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Objectives

To determine usefulness of the abdominal-to-height ratio (AHtR) in determining physical fitness of elderly.

Materials & methods

Of 430 volunteers participated in physical fitness assessments, 70 males and 190 females who were aged above 60 years old, have completed stature, body mass and abdominal circumference measurements and a range of physical fitness tests were analysed. Participants were split into two groups based on calculated AHtR using a cut-off point of 0.5 and compared fitness test results. Associations of AHtR and fitness tests were also examined using regression analysis with consideration of age and BMI.

Results

While 67.1% of males and 73.7% of females had AHtR above 0.5, 87.1% and 91.1% of males and females respectively had BMI below 25.0 kg/m2. Both genders with high AHtR had significantly higher systolic blood pressure ($p<0.01$ in males and $p<0.05$ in females). In addition, females with high AHtR showed lower performances in open-eyed one leg stand, chair stand, shuttle stamina walking test (SSTw) (all $p<0.01$), reach test and also 10 m fast walk test (both $p<0.05$) compared with the low AHtR group. Regression analysis indicated that AHtR was associated with chair stand and SSTw results in females.

Conclusion

The study indicated a possibility of AHtR as a useful index to determine physical fitness in Japanese elderly, particularly in females.

Are urban moroccan women with a healthier diet also more physically active?

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Introduction

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Morocco is facing a rapid nutrition transition affecting negatively individuals' dietary patterns and physical activity (PA), conducting to an increase in obesity and diet-related chronic diseases.

Objective

To classify women according to both diet and PA.

Method

A cross-sectional survey conducted in Rabat-Sala of 855 randomly selected urban women (20-49y). The diet quality index-international (DQI-I) was derived from a single 24 hour recall and the physical activity level (PAL) from a validated PA frequency questionnaire. Principal component analysis and hierarchical ascendant classification categorized women into clusters according to their diet and PA. Relationship between identified clusters and socio-demographic characteristics were investigated.

Results

The mean DQI-I was 57.9/100 and 43.1% of the women had a good quality diet.. The mean PAL (1.78) corresponds to a moderately active lifestyle whereas 47.0% of the women had a sedentary lifestyle (PAL<1.70). A gradient from good to detrimental lifestyle appeared from cluster 1 to cluster 3; moreover each cluster presented a marked concordance for both diet and PA lifestyle. The 'beneficial lifestyle' cluster combined good adequacy, variety and overall balance with intense activities, active leisure activities and working; 'intermediate lifestyle' cluster showed only good variety and moderate activities and walking; 'detrimental lifestyle' cluster was characterised by a bad quality diet and notably sedentary leisure activities. Overall, women with higher education, higher socio-economic status and employed women were more likely to belong to the 'beneficial lifestyle' cluster.

Conclusion

In this context, preventive public health policies might focus on diet and PA together.

Assessing age-related physical activity patterns in a large cohort of older U.S. adults

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Evidence supports that physical activity (PA) is lower in women and in the less educated. Whether these differences change as individual's age is unclear. As the world's population age 65 and older is expected to more than double by 2050, understanding age-related changes in PA, especially in older adults, could impact disease prevention strategies. Using data from the American Cancer Society's Cancer Prevention Study-II Nutrition Cohort (CPS-II NC), we conducted longitudinal analyses to compare age-related changes in physical activity (MET-hours/week) by gender and by level of education over an 8-year period in older adults. The CPS-II NC is a prospective cohort study of men and women enrolled in 1992 who completed a self-administered questionnaire on lifestyle and medical factors. Biennially, living participants updated their information on follow-up surveys. This analysis includes 57,409 participants who were aged 65-89 years old in 1999 with no major chronic diseases (CVD, cancer, stroke, or emphysema) and who completed at least the 1999 and 2007 follow-up surveys. Increasing age was associated with a statistically significant decrease in PA level (-0.325 MET-hours/week per year of age). Overall men had higher PA than women (3.418 MET-hours/week) and those with at least a college degree had higher PA than those with a high school degree or less (4.733 MET-hours/week). While there was a small decrease in the difference of PA

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between men and women as they aged, men remained more active at every age. There was no statistically significant difference in the age-related decline in PA by education. These results support that the gender and education level differences in physical activity persist throughout older adulthood.

Is foot structure related to the time healthy young women spend in various intensities of physical activity? Initial Findings

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The purpose of this study was to investigate associations between characteristics of the medial longitudinal arch and physical activity intensities. Data from 33 healthy young women (age: 23.0±3.2 y; BMI: 22.7±2.5 kg/m2) were analysed. Arch height (cm) was assessed at one half of the foot length, in both sitting (non weight-bearing) and standing (weight-bearing) positions, using an arch height index measuring system device. Parameters of arch stiffness and flexibility (arch drop; arch height flexibility) were calculated. The Recent Physical Activity Questionnaire stratified the 24-h day into time spent in sedentary (MET<1.5), light (MET: 1.5-3), moderate (MET: 3-6), and vigorous (MET>6) physical activity (h/day). Pearson's correlations were used to identify relationships between arch parameters and physical activity intensities ($P<0.05$). Time spent in moderate physical activity was significantly and negatively correlated to arch drop (r=-0.245, P=0.022) and arch height flexibility (r=-0.266, P=0.034). Likewise, time spent in light activity was associated with arch stiffness (r=-0.266; P=0.033). There were no significant relationships between arch parameters and sedentary or vigorous intensities. Although the current data primarily represents non-obese women, the significant correlations between foot structure and physical activity mimic relationships previously found between obesity and physical activity. Given that obesity is also associated with a more flexible foot, the results suggest that musculoskeletal variation could influence physical activity participation, and potentially the physical activity-obesity paradigm. A larger sample size across a greater range of BMI will help elucidate existing relationships, providing valuable information on previously unexamined barriers to being physically active.

The usage rate of Polar Loop Accelerometer during one year holistic wellbeing coaching program

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The interest for wearable technology, like accelerometer, has increased during the last few years tremendously. Wearable devices help their users to monitor physical activity and sedentary time. By monitoring, the users can reflect their activity and possibly change it to more active lifestyle. However, for reliable activity tracking the daily usage rate of the device is critical. The purpose of this

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study was to evaluate the daily usage rate of Polar Loop activity monitor among voluntary Finnish business executives (9 females and 11 males, aged 48±10 yrs.) during one year holistic wellbeing coaching program. In the program, the subjects were profiled based on their attitude towards physical activity by using Huco Sport -profile questionnaire. Moreover, the subjects were tested by laboratory samples (selected blood and urine tests). In addition, the impact of coach appointment interventions during the program on the device usage rate and the subject's activity behaviour was studied. The average days of device use during the follow up was 74% (from 27% to 96%) and the average wearing time was 11:14 h: min/day (from 3:54 to 15:03 h:min/day). Significant correlations were showed between Huco Sport -profile and Polar Loop usage rate and physical activity. The results encourage the use of sporting style profile in order to individualize coaching. Moreover results shows that the vendors should take into account different attitudes toward wearable devices and physical activity while developing their products.

Posters

Theme 01: Measuring Diet in Children and Families

[P001] Estimating the Prevalence of inadequate nutrient intake among elderly based on usual intake

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Introduction
Understanding the prevalence of inadequate intake of micronutrient in elderly is useful to drive public health programs in order to prevent diet-diseases age-related.
Objective
To estimate the prevalence of inadequate nutrient intake in community-dwelling older individuals based on the usual intake.
Methods
This is a cross-sectional study among elderly who lives in one develop city in Brazil (Sao Caetano). Data from 295 community-dwelling older individuals were included analyzed. Individual food intake was obtained from R24h applied on two non-consecutive days. The prevalence of inadequate intake for each nutrient was estimated by the WHO method (IMAPP-Intake, Modeling, Assessment and Planning Program) in which age and gender were included as covariates. The EAR (Estimated Average Requirement) reference values were used to evaluate the prevalence of inadequate, estimated stratified by sex.
Results
A high prevalence of inadequate intake (> 50%) was found for vitamins D (94.4% men vs. 99.8% women) and E (100%, for both genders), calcium (94.48% men up to 71 y vs. 99.8% women up to 70 y and 87.2% for women older than 70 y), magnesium (76.0% men vs. 76.8% women) and copper (100%, for both genders). Lowest prevalence was found for iron, selenium, phosphorus, vitamins

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B12, B1, B3, B6, C, A for both genders.

Conclusions

Beside the population, study living in a city with higher HDI (Human Development Index) in which higher public investments have been done to improve health and vitality at older population, the inadequacy of micronutrients was similar to the overall Brazilian elderly population.

[P002] Dietary risk at 1-5 years of age is related to child neophobia and breastfeeding duration but not age of introduction to solids

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Objective

Early feeding has the potential to contribute to development of inappropriate dietary patterns (dietary risk) in young children. Food neophobia also potentially reduces dietary variety and increases the vulnerability of young children to increased dietary risk. This study aimed to investigate associations between breast feeding duration, age of introduction to solids and child neophobia with dietary risk in young children.

Design

Cross-sectional data were obtained via an online questionnaire completed by parents of children (n=234) internationally aged 1-5 years. Dietary risk scores were calculated using a newly-developed, short (19-item) Toddler Dietary Questionnaire (TDQ, 1-3 years) or Preschool Dietary Questionnaire (PDQ, 3-5 years), which assess and evaluate the previous week's food-group intake against a scoring criteria (0 - 100; higher score = higher risk). The TDQ has previously been shown to have good reliability and comparative validity. Associations were investigated using multiple linear regression models, adjusting for covariates.

Results

Children (51% female, 3.0±1.4 years) were on average breastfed until 10.6±4.8 months and first given solids at 5.5±1.4 months of age. The average neophobia score was 2.2±0.5 (range 1=strongly disagree to 4=strongly agree). Shorter breastfeeding duration (ß=-4.50; 95% CI -7.25, -1.74; p=0.01) and higher child food neophobia score (ß=6.67; 95% CI 4.35 - 8.98; p<0.001) were associated with higher dietary risk scores but age of introduction to solids was not (p=0.52).

Conclusion

Young children's dietary risk is associated with early feeding, reinforcing the need to support parents in feeding their children in the first years of life to promote long-term health.

[P003] Validity of dietary diversity score as an indicator of nutritional adequacy of diets among selected group of adults in a university campus in Manila, Philippines

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Objective

This study was conducted to validate dietary diversity score and its correlation to nutritional adequacy as measured by Nutrient Adequacy Ratio (NAR) and Mean Adequacy Ratio (MAR). Methodology. Cross-sectional analyses was undertaken with a representative sample of 20-59 year old adults (n = 135) in a university campus in Manila in 2008. Dietary diversity scores (DDS) were calculated. A nutrient adequacy ratio (NAR) is the ratio of subject's nutrient intake to the 2002 Recommended Energy and Nutrient Intakes (RENI) for Filipinos. The mean adequacy ratio (MAR) was calculated as the sum of NARs for all evaluated nutrients divided by the number of nutrients evaluated, expressed as a ratio (range from 0 - 1). MAR was used as a measure of adequacy of overall diet. Pearson correlation coefficients between DDS and MAR were calculated and also evaluated for sensitivity and specificity, with MAR taken as the ideal standard of adequate intake.

Results

The adolescents had a mean DDS of 3.63 (1.24) and a mean MAR of 0.79 (0.15). There was a strong correlation between MAR and DDS (r = 0.417; P < 0.0000). A DDS of 4 was shown to be the best indicators for both MAR equivalent to 0.5 and 0.7 since they provided the best sensitivity and specificity.

Conclusion

DDS can be used as a simple and quick indicator of the nutritional adequacy of the diets among these group of adults. Further investigation of this tool is needed for other group of adults and other population group i.e., elderly.

[P004] Misreporting of dietary energy intake and its associated factors among selected primary school children in Selangor, Malaysia

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This study aimed to determine the misreporting of dietary energy intake and its association with socio-demographic characteristics and body weight status among primary school children in Selangor state, Malaysia. A total of 816 respondents (65.4% females; 34.6% males) aged 10.6±0.6 years from twelve selected primary schools in Selangor participated in this study. Majority of them were Malays (68.3%), followed by Chinese (21.8%) and Indians (9.9%). Their body weight and height were measured and body weight status (BMI-for-age) was determined based on the WHO Growth Reference (2007). Two-day dietary recalls were conducted by the researchers, and the mean total energy intake of the respondents were analysed. Ratio between energy intake and basal metabolic rate (EI/BMR) was calculated to determine misreporting of energy intake. An EI/BMR value below the acceptable range (male: 1.39-2.24; female: 1.30-2.10) was classified as under-reporting. The mean total energy intake of the respondents was 1845±533 kcal/day. Overall, 37.4% of the respondents under-reported their energy intake. While 30.9% of them were overweight or obese, 8.6% of them were thin or severely thin. More males (53.2%) under-reported their energy intake

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than females (29.0%). Chinese respondents (50.6%) were more likely to under-report their energy intake than Malays (33.9%) and Indians (33.1%). Overweight/obese respondents were more likely to under-report their energy intake (60.7%). In conclusion, misreporting of dietary energy intake among primary school children present in this study. Statistical adjustment on sex, ethnicity, and body weight status should be considered when analyzing their dietary intake in order to reduce errors associated with misreporting.

[P005] Plasma carotenoid levels as biomarkers of dietary carotenoid consumption: a systematic review of the validation studies

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1 University of Newcastle

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Background

Previous research has demonstrated that plasma carotenoids are a reliable biomarker of usual fruit and vegetable intake. The review aims were to synthesize (i) the mean dietary intake and (ii) plasma concentrations of carotenoids reported from validation studies(iii) compare the strength of the relationship between the two, measured using different dietary assessment methods.

Methods

Six databases were used to locate studies that included: adult populations, assessment of dietary intake, measurement of plasma carotenoids and reported the comparison between the two measures.

Results

One hundred and forty-two studies were included with 95,480 participants, the majority of studies were cross-sectional (n=86), with randomized controlled trials (RCTs) (n=18), 14 case-control studies and 13 cohorts. The most common reported dietary carotenoid and plasma carotenoid was lycopene: weighted dietary mean intake (4555.4 ug/day), and plasma concentration 0.62 umol/L (95%CI: 0.61, 0.63, n=56 studies. The strongest weighted correlation between the two measures was found for cryptoxanthin (r = 0.38, 95% CI 0.34, 0.42) followed by a-carotene (r=0.34, 95% CI 0.31, 0.37).

Conclusion

This review summarizes typical dietary intakes and plasma concentrations and their expected associations based on validation studies conducted to date which provides a benchmark for future validation studies.

[P006] A food frequency questionnaire to assess total sugar intake of Australian toddlers: relative validity and repeatability against repeat 24hour recalls

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Dietary data regarding the intakes of Australian children from weaning until around 2 years of age is limited. One of the reasons for this is the absence of age appropriate, validated tools that are suitable for the unique dietary habits of this age group. Sugar intake is of particular interest to dental and nutrition researchers due to the relationship between sugar intake and dental caries, overweight and obesity. The aim of this research therefore, is to assess the relative validity and repeatability of a Food Frequency Questionnaire designed to estimate total sugar intake in children aged 18-30 months, against three non-consecutive 24-hour recalls (24HR). Ninety seven parents of eligible children completed the online FFQ, firstly before (FFQ1) and then again after (FFQ2) the three 24-hour telephone recalls. Participants were classified into tertiles, with 55.7% of participants in exact agreement between 24HR and FFQ1, and only 9.3% grossly misclassified. Pearson's correlation coefficient between these two was 0.518 (p = <0.001). This suggests that this instrument is suitable for estimating total sugar intake in this population. In terms of repeatability, FFQ1 and FFQ2 also showed good agreement, with 54.7% in exact agreement, and only 8.3% grossly misclassified. Pearson's correlation was 0.552 (p = <0.001). Further analyses will determine whether the tool is also valid for estimating free sugars. This research is part of the NHMRC funded Study of Mothers and Infants Life Events affecting oral health (SMILE) project.

[P007] The reliability and validity of a short food frequency questionnaire among 9 to 11-year-olds: A multinational study on 3 middle income and high income countries

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Background

The main aim of this study was to assess the reliability and validity of a food frequency questionnaire with 23 food groups (I-FFQ) among a sample of 9-11 year old children from three different countries that differ on economic development and income distribution, and to assess differences between country-sites. Furthermore, we assessed factors associated with I-FFQ's performance.

Methods

This was an ancillary study of the International Study of Childhood Obesity, Lifestyle and the Environment. Reliability (n=321) and validity (n=282) components of this study had the same participants. Participation rates were 95 % and 70 %, respectively. Participants completed two I-FFQs with a mean interval of 4.9 weeks to assess reliability. A 3-day pre-coded food diary (PFD) was used as the reference method in the validity analyses. Wilcoxon signed-rank tests, intra-class-correlation coefficients and cross-classifications were used to assess the reliability of I-FFQ. Spearman correlation coefficients, percentage difference, and cross-classifications and were used to assess the validity of I-FFQ. A logistic regression model was used to assess the relation of selected variables with the estimate of validity. Analyses based on information in the PFDs were done to assess how

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participants interpreted food groups.

Results

Reliability correlation coefficients ranged from 0.37 to 0.78 and gross misclassification for all food groups was < 5 %. Validity correlation coefficients were below 0.5 for 22/23 food groups, and they differed among country-sites. For validity, gross misclassification was < 5 % for 22/23 food groups. Over- or underestimation did not appear for 19/23 food groups. Logistic regression showed that country of participation and parental education were associated with the validity of I-FFQ. Analyses of children's interpretation of food groups suggested that the meaning of most food groups was understood by the children.

Conclusion

I-FFQ is a moderately reliable method and its validity ranged from low to moderate, depending on food group and country-site.

[P008] A systematic review of the validity and reliability of individual short food questions to measure dietary intake in children and adolescents

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Background

Short food questions (SFQ) are appealing as they have low participant burden, can be self-completed and administered in a variety of ways.

Objective

To identify and critique validation studies evaluating the performance of SFQ which assess dietary intake in children.

Design

A systematic review of literature published between 2004-2014 was conducted using defined criteria. Studies were included if: they reported on a question or short item (50 items, data presented as 30 food groups) measuring food intake or food-related habits, in children (aged 6 mo-18 years) and reported on question validity or reliability.

Results

6443 papers were identified, 27 met the inclusion criteria. Most questions assessed individual foods/ food group intake (n=25), only four studies asked about food habits; the most common being breakfast and meal frequency (n=3 studies). The food groups most commonly assessed were fruit or vegetable intake (n=20 studies each), dairy foods and discretionary foods (n= 19 studies each). Nineteen studies assessed reliability, of which only half were deemed reliable, and 25 determined accuracy most commonly compared against food records. Evaluation of question performance tended to rely on lower-order tests such as correlation.

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Conclusions

The findings of this review provide a useful overview of short food questions commonly used to assess food intake in children. The findings will enable researchers to identify existing gaps in repeatable and valid short food questions which will provide direction about the need for future tool development. This work was undertaken by the food and Nutrition stream of the Australasian Child and Adolescent Obesity Research Network (ACAORN).

[P009] Waterloo web-based eating behaviour questionnaire (WEB-Q): twelve years of experience

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The Waterloo web-based eating behaviour questionnaire (WEB-Q) is an interactive on-line 24 hour dietary recall, with good validity for children above 11 years of age, and includes a platform for food frequency (FFQ) and associated questionnaires (Hanning et al., 2009). Unique login and passwords allow confidential data entry on single or repeat occasions. The multi-pass approach to data entry includes: selection from over 900 foods using varied options (pictorial menu of common choices by meal/snack, alphabetical listing, entering food name, searching by food grouping); nested listings of general and specific choices; selection from photos of six portion sizes in standard-sized dishes/place settings; prompts if foods/beverages not selected; review/edit of choices. Input is analyzed on-line for food group servings and nutrients relative to guidelines and feedback provided. Supplementary questionnaires have included FFQ; physical activity; knowledge, attitudes and beliefs; social aspects of eating; and use of traditional Aboriginal foods. WEB-Q has been used to survey over 25,000 youth across five Canadian provinces for cross-sectional school-based surveillance/monitoring, program evaluation, and multiple-day recalls repeated at set intervals. Added options have included: French language, alcohol-containing beverage choices, traditional Aboriginal foods; a beverage tutorial; review of foods consumed during the school day for where obtained (e.g., brought from home, purchased [school cafeteria, fast-food restaurant/take out) and standard messaging according to results. WEB-Q provides a valid, flexible, user-friendly approach to efficiently collect and analyze food intake data from youth. 24-hour recalls permit diet quality assessment, risk assessment and contributions of foods from school to total daily intakes.

[P010] Is higher education and income level of mothers a risk factor for primary school children in Haiphong City, Vietnam to be overweight and obese?

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Background

Overweight and obesity was highlighted as a public health issue in Asian countries, including Vietnam, more than a decade ago. While the prevalence is rapid rising and consequences were

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significant, there were insufficient data for childhood adiposity in Haiphong, a major city in Vietnam. The aim of this study was to determine the prevalence of overweight, obesity and abdominal adiposity and contributory factors among primary school children in Haiphong City.

Methods

A cross sectional study was conducted on 276 primary school children in 9/2012 in Haiphong City. Children's weight, height and waist circumference were measured to calculate Body Mass Index by age z-score (cut-off points above +1SD and +2SD defining overweight and obesity, respectively), and waist-to-height ratio (WHtR) (cut-off points 0.532, 0.531 for girls, boys aged 5-7 years and 0.557, 0.540 for 7-10 years old girls, boys, respectively, corresponding to the 90th percentile for WHtR). Information on diet, physical activity and socioeconomic status were collected by self-administered questionnaires.

Results

The prevalence of overweight, obesity and abdominal adiposity was 11.2%, 10.1% and 19.9%, respectively. The figures for boys and children in urban areas were higher than for girls and children in rural areas. Children of mothers with lower education (under high school) and income levels (below USD150/month) were less likely to be overweight and obesity (OR=0.43 and 0.35, respectively, $p<0.05$) and abdominal adiposity (OR=0.31 and 0.39, respectively, $p<0.05$).

Conclusion

Further studies to assess the relationships between mothers' education and income levels and childhood obesity in Vietnam are necessary.

[P011] Pacific youth's dietary diversity, food variety and eating habits may explain increased risk to develop obesity

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Background

In New Zealand (NZ) Pacific youth (aged 16-24 y) are at high risk of developing obesity. As part of an over-arching cross-sectional study, we investigated diet quality of NZ Pacific youth. Design: Face-to-face interviews with structured probing questionnaires was used (n=30). For the dietary assessment, a Pacific-focused dietary diversity questionnaire was developed, including both nutritious and discretionary foods and food groups to capture diversity (food groups) and variety (food items). Eating habits, meal patterns, food choices and related cultural and social influences were investigated. Dietary diversity scores (DDS) were calculated from disaggregated food groups (26 food groups: 15 nutritious and 11 discretionary). Food variety scores (FVS) were calculated from individual food items (227 total foods: 129 nutritious and 98 discretionary). The eating habits data were analysed using a content analysis approach highlighting meal patterns and food consumption trends.

Outcomes

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The mean total, nutritious and discretionary DDS over seven days was 23.1, 14.3 and 8.83 groups respectively. The mean total, nutritious and discretionary FVS was 91, 51.7 and 39.3 foods respectively. Highest nutritious variety was vitamin A-rich fruit and vegetables (3-8 foods), and highest discretionary variety was drinks (4-10 drinks) and takeaways (3-9 foods), with poor variety in legumes and dairy groups. A two-meals/day eating pattern was observed. Availability of discretionary foods and cultural values around food consumption contributed to overeating at social occasions.

Conclusion

Assessment of diet quality using dietary diversity identifies dietary components that may at least in part explain an increased risk of obesity development and could guide intervention strategies to improve health outcomes.

[P012] Diet assessment in low-to-middle income adolescents from a developing country: Lessons from the Chilean growth and obesity cohort study

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Diet assessment in population-based studies among low-income children from developing countries poses numerous challenges. The Chilean Growth and Obesity Cohort Study (GOCS) is a longitudinal follow-up study of 1100 low-to-middle income children born in 2002-2003 in Santiago, Chile. Central aims are to assess how childhood nutrition impacts the development of obesity, sexual maturation, and 'among girls' breast development. None of the available food frequency questionnaires (FFQs) and automated 24-hour recalls was compatible with the typical Chilean diet. We developed a semi-quantitative FFQ but obtained poor correlations (<0.3) when validating it against three 24-hour recalls; main sources of variability were maternal employment and education. We therefore developed a series of 24-hour recalls completed by the mother with the child selecting portion sizes from a food atlas. Standardization efforts revealed important differences in food coding among dietitians; thus, we developed automated software for data entry. Nutrient analyses revealed that most processed products recently introduced in the market were not included in the national nutrient database and had to be added manually. We conclude that (1) diet assessment instruments need to be generated specifically for each ethnic population, (2) repeated 24-hour recalls (3-4 per year) yield more valid results than FFQs in children aged 10-13 years, (3) low parental education and eating habits away from home pose additional challenges in this age group, (4) valid dietary assessment in these settings requires careful standardization of interviews with structured entry programs, and (5) nutrient databases are often insufficiently maintained and updated in developing countries.

[P013] Development and validation of a culturally specific food frequency questionnaire for the Malaysian Punjabi adults.

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The Food Frequency Questionnaire (FFQ) has been widely used to assess dietary intake in large population studies. The objective of the present study is to develop and validate the FFQ for assessing the dietary intake of Malaysian Punjabis adults. In the development phase, a list of food items consumed by the Punjabi adults (n=100) was determined using a 3-day dietary recall. The validation process was then conducted by verifying the developed FFQ against respondents' (n=101) 2 days dietary record. Data was analyzed by Spearman correlation, cross-classification, and Bland-Altman plots. A total of 42 males and 59 females participated in the study. The FFQ overestimated almost all nutrients as compared to the dietary records. The differences in the median for both methods ranged between 8.9 to 11.2% for all macronutrients. The Spearman correlation coefficient of the nutrient intake using the FFQ and 3-day dietary record was 0.54, 0.38, 0.47, and 0.31 for energy ($p<0.01$), carbohydrate ($p<0.01$), protein ($p<0.01$) and fat ($p<0.05$) respectively. The classification into the same and adjacent quartiles was between 61-84%. Bland-Altman plots showed relatively good agreement for both the dietary methods used. The developed FFQ had a moderate agreement with the dietary record in terms of the energy and macronutrients intake. It can be termed as a valid tool to assess the population's dietary intake. However, further attention shall be given if micronutrients are intended to be measured.

[P015] Using innovative and participatory methods to capture the contribution of local food biodiversity in the diet in Vietnam.

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In Vietnam, food diversity is high and dietary habits largely variable between regions and ethnic groups, making intake assessments difficult and resulting in few published data. Main challenges are i) identifying and estimating unique food variety consumed in a context with vast species diversity as not all species are likely to appear in a 24-hour recall and ii) estimating portion sizes as chopsticks are used and preferred pieces (e.g. meat) are self-selected from the common pot. A three-step mixed method approach has been developed and piloted in Vietnam to overcome these challenges. The method consists of two focus group discussions (FGD) and a 24-hour recall (Ferguson/Gibson). The first FGD is administered at the community level to inventory local foods consumed from the farm, wild and markets with 347 foods from 257 species identified. The 24-hour recall method was adapted through a consultative process with local stakeholders to identify strategies to overcome intake survey barriers in Vietnam. The recall was administered to 410 women, validated by a

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repeated recall on a non-consecutive day, and covered two seasons. Not all FGD inventoried foods were captured in the recall due to seasonal availability. To calculate usual intake of local species, a second FGD identified the proportion of habitual consumers of inventoried foods. It was expected that participatory discussion and censuses building would identify the norm for habitual consumption in the community. This mixed method is expected to provide an efficient and accurate way to conduct diet assessments and capture dietary diversity more completely.

[P016] Sustainable community-based diabetes prevention program by lifestyle modification for at-risk populations in Thailand: Educational tool development for change agents

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Objective was to develop health promotion tools and web-based food frequency questionnaire (FFQ) for adolescent dietary patterns. This study consisted of 2 phases; 1) formative and 2) tool development and validation phase. Key informants including 8 teachers and parents, and 22 students were purposively selected for focus group and in-depth interview. Scripts were used to extract the key concept of supports and barriers that influenced the nutritional status of the children. The development of the tools for the validation phase; knowledge test, web-based FFQ; was based on formative results and secondary data from the Consumption survey. Fifty-eight food items were selected by ranking the most frequently consumed by adolescents, and scoped down by selecting the items that contributed 70% of fat and fiber. One hundred and thirty-five students from grade 7-9 participated in validation phase. Relative validity method, using adapted 24-hour recall for 6 days, was compared with the web-based FFQ. Formative results included barriers, supports, opportunities, and which also included environmental influences, education and knowledge, food accessibilities and availabilities depicted in the hurricane diagram and concept mapping. The results of the tool development and validation phase showed more obese school-aged girls than boys, especially for grade 9 girls even with higher levels of basic nutritional knowledge. There was no statistically significant correlation and agreement between web-based FFQ and adapted 24-hour recall except for fiber with p-value 0.01. Non-screen-based activity attracted the attention of students. More health promotion tool improvements were still needed to improve before the implementation phase.

[P017] Association between home and school food environments and dietary behaviors among 9 to 11-year-old Children in 12 countries

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Food environment may be associated with dietary behaviors, but studies comparing the impact of food environments at home and school are scarce. We investigated the roles of home and school environments on dietary patterns of children from 12 countries representing a wide range of geographic and sociocultural variability. Participants were 6685 (54% girls) 9-11-year-old children. Parents reported the availability of certain foods in the home, and trained researchers performed school audits recording the availability of foods for sale. Foods were then divided into wholesome and empty-calorie foods and scored according to their availability. Children reported the number of meals eaten outside of the home and school. Data-driven dietary pattern scores were calculated from food frequency questionnaires. Multilevel models were used to study the associations between home and school food environments and dietary patterns. Home food environment was associated with unhealthy and healthy eating patterns. For low consumption of unhealthy foods, low availability of empty-calorie foods was found to be more important than high availability of wholesome foods. In addition, meals eaten outside of the home and school were associated with higher unhealthy eating pattern scores. Food availability at school was not associated with dietary patterns. In this sample, the role of home food environment was more significant than the school food environment in predicting food consumption. Meals eaten outside the home and school contributed to unhealthy eating pattern. Parents should be encouraged to limit the availability of empty-calorie foods and eating out.

[P018] Energy and macronutrient intakes of octogenarians: Results from Te Puawaitanga O Nga Tapuwae Kia Ora Tonu, Life and living in advanced age: A cohort study in New Zealand (LiLACS NZ)

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To date no comprehensive assessment has been undertaken in NZ to identify food and

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macronutrient intake in people of advanced age. As part of the LiLACS NZ study, dietary intake was assessed in 216 Maori and 362 non-Maori octogenarians. The repeated multiple pass, 24 hour diet recall method (MPR) was used to obtain energy and macronutrient intake. FOODfiles was used to calculate nutrient intake. Food items reported in the MPR were allocated to food groups used in the New Zealand Adult Nutrition Survey (NZANS). Intakes were compared to the Nutrient Reference Values (NRVs) for Australia and NZ. The median BMI was higher for Maori (28.3 kg/m2) than non-Maori (26.2 kg/m2) p=0.007. For Maori, median energy intake was 1779 kcal/day for men and 1433 kcal/day for women with 16.3% energy derived from protein, 43.3% from carbohydrate and 38.5% from fat. Median energy intake was 1887 kcal/day and 1497 kcal/day for non-Maori men and women respectively with 15.4% of energy derived from protein, 45% from carbohydrate and 36.7% from fat. For both ethnic groups bread was the top contributor to energy and carbohydrate intake. Protein came from beef and veal, fish and seafood, bread, milk and poultry with the order differing by ethnic group and sex. Fat came mainly from butter and margarine. Energy adjusted protein was higher for Maori than non-Maori (p=0.049). For both ethnic groups, percent carbohydrate tended to be lower and fat higher compared to adults aged > 70 years in the NZANS.

[P019] Association between sugar consumption and obesity prevalence: Global and regional

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Obesity is a chronic, stigmatized and costly disease and its prevalence is increasing. It now seems no longer acceptable to argue that obesity can simply be explained in terms of caloric consumption only using simple concept of energy in and energy out. Human metabolism altered with specific food components and dietary patterns varying in their composition of food groups may also contribute to the increase in body adiposity deposits. Sugar has been suggested to have such an influence. Data from 170 countries were extracted from the UN agencies for analysis. The associations between obesity prevalence and per capita consumption of sugar sourced from the FAO and the International Sugar Organization (ISO) were examined respectively worldwide and with regard to cultural, geographical, economic regions using Pearsons correlation coefficient (PCC), Spearman's rho and partial correlation with the backdated cofounders. Each country was treated as an individual and all the data were statistically indicated at per capita level. We have used PCC for data analysis and have observed the strong positive correlation between obesity prevalence and per capita sugar consumption using data sourced from 170 countries by FAO and 128 countries by ISO. These associations were still positive when the cofounders of the prevalence of physical inactivity, GDP, and the intake of meat, wheat, calories and fat were controlled in PCA. The associations between obesity prevalence and sugar consumption in developed country groupings, such as OECD, the World Bank High Income Classification were stronger than those in relatively poor groupings, such Africa, Asia and Latin America and the Caribbean. Sugar consumption may contribute at least 10% to the worldwide variation in obesity. Populations with greater sugar intake have higher prevalence of obesity both worldwide and with special regard to the developing regions. Prospective studies on association between fructose only consumption level and obesity prevalence are suggested to further explore these associations.

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Theme 02: Novel Methods for the Assessment of Diet & the Food Environment

[P020] Examining food choice with fake foods - FFB 2.0

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Examining Food Choice With Fake Foods - FFB 2.0 Experimental research involving food is often limited by practical issues such as high costs, limited availability of suitable infrastructure and the effort of preparing food and its subsequent waste and spoilage. The fake food buffet (FFB) method was developed to overcome these limitations and to investigate food choice behaviour under well-controlled environmental conditions. The FFB was validated and has been successfully used for various food choice studies. Here we present an advanced version of the fake food buffet, the FFB 2.0, which allows investigating daily food choice under controlled laboratory conditions. The FFB 2.0 contains 159 food items representing a broad variety of foods typically consumed throughout the day. The food selection is balanced according to the foods' healthiness based on nutrient profiles. The buffet contains a variety of snack and convenience foods, beverages and sauces to represent a common diet. All fake food items are linked to a nutrient database, allowing experimenters to estimate energy, micro- and macro nutrient selection. The features and applications of the FFB 2.0 will be discussed and experimental data from a study on the influence of nutrition knowledge on food choice will be presented as an example for the research potential of the FFB 2.0.

[P021] The development and validation of a simple and interactive dietary intake tool for use with Australian Aboriginal and non-Indigenous adults

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Background
Poor nutrition is a major risk factor in the development and progression of preventable chronic disease amongst the Australian Aboriginal and Torres Strait Islander population. Standard nutrition assessment methods lack feasibility and acceptability in Aboriginal communities making collection of individual dietary intakes challenging in this setting.

Methods
We developed and validated a simple and interactive dietary intake board to assess diet quality in two longitudinal life course studies; the Aboriginal Birth Cohort and Top End Cohort. Aboriginal and non-Indigenous adults aged 23 to 28 years were seen between 2013 and 2015 in urban, rural and

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remote communities across the top end of the Northern Territory.

Results

The nutrition assessment, using the dietary intake board, was completed by 336 participants. To assess validity, 65 participants (selected from both studies) completed a 24 hour dietary recall. Mean agreement between the intake board and 24 hour recall ranged from -0.30 (CI -1.53, 0.92) for takeaway & extras to 0.03 (CI -0.711, 0.77) for meat. The correlation coefficient ranged from 0.52 for takeaway & extras to 1.00 for fruit. The intake board classified 98 to 100% of participants' food group intakes into the same or adjacent tertile as the 24 hour recall.

Conclusion

This interactive visual tool provides a quick, acceptable and valid method for estimating consumption of food groups. This board captures usual intake over a longer period compared with the 24 hour recall. The board works across populations and settings and is showing particular usefulness in the hard-to-assess remote Aboriginal population.

[P022] Study on reducing hazardous materials in foods (HMFs) - design and methods of the Korean Total Diet Study

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Total Diet Studies (TDS) are national surveys recommended by the World Health Organization and the European Food Safety Agency in order to provide information on chronic dietary exposure of a population to food contaminants like toxic elements, mycotoxins, persistent organic pollutants (POPs), pesticide residues, and food additives necessary to perform risk assessment. In line with the effort to reduce hazardous materials (HM) in foods, this study was designed to estimate the exposure of the general population to 25 hazardous materials such as trans fat, furan, heterocyclic amines (HCAs), acrylamide, polycyclic aromatic hydrocarbons (PAHs), aldehydes, ethyl carbamate, biogenic amines, nitrosamines, trihalomethanes (THMs), ethylene oxide, benzene, 3-MCPD, and 1,3-DCP first during 3 years, from 2013 through 2016, as a Total Diet Study (TDS). At the second stage, from 2016 to 2017, appropriate measures for reducing exposure to contaminants of concern will be devised. In TDS, dietary intake data from 2008-2011 Korea National Health and Nutrition Examination Survey was used to select representative foods (RF). Collection and preparation of RF samples are conducted in 3 rounds handling different food groups in each year. After analysis of RF samples for contaminants, comprehensive exposure for each HM is estimated at individual & population level based on the individual food intake and HM content in RF using best-fit mapping between RF and other foods.

[P023] New theories on human diet & food environments alter approaches to assessment

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Many of the recent degenerative health conditions, including obesity related metabolic syndrome and consequent cardiovascular disease, have been attributed to unhealthy diets and environments. New evidence-based theory indicates that humans require a large and varied supply of food micronutrients, with minimal additives, for healthy longevity. Such 'whole food' diets allow mobilisation of any extra lipid from both diet and adipose stores, for high-level cellular maintenance and repair. Thus diets should be graded on whole food micronutrient to macronutrient ratios and lack of toxins. In the past assessing phytonutrient content in whole food items, their absorption, and effects on gut microbes was not possible. Now, such food nutrient ratios and non-nutritive additive content and absorption can be analysed by metabolomics of dietary items, gut microbes, bowel contents (eg faeces), blood and urine. Once nutrient ratios and additives are graded, food production and processor industries can be subsidised for high nutrient ratio/low additive produce or taxed on low nutrient ratio/high additive foodstuffs. Comments will be made on progress of research and metabolomics database libraries of such food analyses, mathematical modelling of effects on energy metabolism when plentiful micronutrient are present, and political ramifications of dietary nutrient grading systems.

[P024] Validation of food frequency questionnaire (FFQ) for dog feeding against 7 day food diaries

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The DOGRISK project studies the association of feeding and chronic diseases in a Finnish pet dog population. The diseases of interest are shared by dogs and humans and thus the epidemiological analyses are expected to generate hypotheses relevant for human health. Dietary assessment methods designed for use in human nutritional studies were modified for use in dogs. We aimed to validate a dog food frequency questionnaire (FFQ) against 7 day food diaries. The data on dog feeding were collected via a self-administered web-based questionnaire including a FFQ. It assesses dietary intake of dogs in three different age periods: puppies, young dogs and adults. The FFQ has 47 questions and the frequency of feeding is in 5 point scale from never to daily. We converted these to weekly frequencies for the analysis. Respondents who had answered in the FFQ during one calendar year were invited to take part in the validation study (N=239). A total of 140 (59%) owners agreed to participate. 86 (78%) of those who started the diary, kept it for seven days. Respondents were asked to record everything the dog consumed. The owners were instructed to use household measures or weighing to record the foods and advised to specify the items with details about brand name, fat content, manufacturer and preparation method. We calculated the frequencies of each food from the diaries. The mean number of foods reported per day was 5 (range 0 -14, SD ± 2.9). Agreement between the two methods will be examined.

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[P025] Using a smartphone meals diary to explore snacking behaviours in young adults

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Purpose

Many dietary assessment methods are limited in their ability to assess meal patterns including behaviours such as snacking or contextual factors. Snacking has previously been found to be highly prevalent in young adult populations and within a variety of contexts. The aim of this study was to describe the snacking occasions of young adults using a new smartphone meals diary.

Methods

Participants (59 females, 20 males) aged 18-30 years used the FoodNow app over four non-consecutive days, recording all food and beverages consumed using a combination of written text, voice recorded messages and photographs. At each eating or drinking occasion a series of contextual questions were completed. These questions included the time, place, social company, activities during consumption, a description of the eating occasion, and information surrounding the purchasing and preparation of the food ingredients. A snack was defined as any eating or drinking occasion reported by the participant as anything other than breakfast, lunch, dinner or plain water consumption.

Results

Participants provided data over 306 days, which included 773 eating occasions identified as a snack. The most frequently reported contexts of snacking included 'home' as the venue (354), 'by myself' as the social company (382) and 'using the computer' as activity during consumption (202). Snacking was reported throughout the day with the most common time frame for consumption 4-5PM (69) followed closely by 5-6 PM (65).

Conclusions

Future work will examine the potential influences on these snacking behaviours in order to develop targeted public health messages.

[P026] An automated dietary assessment system and nutrient database for the Malaysian Cohort Project

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A comprehensive dietary assessment tool to capture data on the wide variety of food and nutrient intakes across different regions and ethnic groups is needed to establish diet-disease relationship. Therefore the aim of this study is to develop a computer-based, interviewer-administered dietary assessment system linked to a nutrient database. This dietary assessment system or Dietary

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Information Management System (DIMS) consist of three modules i.e. a nutrient database, an interactive computerized 24-h diet recall and finally the computerized semi-quantitative food frequency questionnaire (FFQ). A sub-sample of 10,000 participants was purposely selected from 106,527 participants of The Malaysian Cohort (TMC) project for the development of DIMS nutrient database module and 24-h diet recall module. Further, a sub-sample of 800 participants based on good quality data of a single 24-h diet recall and 2-d diet record were selected to represent the TMC participants for the development of food item list in the FFQ module. DIMS, which managed to include more than 2,500 items of food and beverages in the nutrient database module, finally listed 203 food items and cooked dishes retrieved using step-wise multiple regression analysis into the FFQ module. The FFQ module was designed using the habitual intake of mixed dish-based approach, frequency of intake, portion size and linked to the nutrient database module. Images of food items were also included to aid food intake estimation. At the end of interview session, the DIMS could generate an output explaining diet quality for participant's easy reference. A preliminary validation study using a paper format for the selected food list in FFQ module was conducted in another group of participants (n=103) prior to constructing the system and showed promising results when compared to the reference method. This well-accepted system provides a culturally specific automated dietary assessment system for measuring habitual food and nutrient intake in order to establish diet-disease relationship across the multi-ethnic population of Malaysia.

[P027] Nutritional epidemiology in canine population: Using pet dogs as an animal model for studying diet-disease associations

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Traditional animal experiments have problems associated with ethical considerations and generalizability of the results to human populations. Applying methods of nutritional epidemiology to analyze the diet-disease relationships in pet dogs is a novel approach which combines some of the advantages of animal and human research. As the lifespan of dogs is much shorter than that of humans, also the follow-up times are shorter. The dog's diets are usually more monotonous than those of humans, which improves the reliability of long-term dietary estimation. Pet dogs share many environmental factors with their owners. Dogs also encounter many of the health problems prevalent among humans. For example, atopic disorders, osteoarthritis, diabetes, epilepsy, overweight, and cancer are common in both species In the DOGRISK project we have collected data on the feeding, environmental factors and diseases of Finnish pet dogs using an owner-administered internet-based questionnaire now being validated. Feeding information is collected separately for the age periods of puppyhood, youth and adulthood with 47 questions intended to cover the total diet. Five frequency options are given, ranging from 'never' to 'daily' or 'almost daily'. The questionnaire also includes questions on 43 different disease conditions and on a variety of dog characteristics and environmental factors. The questionnaire was opened in the internet in 2009,

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and by April 2015 there were 10072 answers. The data set will be used for epidemiological analyses of diet-disease associations. It also allows generating hypotheses to be further tested in humans and dogs.

[P028] Development of a semi-quantitative FFQ for dietary assessment of a multi-ethnic population: Experiences from Singapore

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Globally the consumption of ethnically diverse and away-from-home foods has increased. This presents challenges for developing food frequency questionnaires (FFQs) that can only include limited numbers of foods. Singapore is a multi-ethnic highly-urbanized Asian country with a wide variety of traditional ethnic and international cuisines. The objective was to develop an updated FFQ accounting for ethnic-specific dishes and novel foods as well as low participant awareness of components of complex heterogeneous mixed dishes. For coverage of ethnic-specific foods in the FFQ food-list, we used two 24-hour dietary recalls from a nationally representative sample of 805 adult Singapore residents which oversampled minority groups. Recipe names were standardized based on main ingredient and cooking method, and similar recipes were grouped into 240 food groups. Overall and by ethnic group, food groups contributing cumulatively to 90% of key nutrient intakes or cumulatively explaining 90% of intake variance were included in the food-list. FFQ layout was informed by pre-testing and cognitive interviews. Ethnic group differences in the proportion of consumers were small for most food groups, exceptions including thosai, dhal, pork dishes, white fish, potato, and noodles in soup (difference of 20 percentage points). Corresponding differences by ethnicity were observed in contribution of these food groups to nutrient intakes. One third of the final 147-item food-list constituted complex mixed dishes. Participant preference for reporting varied by dish type, e.g. participants preferred to report separately on each vegetable within mixed vegetable dishes. Results from this study provide methodological insights for the development of multi-ethnic FFQs.

[P029] Developing community-based urine sampling methods to integrate biomarker technology for patient health assessment

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Dietary exposure and nutritional status has a huge impact on the health and well-being of populations. It is widely accepted that there is great potential to use dietary advice/interventions to delay drivers of chronic health risk. Obtaining objective, self-reported dietary exposure information from individuals is challenging due to the complexity of the monitoring tools (e.g. Food Frequency Questionnaires), hindering research efforts to link specific foods to clear population health outcomes. Accurate diagnoses of dietary exposure and nutritional status is particularly important for young, elderly and vulnerable individuals whom are incapable of precise self-reporting. In epidemiological studies, urine sampling is a non-invasive, easy sample for participants to collect in their home-settings. However collection of urine samples that can accurately represent the eating pattern of an individual is challenging as a result of the cyclical nature of eating behaviour and the dynamic, and often rapid, metabolism and excretion of metabolites derived from dietary sources. With limited opportunity for urine sampling in epidemiological studies it is essential that the methodology has minimal impact on the day-to-day activities of participants, and is data-rich in terms of biomarker discovery and/or targeted measurement. We are aiming to develop and validate a simplified, robust, diagnostic urine population screening method using metabolomics coupled with machine learning technology. This method needs to be acceptable in a community setting and suitable for routine use to objectively monitor behavioural (e.g. diet and exercise) drivers of chronic health risk and that can describe current health status closer to point of care.

[P030] Developing a dietary intervention protocol for metabolomic profiling of habitually eaten foods in a free-living population

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The M.A.I.N. (Metabolomics at Aberystwyth, Imperial and Newcastle) Study is applying metabolomics approaches to discover and validate food-derived metabolites in biofluids which could provide an objective method of measuring food intake. The aim of this study was to develop a dietary intervention protocol suitable for measuring urinary biomarkers of habitual diet in a free-living population. Foods most commonly eaten by the British population were identified and organised into a three-day menu plan; several foods appeared twice or three times, but in different formulations. To assess the effect of timing of food consumption, participants were randomised to one of 12 3x3 Latin squares. An additional 'unhealthy' meal was provided at the beginning of the study to capture biomarkers of foods associated with poor health and participants collected urine samples at pre-determined and spot times. Thirty-six healthy adults (21 females) aged 19-77 years with a mean BMI of 23.73 (SD 3.15) kg/m2 were recruited. Four participants dropped out in the first week. There was 78-100% compliance with menu items across the study; lower compliance was associated with drinks. More participants returned first morning void compared to fasting urine samples. Overall high dietary compliance suggests the study design was suitable for purpose and the urine which was easiest to collect has been identified. High resolution metabolite fingerprinting of

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the most data rich urine samples is currently underway to identify known and novel metabolites of the key foods relevant to public health which have been incorporated into the intervention.

[P031] Diet and excess mortality in Scotland compared to England: Exploring differences in dietary intake

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Differences in diet may provide an explanation for higher premature death rates in Scotland compared to England. This work explored dietary differences between the two countries through a rapid review and analysis of pooled national data. The review sought to identify papers, reports and data sources with geographically relevant comparative data for Scotland and England. Comparable data was limited due to small Scottish samples in national level surveys or poor quality dietary measures. Nevertheless, findings suggested that lower intakes of fruit and vegetables, water- and fat-soluble vitamins, and fibre were reported in Scotland but intakes of calcium and processed meat were higher. The review indicated that useful comparative data could be pooled from UK food purchase data (2001-2012). These were analysed to compare key dietary intakes for England and Scotland, controlling for proxies for socioeconomic position in a multivariate model. Comparisons were also made within equivalised income quintiles to compare households experiencing similar levels of deprivation. Analysis showed that population adjusted per capita means for fruit and vegetables (267 versus 298 g/day), oil-rich fish (30.0 versus 35.4 g/week) and fibre (12.3 versus 12.8 g non-starch polysaccharide /day) were significantly lower in Scotland compared to England. Percentages of energy from saturated fat and added sugar were higher. Comparison of differences within equivalised income quintiles suggested that differences in dietary components known to be related to health outcomes, namely fruit, red and processed meat, vitamin C, alcohol and fibre were most apparent in the lowest income quintiles and were worse in Scotland.

Theme 03: Assessing Diet in Interventions

[P032] Measuring the effectiveness of salt intake intervention. Can a sodium and potassium specific food record checklist complement or replace 24-hour and spot-urine collections?

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A 1-year work-site intervention in Switzerland aims to reduce employees' daily salt intake. Primary

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outcome is sodium intake/excretion in 24-hour- and/or spot-urine. As recommended by WHO/PAHO, we developed/tested a self-administered semi-quantitative Food Record Checklist (FR-CL) to assess consumption of sodium and potassium rich foods two days before plus the day of 24-hour-urine collection. Step 1: Construction of the FR-CL (instruction; food list structured by categories/subgroups, reference portions, tick-list for quantification and sodium-relevant food preparations per meal; questions for condiment use and food choice in canteen) and of a sodium and potassium database. Step 2: Internal test for format/food list completeness. Step 3: Pretest (N=26 students) for ease of use, comprehensibility and reasonable estimate of daily sodium intakes. The internal test resulted in correction of formal errors, addition of foods and rearrangement of 13 food categories. Most pretest participants completed the FR-CL on the day of consumption. All rated the FR-CL comprehensible; still, 40-50% mentioned problems in reporting/allocating specific foods. Reference portions were considered adequate. Median salt intake was 12g/day compared to 8-10g/day population intake. Seven persons had intakes above 15g/day: they consumed several high-sodium foods, reported consumption of non-listed foods, indicated use of discretionary salt/condiments. High intakes may also be due to defined sodium values of specific foods or their reference portion sizes. Results deemed overall sound. We are using the revised instrument in the intervention study and will assess the validity of the FR-CL alone and in combination with spot-urine against 24-hour-urine. Intermediate results will be presented.

[P033] Validation of a food frequency questionnaire in hyperlipidaemic population

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Introduction
Limited validated tools specific to hyperlipidaemic populations exist to measure usual dietary intake. The cardiovascular disease Australian Eating Survey (CVD-AES) food frequency questionnaire (FFQ) was developed specifically for a hyperlipidaemic population to assess intakes of foods related to CVD health and based on the AUSNUT 2011-13 database. The aim was to compare fat intakes as measured by the CVD-AES to erythrocyte membrane fatty acids.

Methods
68 observations from 39 people over two time points (59.3±11.1 years, 27 females, total serum cholesterol 6.79±1.10 mmol/L) were assessed using a CVD specific semi-quantitative FFQ (total of 199 questions). Erythrocyte membrane fatty acids were assessed from fasting samples using gas chromatography. Spearman's rank correlation coefficients were calculated between dietary intake estimates as assessed by the CVD-AES and concentrations in erythrocyte membrane concentrations (% of total fatty acids) for linoleic acid (LA), alpha linolenic acid (ALA), eicosapentanoic acid (EPA), docosapentaenoic acid (DPA), docosahexaenoic acid (DHA) and total omega 3 (n3) .

Results
Preliminary results show significant correlations between dietary estimates and erythrocyte membrane concentrations for LA (r=0.30, p<0.01), DHA (r=0.34, p=<0.01) and n3 (r=0.25, p=0.04), but not for EPA (r=0.24, p=0.055) or DPA (r=0.04, p=0.75).

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Conclusion

The CVD-AES can obtain weak-to-moderate estimates of usual fat intake in hyperlipidaemic populations. Further work with greater sample sizes will confirm the strength of these relationships and determine question specificity to reduce respondent burden.

[P035] Three mini toolkits for collecting and analysing dietary data in clinical studies

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Objectives

The collection and analysis of dietary data is an important component of clinical studies. The objective was to create a series of mini toolkits that would facilitate the implementation of dietary assessment and analysis, standardize procedures and provide a resource pool for clinical study scientists.

Methods

Three mini toolkits were created:

(1) The Dietary Assessment Methodology Toolkit was created to assist in the selection of a dietary assessment method.

Components include:

- Decision tree and matrix to help guide method selection
- Focus on 3 common methods and their strengths and weaknesses
- Examples of tools (such as validated FFQs)
- Mapping tool for methodology publications worldwide

(2) The Dietary Data Analysis Toolkit was created to assist in cleaning, analysing, and extrapolating dietary data.

Components include:

- Overview of sources of error and bias in dietary data and how to minimise them
- Guidelines on data monitoring, quality control and data cleaning
- Decision tree on how to identify energy mis-reporting
- Examples of simple and complex dietary data analysis

(3) The Diet Quality Index Toolkit was created to assist in the selection of an appropriate diet quality index (DQI).

Components include:

- Types of DQIs and their strengths and weaknesses
- Decision tree and matrix to guide DQI selection
- Information on validating a DQI
 - Example DQIs and publications

Conclusions

The toolkits are currently being used in clinical studies. Adaptation of the toolkits to other settings should be considered in the future.

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[P036] The impact of a three-month intermittent fasting and physical activity regimen on body composition in young adults

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Managing food and physical activity can be challenging for young people, especially when they leave home which can lead to weight gain in the early days of independent living. This study focuses on young people seeking weight management whilst at university, utilising a modified fasting regimen with high protein intake on two 'fasting days' and a menu based on the Australian Dietary Guidelines on five days of the week. Fourteen overweight young adults (mean age 22.40 ± 0.95 years, eight females, mean Body Mass Index (30.69 ± 4.12kg/m2) wishing to lose weight were recruited. Dual-energy X-ray absorptiometry and 24 hour dietary intake recalls were completed. The three month weight management program was supported by six face to face sessions with an Accredited Practising Dietitian and supplementary milk based protein shakes were provided for the 'fasting days' along with structured dietary advice and moderate increase in physical activity. After three months, there were no significant differences in percent energy from protein between 1) baseline diet (25.95%) and the reduced energy eating plan (25.27%) or 2) baseline diet and 'fasting days' (26.73%). Significant reduction in both percent body weight (mean 5.29 ± 4.83%) and percent fat mass (2.59% ± 2.99%) were measured, all $p<0.05$. Conversely, percent lean mass of tissue increased (2.59 ±3.00%), $p<0.05$ over 3 months. This intermittent fasting and physical activity regimen can potentially decrease body fat and maintain lean mass in young adults, due to reduction in overall energy intake but without significant change in percentage of protein intake.

[P037] Validation of internet-based self-reported anthropometric, demographic data and participant identity in the Food4Me study

Katherine Livingstone[1,2], Carlos Celis-Morales[1], Clara Woolhead[3], Hannah Forster[3], Clare O'Donovan[3], Anna Macready[4], Rosalind Fallaize[4], Cyril Marsaux[5], Eirini Efstathopoulou[6], George Mochonis[6], Santiago Navas-Carretero[7], Rodrigo San-Cristobal[7], Silvia Kolossa[8], Magdalena Godlewska[9], Agnieszka Surwillo[9], Ingrid F Gjelstad[10], Anette S Karlsen[10], Christian A Drevon[10], Yannis Manios[6], Iwona Traczyk[9], Jildau Bouwman[11], Keith Grimaldi[12], Larry D. Parnell[13], Eileen R Gibney[3], Lorraine Brennan[3], Marianne C Walsh[3], Julie A Lovegrove[4], J Alfredo Martinez[7], Hannelore Daniel[8], Wim H M Saris[5], Mike Gibney[6], John C Mathers[1]

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With the growing numbers of e-health intervention studies, concerns have arisen regarding the validity and reliability of internet-based self-reported (SR) data. Therefore, the aim of this study was to assess the validity of internet-based SR identity, anthropometric and socio-demographic data compared with standardised measurements performed face-to-face in a validation study (VS). A total of 140 participants from seven European countries, participating in the Food4Me Study, were invited to take part in the VS. Participants visited a research centre in each country within two weeks of self-reporting their data via an internet-based questionnaire. For SR data, identity was checked visually and by repeated collection and analysis of buccal cell DNA for 33 genetic variants. Validation of identity showed perfect concordance between SR and VS demographic data (age and sex verification). ICC between SR and VS were high for anthropometric data (height 0.992 [95% CI 0.988 to 0.993], $P<0.0001$; weight 0.996 [0.995 to 0.997], $P<0.0001$ and BMI 0.993 [0.990 to 0.995], $P<0.0001$). However, SR height (0.003 m [95% limits of agreement -0.027 to 0.032], $P=0.046$) was slightly higher than the VS measurements but lower for weight (-0.65 kg [-3.6 to 2.2], $P<0.0001$) and BMI (-0.30 kg.m-2 [-1.56 to 0.96] $P<0.0001$). In addition, Bland-Altman analyses show that just 4.2%, 7.1% and 5.0% of the total participants fell outside 95% limits of agreements for height, weight and BMI respectively. Our findings confirm the reliability of internet-based SR anthropometric data collected remotely in European adults.

[P038] Reproducibility and measurement error of the Food4Me online food frequency questionnaire for estimating dietary intakes across Europe

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Food frequency questionnaires (FFQ) are subject to measurement error thus information on their reproducibility is essential. The aim of this analysis was to assess the reproducibility of the pan-European Food4Me FFQ. Linear regression, correlation coefficients, Bland-Altman plots and cross-classification of quartiles for daily intakes were used to assess reproducibility between screening and baseline measurements completed within a one month period (mean 19 days, SD 6.3). 665 participants were included in the study (mean 38.6 years, SD 13.4). Total energy intake was 252kcal/day lower at baseline than at screening (P<0.001). Spearman correlation coefficients (SCC) ranged from 0.63 (total fat g/day) to 0.89 (alcohol g/day) with a mean SCC of 0.68. Regarding food groups, SCC ranged from 0.46 (tinned fruit and vegetables) to 0.88 (alcoholic beverages). For nutrients, the mean cross-classification was 50% for 'exact agreement'. Bland-Altman plots showed good agreement for total energy, with <5% of participants falling outside the limits of agreement. Reproducibility of total energy intakes was high between countries, sex and age groups. Reproducibility was lowest in obese participants (SCC 0.54) compared with those with a BMI of <25kg/m2 and overweight participants (0.67 and 0.66, respectively) and SCC were lowest for the longest time between FFQs (0.63) compared with short (0.65) and medium (0.67) time periods. The Food4Me FFQ showed good reproducibility when administered to a large European population. Variations in reproducibility between countries were minimal, thus suggesting that this FFQ is a reproducible and widely applicable tool for reporting total energy, nutrients and food group intakes.

[P039] Development of a matching file of Australian food databases (AUSNUT2007 to AUSNUT2011-13) for use in the clinical trial context

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Research on dietary patterns requires foods to be classified into groups. In Australia, different classification systems have been used in the food databases AUSNUT1999, 2007 and 2011-13. While Food Standards Australia and New Zealand has developed matching files to convert data from the 1999 to 2007 version, and from the 1999 to 2011-13 version, there is no standardized method to match AUSNUT2007 foods to their 2011-13 counterparts. This presents challenges for dietary trial data collected using AUSNUT2007 which requires AUSNUT2011-13 classifications for further dietary pattern analyses. The aim of this study was to develop an AUSNUT2007 to 2011-13 matching file, to facilitate a food classification system for use in the clinical trial context. Food items aligned with AUSNUT2007 were matched back to AUSNUT1999 and then forward to AUSNUT2011-13 using food ID codes and the existing matching files, with the use of look-up tables. Any remaining AUSNUT2007 foods were manually matched to appropriate 2011-13 foods based on conceptual similarities. Quality assurance was applied using a systematic two-staged approach. Of the n=3874 foods and beverages in AUSNUT2007, n=1270 (32.8%) were matched to AUSNUT2011-13 equivalents using

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matching files. The remaining foods (n=2604, 67.2%) were matched manually. Quality assurance indicated challenges when matching AUSNUT2007 'not further specified' foods to AUSNUT2011-13 equivalents. Differences in study populations and dietary assessment methods present challenges for developing matching files for serial food composition databases. These challenges were demonstrated in our systematic approach to develop an AUSNUT2007 to AUSNUT2011-13 matching file suitable for use in the clinical trial context.

[P040] How accurate are food intake charts completed by nursing staff as part of usual care when no additional training is received?

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Background
Accurately measuring dietary intake is important in acute care, yet Australian visual estimation intake tools have not been validated in 15 years. We compared energy and protein intakes of inpatients using weighed food records (WFR) with food charts completed by nursing staff.

Methods
Main meal intake was determined by deducting the weight of individual foods remaining on patient trays from a reference tray weight. Mid-meal consumption was determined by patient report. WFR and food charts were converted to nutrients using supplier information. Food charts were also converted using a ready reckoner. Agreement between the test (food charts) and reference methods (WFR) was evaluated.

Results
Forty-three intake days were compared (n=15 inpatients, 77(8)yrs, 60%M). Average energy and protein intakes were similar between food charts and WFR (3155(1849)kJ, 29.9(19.7)g protein; $p>0.05$). Significant correlations were only observed at breakfast between WFR and food chart ready reckoner (energy: r=0.793; protein: 0.588; $p<0.01$), and breakfast and morning tea using the food chart supplier information (energy: r=0.767-0.898, $p<0.05$; protein: r=0.786-0.912, $p<0.05$). Cross-classification was unacceptable (11-33% of data grossly misclassified), and limits of agreement were wide (-363% to +467%).

Conclusion
Agreement was poor between intake methods at the group and individual level at most meals and mid-meals. Food charts completed by nursing staff as part of usual care with no additional training may not accurately measure inpatient intake. Regular training for nursing staff on completion of intake tools may be required, as well as seeking alternative, efficient, and accurate means of measuring inpatient intake.

[P041] Systematic review: How well have tools measuring nutrient intakes of adults in acute or chronic care institutions been validated?

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Background

The quality of dietary intake tools validated in adults requiring care in institutions has not previously been evaluated. We aimed to describe the dietary intake tools that measure nutrients of adults requiring care in institutions, and evaluate how well they have been validated.

Methods

Articles validating tools that measured nutrient intakes of adults requiring institutional care that were published from 1990 were sourced from a range of databases using standard search terms. A validation quality scoring system was sourced from an international review, a validation score was calculated, and relevant data extracted from the articles.

Results

Ten studies were located (n=1 from Australia, n=8 from Europe). Validated tools included visual estimation records (n=7), food diaries (n=1), and 24-hour recalls (n=2). No studies have validated photographic records or used other technology to measure intake. Reference methods included weighed consumption (n=7), surveys (n=1) and doubly-labelled water (n=1). Two thirds (n=6/9) of studies achieved at least an acceptable quality validation score (score 2.5/6.5) and none achieved the maximum score (median(range) 2.75(0.5-4)). More than half of the validation recommendations were met by 50% of studies. Studies often did not include high-energy high-protein drinks or mid meals, nor did they measure repeatability. Agreement between test and reference methods varied but, when reported, was generally acceptable at the group level, but not at the individual level.

Conclusion

Studies predominantly validated visual estimation tools. Studies validating alternative tools would be beneficial so that a simple, accurate intake tool that utilises technology (e.g. photographs) is available.

Theme 04: Advances in Technologies for Dietary Assessment

[P042] Systematic review of portion size estimation tools for dietary assessment

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Background

Incorrect estimation of portion sizes leads to significant random error during dietary assessment. Objective: To identify and categorise portion size estimation elements (PSEE) applicable to dietary assessment.

Method

A systematic review was conducted using search terms-related to PSEE, 22 databases, internet sites and cross-referencing for published records in English between 1910 and 2014, describing PSEE. PSEE were defined as components of the dietary assessment method designed to allow quantification of

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the amounts of food consumed. These include portion size estimation aids (e.g. photographs), guidance amounts/lists (e.g. small, medium, large; household units), natural units (e.g. 1 slice) and standard units of measurement (gr, oz, ml).

Results

Around 11,200 records were identified from which 293 abstracts were screened (1975-2014). From these, 498 PSEE were identified comprising: 4% one dimensional (1D) PSEE, 50% 2D and 46% 3D. One-dimensional PSEE comprised portion size lists (67%) and food guides (33%). Two-dimensional elements included all image-based PSEE split as: 36% photographic atlases, 33% electronic devices and images, 11% other food images/diagrams, 7% utensil photos, 6% non-food object photos, 5% food replica photos, and 2% hands-based portion measurements and ruler. Three-dimensional PSEE included household utensils (44%), food scales (31%), and food replicas/models (25%).

Conclusion

An extensive range of PSEE have been reported in the literature with an even representation of image-based (including electronic format) and volumetric tools. Further work will be examining the relative efficacy of each type of tool.

[P043] Validation of a web-based questionnaire to assess the food intake of Brazilian schoolchildren

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Background

The Food Intake and Physical Activity of School Children (CAAFE) is an online questionnaire to self report diet and physical activity of Brazilian schoolchildren.

Objective

To assess the validity (matches, omissions and intrusions) and moderating factors of the CAAFE.

Methods

Direct observation of foods consumed (5 public schools) and child self reporting on the CAAFE. Additional data: school grade, gender, body mass index (BMI), completion of food diary, socioeconomic status, access to computer. Data was analyzed using Poisson regression.

Results

602 children participated (9.5 ± 1.24 years, 53.6% boys). On average there were 43% matches, 29% intrusions, and 28% omissions. Matches doubled in 3rd grade compared to 2nd grade (p = 0.004); almost tripled for afternoon snack compared to morning snack (p<0.001); and was 69% higher for children with access to a computer at home (p<0.01). Intrusions decreased by almost half in 5th compared to 4th grades (p = 0.004). Omissions declined significantly in 3rd and 4th grades, but increased in 5th grade. Omissions were 47% lower for children in the highest income and lower among children who completed the food diary. No differences were found for gender or BMI.

Conclusions

Children older than 8 years old, who owned a computer and completed a food diary, performed

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better in the CAAFE. A high incidence of disagreement was found in relation to the schools and the type of meal. Overall matches (43%), intrusions (29%) and omissions (28%) indicate that further studies are required to improve the validity of the CAAFE.

[P044] Text messages to improve diet and physical activity behaviors for adolescent girls attending the 'Healthy Habits, Healthy Girls' Brazil

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Background
Interventions incorporating mHealth technology have utility for increasing physical activity (PA) and improving dietary behaviors in adolescents.

Objective
To describe the use of text messages as an intervention component of the Healthy Habits, Healthy Girls (H3G-Brazil).

Methods
H3G-Brazil intervention was a randomized controlled trial with 253 adolescent girls (16.05±0.85) attending schools from disadvantaged backgrounds. Guided by social cognitive theory and based on the Australian Nutrition and Enjoyable Activity for Teen Girls study. H3G-Brazil included diet and PA multiple components. One of those components was text messages sent bi-weekly using the commercially available Whatsapp to encourage social support. WhatsApp groups were created by school (i.e., 5 groups) and an accredited dietitian was responsible for moderating communication among school groups. Over the study period, 42 messages focused on healthy eating, physical activity and sedentary behaviors were sent to the girls.

Results
90.1% of the girls owned a smartphone and e-mails were sent to girls who did not own a device. Although, the messages did not require a response, there were 514 interactions between girls and moderator over study period. 74.14% of the girls found useful the messages and 50% like receiving through WhatsApp. Less than 20% of participants left the groups during the intervention.

Conclusion
Whatsapp text messages were an adequate tool and cheap strategy to improve health behaviors among adolescent girls from disadvantaged backgrounds living in a middle-income country. However, this type of technology should be used combined with other diet and PA components (e.g., seminars, workshops and parents newsletters).

[P045] Dietary assessment tool e-library - Accessing quality tools to raise standards in dietary assessment

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Dietary assessment that is unencumbered by measurement error remains a prized goal.   To this end, many Dietary Assessment Tools (DATs) have been developed across the globe, making the comparability of dietary data collected in different epidemiological and clinical studies a challenge. To facilitate the collection and analysis of quality, diet-related data and raise standards, the DIETary Assessment Tool NETwork (DIET@NET), a partnership of experts, is identifying and rating DATs for inclusion in a novel, interactive DAT e-library www.nutritools.org. Due to the large number of tools developed, a review of systematic reviews has been used as the first step towards identifying available, validated DATs. Reviews that systematically searched for DATs that measure specific dietary outcomes: energy intake, macro-, micro-nutrients, food groups, dietary patterns or non-nutrient such as phytochemicals will be included. Searches of MEDLINE, EMBASE, The Cochrane Library, Web of Science and SCOPUS databases were conducted; with restrictions on language and year (post 2000), 7640 records were found. De-duplication and preliminary screening (title/abstract) highlighted 118 reviews covering over 400 potential DATs (estimated). Data extraction from the original development and validation papers will enable DIET@NET experts to rate these DATs in terms of their validity, reliability and applicability. This will inform the Nutritools website, guiding researchers to validated, expert-rated DATs and best practice guidelines for their use. Access to DATs will be provided, with an online facility for data entry and food/nutrient analysis where possible. The DIET@NET vision is that this DAT e-resource plays a key role in enhancing the quality of dietary data collected in the future and its interpretation.

[P046] Does choice of branded or generic food codes in myfood24 affect estimated nutrient intake?

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Aim

To assess the effects of using branded compared to generic food codes on estimated nutrient intakes using myfood24. Introduction: food coding requires many assumptions leading to uncertainties in calculated nutrient values. myfood24 is an online dietary assessment tool developed to improve the collection of nutritional information. A unique feature included is a large food database of 45,000 items; including both branded and generic products.

Method

61 participants used myfood24 to recall their diet. They freely selected their foods; no guidance was given over the use of branded or generic codes. Detail of brands consumed was collected after the recall. The recalls were then recoded to form an all branded and an all generic recall. The three recalls were compared using a one-way repeated measures ANOVA to see if recorded nutritional intake was affected by the different methods of food coding.

Results

The choice of food code (free choice, branded or generic) did not significantly affect the majority of calculated nutrient intakes. Branded codes resulted in significantly lower cholesterol (273mg

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branded, 290 mg both generic and original, f value 4.3; P=0.01) and iodine values. Generic codes resulted in significantly lower values for riboflavin, vitamin B6, and vitamin B12 (3.9 µg generic, 4.3µg both branded and original, f value 7.09; P=0.001). Fat intake from branded codes was borderline, non-significantly lower.

Conclusions

Choice of branded or generic codes makes little difference to overall nutrient intakes calculated. The use of branded products in myfood24 supports user selection of items while minimally affecting calculated nutrient values. The myfood24 study was funded by the Medical Research Council (MRC) (ref: G1100235/1).

[P047] Development of online tools for assessing long term and daily calcium intake for vegetarians in Taiwan

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Background

The EPIC-Oxford study showed that the higher risk of bone fracture in vegan is likely due to inadequate calcium intake.

Aim

To identify major predicting foods for calcium intake from vegetarians; and to develop a short questionnaire and a smart phone App for assessing daily calcium intake.

Methods

78 vegetarians or near vegetarians recorded at least 3 days of dietary records. Food items were categorized into 50 food groups/items. Stepwise regression was used to identify food items/groups contributing to the highest variance of calcium intake: $Y = a + β1X1 + β2X2 + β3X3 + … + E$, where Y = total calcium intake, X = food items selected by stepwise regression, X1 = food item with the largest partial R square to total calcium intake, X2 = food item with the second largest partial R square to total calcium intake, and so on.

Results

The top 7 foods included in stepwise regression: milk, tofu, high calcium vegetables, other vegetables, meat-analogues, yogurt, and cereal powder - predict 94% of variance, and account for 69% of total calcium intake. Vegetarians consumed 36% of their calcium from vegetables, 14% from tofu, and 12% from milk and yogurt. Based on these data, we are in the process of building a short calcium questionnaire and a smart phone 'Calcium Calculator' to assess long term and daily calcium intake, respectively.

Conclusion

These tools could be used nutritional assessment and education among vegetarians and vegans in Taiwan.

[P048] Comparison of INTAKE24, an online dietary recall system, with interviewer-led recalls

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INTAKE24 is a web-based 24h dietary recall which follows the Multiple Pass method. The system was designed using an iterative process with four cycles of user-testing and development. Funded by Food Standards Agency Scotland the system was originally developed for use with 11 to 24 year olds living in Scotland and is currently being tested for adults. The system contains a database of over 1800 foods linked to the UK NDNS Nutribank food composition codes. Portion size is estimated using over 2500 food portion images from the UK Young Person's Food Atlas which have been extensively validated. A relative validation of INTAKE24 was conducted in 180 people aged 11 to 24 years by comparison against interviewer-led 24hr recalls. Each participant completed four recalls using INTAKE24 over a period of one month and four interviewer-led recalls covering the same day. The interviewer-led recalls were conducted after completion of INTAKE24 (in all but a sub-sample) to test the system in the way it would usually be used (unaided by having completed an interviewer-led recall first) and against 'as close to actual' as was practicable to assess (an interviewer-led recall enhanced by having completed INTAKE24). The mean time taken to complete INTAKE24 was 12 minutes compared with 20-25 minutes for the interviewer-led recall. Match rate was 81%. Estimates of energy, carbohydrate and protein intakes were within 1% and estimates for fat were within 3% on average of the interviewer-led recall. Accuracy and precision will be reported. A demo can be accessed at https://intake24.co.uk

[P049] Development and field testing of INTAKE24 for the general adult population

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INTAKE24 is an online 24hr dietary recall which follows the Multiple Pass method, originally developed for use with 11 to 24 year olds. The system has been further developed and adapted for use with the general adult population by inclusion of a recipe builder for inputting detailed information on foods cooked from scratch, a video tutorial and task specific help and a function for reporting foods not located using the look-up. INTAKE24 is being field tested in a sub-sample of the Scottish Health Survey population. Invitation letters will be sent to 1000 Scottish Health Survey participants from across the age range (11 years up to and including older adults) who will be invited to complete INTAKE24 on 4 days over a 2 week period. The study will test the acceptability and feasibility of INTAKE24 in this population. Field testing will take place in June-July 2015. Results will be presented to include an analysis of the performance of the system in the field including: the demographics of participants; completion rates (including details on full and partial completion);

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attrition rates, geographic coverage, reasons given for not taking part, usability and user experience, the number and demographic profile of participants requiring assistance and the nature of assistance required. Detailed feedback on the system will be requested from all participants to allow us to refine the system further. A demo of INTAKE24 can be accessed at https://intake24.co.uk

[P050] Acrylamide intake in Japan: Database development and estimation of intake level

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Objective
To estimate intake level of acrylamide, and contributing foods of acrylamide among Japanese.
Methods
To develop database of acrylamide contents in Japan, we used published data mainly from Ministry of Agriculture, Forestry and Fisheries in Japan, and supplemented the data using international databases such as EU database. To estimate intake level, we used dietary record (DR) data previously collected in 3 studies: 1) 28-day DR of 4 JPHC (Japan Public Health Center-based Prospective Cohort Study) areas collected in 1995 (102 males, 113 females), 2) 28-day DR of 5 JPHC areas collected in 1998 (194 males, 196 females); 3) 4-day DR of cancer-screening recipients living in the metropolitan area of Tokyo (69 males, 74 females) in 2007-8. Food items that contribute to the total intake were identified.
Results
Among 1878 food items in Standard Tables of Food Composition in Japan, 299 foods contained acrylamide. Mean acrylamide intake levels were lower in studies in 1990s (varied from 6.0-7.8 microgram/day, depending on areas and sex) than that of more recent study in Tokyo area in 2000s (12.9-14.9 microgram/day). The food items which contributed to acrylamide intake among Japanese included roasted barley tea, coffee, oolong tea, and roasted tea in all areas.
Conclusion
Acrylamide intake levels were slightly lower compared to the previous research done in Western countries. Because home-cooking is more frequent in Japan, further methodological research to include the influence of home-cooking might lead better estimation of acrylamide intake in Japan.
Financial support: Supported by Sagami Women's University Research Grant.

[P051] A qualitative investigation of real-world user experiences with mobile apps for diet self-assessment

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Purpose

Diet self-assessment mobile apps have recently become popular for weight management, but little is known about real-world use of these tools. The purpose of this work was to understand real-world user experiences with diet self-assessment mobile apps.

Methods

Healthy adults (n=16; n=4 males, n=12 females) from Waterloo, Toronto, and Edmonton, Canada areas who had been using publicly available mobile apps for diet self-assessment to manage body weight in a real-world setting were recruited via social media, posters, and word of mouth to complete a one-on-one in-person semi-structured interview. Interviews were audio recorded, transcribed, coded and organized into themes using NVivo 10 (QSR International, Doncaster, Australia).

Results

Participants were enthusiastic about this tool, and used a variety of apps frequently without professional assistance. Some participants entered food intake throughout the day and others entered most data at night; however, others used these apps to pre-plan intake. Users frequently entered food data via favourites, recently entered items, recipes or barcode scanners. Food data entry was sometimes difficult, time consuming and required motivation despite portability. Some users appreciated large food databases; however, large databases were sometimes confusing and overwhelming. Exercise data entry alongside diet data entry sometimes caused confusion about caloric needs. Some participants mentioned apps promoted an unhealthy obsession with calories and data entry. Suggestions were provided for future apps.

Conclusion

This work documents user experiences with diet self-assessment apps. This data provides essential information to develop better apps and supports to enhance this process. Funding: Canadian Foundation for Dietetic Research

[P052] Nutrient validation utilizing self-reported dietary assessment methods in women: Lifestyle validation study

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We evaluated the validity of a 152-item semi-quantitative food frequency questionnaire (SFFQ) by comparing intakes of energy and 44 nutrients without supplements estimated by SFFQ with those measured by two 7-day dietary records (7DDR), and four automated-self-administered 24-hour recalls (ASA24) kept over a one-year period by 632 women. Paper SFFQ1 was collected at baseline; paper SFFQ2 and an online SFFQ (WebFFQ) were collected at the end of each participantâ€™s diet

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data collection year. Compared to 7DDRs, the SFFQ tended to underestimate sodium intake, but overestimated intakes of energy, macronutrients and several nutrients in fruits and vegetables. Spearman correlation coefficients between energy-adjusted intakes from 7DDRs and the SFFQ2 ranged from 0.36 for lauric acid to 0.77 for alcohol (mean r=0.53). Correlations of the SFFQ2 were weaker when compared to ASA24s (mean r =0.43). After adjustment for within-person variation in the comparison method, the correlations of the SFFQ2 were similar with 7DDRs (mean r =0.63) and ASA24s (mean r =0.62). For 22 nutrients that were also included dietary supplements, the correlations between SFFQ2 and 7DDR were generally higher after including supplements in those nutrients (mean r=0.71 vs 0.63 from diet alone). Compared to SFFQ2, similar patterns of correlations with 7DDRs or ASA24s were observed in SFFQ1 and WebFFQ. These data indicate that this SFFQ provides reasonably valid estimates for intakes of a wide variety of dietary variables, and that when used as a comparison method, multiple ASA24s can provide similar estimates of validity as 7DDRs if day-to-day variation is taken into account.

[P053] An innovative methods for dietary assessment in Japan as a platform for the large-scale cohort consortium

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Background

A large scale multi-country cohort consortium may improve statistical power in nutritional epidemiological study, but also may requires comparability of mean intakes between different dietary patterns. Application of detailed- and minimal biased- dietary assessment is desirable into a part of the large-scale epidemiological study to overcome the dilemma of using FFQs. A computerized 24-hour dietary recall system is one of the innovative tools which was demonstrated to provide high-quality dietary intake data with minimal bias. We developed a web-based computerized 24h-DR system for epidemiological studies in Japan.

Method/Results

This system has a built-in representative recipe (a component of ingredients and their weight in the mixed-dishes as a unit) database based on the observational weighed food record. Food ingredients with negligible frequency (appearance of <10% in the recipe) and weight (<1% of each recipe weight) were excluded. Standardized procedures follow: lists of foods consumed the previous day (meals and between-meal eating: yes/no, time, occasion, whom you ate with, and rough menu); detailed descriptions for each food consumed, including amount eaten with scaling factor (10â€"1000% of food portion by 10 point scale) and additions to the food; in this section, the individual ingredients can be edited; checking for forgettable foods such as beverages.

Conclusion

This system may be useful as a platform for the calibrated large-scale cohort consortium with any other Asian cohort that typically consumes mixed-dishes. Acknowledge: This study was supported by

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[P054] VioScreen, a web-based self-administered graphical food frequency questionnaire that uses 1,200 food images to improve dietary assessment

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Dietary assessment is achieved in a variety of ways, from written records and interviews to short questionnaires based on food categories, all with mixed success. To solve this problem, VioScreen was developed using a graphical Food Frequency Questionnaire (FFQ) methodology. VioScreen, a web-based self-administered dietary assessment tool, includes 1,200 food images and portion size options. Results are immediately available for analysis; reports can be produced that includes a food pattern analysis, a list of foods and nutrients consumed, and when used by a counselor generates tailored behavioral feedback. The system nutritional analysis uses the University of Minnesota's NDSR database to ensure up-to-date food and nutrient information. VioScreen was evaluated through an inter-method reliability study with 74 subjects conducted at The Ohio State University by comparing a baseline and 3 month FFQ to six 24-hour recalls using NDSR conducted between the two FFQ's. The inter-method reliability was higher for VioScreen than for the paper FFQ VioScreen was modeled after and higher than reported for many other paper FFQs used in major epidemiological studies. Of the macronutrients, only alcohol values were similar; for all others VioScreen correlations were substantially higher, being at or above 0.80 for most macronutrients (0.90 for alcohol, 0.84 for saturated fat, 0.82 for fat, and 0.79 for carbohydrate) and 0.67 for protein. Participant evaluations of VioScreen were generally very good to excellent on ease of use and capturing foods usually consumed. All subjects rated the questionnaire as easy to use, 93% rated VioScreen as either great or excellent.

[P055] Applied metabolomics approaches to discover food-derived metabolites in human urine

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An understanding of causal relations between diet and health is hindered by the lack of robust biological markers of food exposure. Most dietary biomarkers currently have been identified on the basis of knowledge of food composition by using hypothesis-driven approaches. However, the rapid development of metabolomics resulting from the development of highly sensitive OMICS analytical instruments, metabolite databases and bioinformatics has aided in the identification of novel biomarkers for the intake of a range of foods. We have previously used data-driven approaches

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using non-targeted metabolomic techniques coupled with semi-automated machine learning data mining to understand the limitations in discovering food-derived biomarkers in human urine. Our current study, M.A.I.N (Metabolomics at Aberystwyth, Imperial and Newcastle) builds on these data to discover and validate potential dietary biomarkers in both controlled clinical and epidemiological contexts. Spot urine collections are being investigated with a range of metabolomic techniques, starting with Flow Infusion-High Resolution Fingerprinting (FIE-HRMS) using Orbitrap Mass Spectrometry (MS) coupled with multivariate classification and feature selection. Potential food biomarkers are being elucidated using Ultra High Performance Liquid Chromatography-High Resolution MS (UHPLC-HRMS) and tandem mass spectrometry, without the needed for extensive targeted studies. Pre-processing and multivariate analysis of high mass resolution data (both LC and FIE) is computationally intensive, therefore all metabolomics workflows are fully integrated with a High Performance Computer allowing in-depth modelling, quicker processing times and robust validation. Potential food biomarkers are being validated by quantification (using chemical standards where possible) in biofluid samples obtained from controlled clinical studies and free-living individuals.

[P056] Using image-based technology to assess diet as an environmental exposure

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Members of three Tribal Nations located on the coast of Washington state, USA, may be at risk for neurobehavioral impairment, i.e., amnesic shellfish poisoning, secondary to consumption of razor clams which may be associated with repeated, low level domoic acid (DA) exposure present in these clams following hazardous algal blooms. Ongoing studies with a cohort representing these populations have confirmed a high proportion of clam consumers, DA levels vary by beach, and high consumers of clams tended to have lower memory scores. Two goals of continued monitoring of the cohort include improving the assessment of: 1) clam consumption as a proxy for DA exposure; and 2) functional impact of short-term memory loss. The technology assisted dietary assessment (TADA) mobile food record (mFR) application was adapted for capturing eating occasions including clams. When an image is captured with the mFR running on an iPod touch, the user is prompted to identify the beach of origin of the clams from a list of 18 beaches. An image initiates a 24-hour and 7-day countdown to launch a modified 'Everyday Memory Questionnaire' which runs on the mFR. Since clams are episodically consumed, an ecological momentary assessment prompt is randomly launched in the morning and afternoon. All data are sent via wifi to a central secure server. These enhanced methods for human exposure assessment coupled with outcome assessment will aid in understanding the functional impact of DA related memory disorders. Further, these adaptations to the mFR hold promise for exploring other deleterious food-based environmental exposures.

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Theme 05: Dietary Biomarkers

[P057] Biomarker-predicted sugars intake compared with self-reported measures in US Latinos: Results from the HCHS/SOL SOLNAS Study

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Background

Measurement error in self-reported sugars intake may obscure the association between sugars consumption and health outcomes. The sum of 24-hour urinary sucrose and fructose may serve as a predictive biomarker of total sugars intake.

Methods

The Study of Latinos: Nutrition & Physical Activity Assessment Study (SOLNAS), a nested study within the Hispanic Community Health Study/Study of Latinos (HCHS/SOL), included 477 adults aged 18-74 years. Doubly-labeled water (DLW) and 24-hr urinary sucrose and fructose were used as biomarkers of energy and sugars intake, respectively. Participants' diets were assessed by up to three 24-hr recalls (NDSR Version 2011, University of Minnesota, 88% had two or more recalls). Biomarker and self-reported measures were repeated six months later among participants in a reliability assessment (n=96). We report Spearman correlation coefficients between the biomarker-predicted and self-reported total sugars intake, and reproducibility estimates for these two measurements among a reliability sample of 96 participants.

Results

Average (geometric mean) dietary sugars intake was 167.5 (95% CI: 154.4-181.7) grams/day for the biomarker-predicted and 90.6 (95% CI: 87.6-93.6) grams/day for the self-reported intake. Self-reported sugars intake was not correlated with biomarker-predicted sugars intake (r=-0.06, p=0.20). Among the reliability sample, the reproducibility coefficient was 0.59 for biomarker-predicted and 0.20 for self-reported total sugars intake.

Conclusions

Possible explanations for the lack of association between biomarker-predicted and self-reported sugars intake include measurement error in self-reported sugars intake, high intra-individual variability in sugars intake, and/or urinary sucrose and fructose serving as a poor proxy of total sugars intake in this study population.

[P058] Repeated assessment of dietary data using food frequency questionnaires and 7-day food diaries and plasma phospholipid fatty acids

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Background

Biomarkers, like plasma phospholipid fatty acids, may be used as biochemical indicators of dietary intake as well as to validate dietary assessment methods such as food frequency questionnaires (FFQ) and food diaries. By repeating measurements over a year changes in fatty acid intake and in plasma phospholipid fatty acids may be investigated.

Methods

Women with newly diagnosed breast cancer aged 35-75 years were included in a pilot study of a randomized controlled exercise intervention trial, at the University Hospital of Oslo, Norway. The dietary intake was assessed by two self-reported methods, a FFQ to collect retrospective data on usual diet before surgery (baseline) and after 12 months, and a 7-day pre-coded food diary to prospectively record the diet (baseline, 6 months, 12 months). Plasma phospholipid levels of selected fatty acids were analysed from fasting blood samples (baseline, 6 months, 12 months).

Results

The participating breast cancer patients (n=60) were on average 55 years old and had a mean body mass index of 25 kg/m² at baseline. During one year of follow up (n=51), we observed changes in mean concentration of n-3 and n-6 fatty acids in plasma phospholipids. The changes varied between 0.04 weight percent (wt %) of total fatty acids for DPA (22:5n-3, from 0.99 to 1.01 and then 0.97) and ALA (18:3n-3, from 0.30 to 0.34 and then 0.34) and 0.35 wt % for total n-3 fatty acids (from 10.03 to 9.77 and then 9.68). More results will be presented at the conference.

[P059] Hormonal responses to rehydration drinks during recovery from exercise in the heat

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Fluid and electrolyte balance are regulated by circulating hormones, in particular, anti-diuretic hormone (ADH) and aldosterone. The study aimed to investigate the responses of ADH and aldosterone to ingestion of different rehydration drinks during recovery from exercise in the heat. Nine healthy males aged 24±2 (mean±SD) years, with peak oxygen uptake 55.2±5.9 mL/kg/min completed three experimental trials in a randomised manner ingesting water (WA), a carbohydrate-electrolyte drink (CE; carbohydrate: 62 g/L, sodium: 31±3 mmol/L, potassium: 5.3±0.3 mmol/L) or a novel rehydration solution (NR; carbohydrate: 33 g/L, sodium: 60±3 mmol/L, potassium: 18.2±0.4

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mmol/L). A total fluid volume equivalent to 150% of sweat loss during a 75 min cycle ride at 65% peak oxygen uptake (temperature: 30.4±0.3°C, relative humidity: 76±1%, simulated wind speed: 8.0±0.6 m/s) was ingested during the ride and within the first two hours of 5 h recovery (temperature: 23.0±1.0°C, relative humidity: 67±2%). Blood was collected at baseline, end of cycle ride, 0, 1, 2, 3 and 5 hours of recovery. Plasma ADH and serum aldosterone concentrations were determined using radioimmunoassay. There were small increases in plasma ADH concentrations (p<0.05) after 75 min of cycling coinciding with significant reductions of ~10% in plasma volume (p<0.001) and increases in serum osmolality (p<0.001) on all trials but these changes were not different among trials (p>0.05). Serum aldosterone increased during the cycle ride on all trials (p<0.001) accompanied by increases in serum sodium (p<0.001) and potassium concentrations (p<0.001) but with no differences among trials (p>0.05). All blood markers returned to baseline after 5 h recovery with no differences among trials (p>0.05) except for sodium concentrations which were lower (p<0.05) in WA than CE or NR. Fluid retention was higher in NR (30±15%) than WA (-4±19%; p<0.001) or CE (10±15%; p<0.005). These findings suggest that ADH and aldosterone respond similarly to drinks ingested for rehydration despite greater fluid retention with the novel rehydration solution than water or sports drink.

[P060] Maternal factors influence infant's vitamin D status

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Vitamin D regulates the expression of 3% of genome and has pronounced effects on ante- and postnatal development. At northern latitudes main sources of vitamin D are food and supplements. The objective of this study was to define the main maternal determinants for cord blood 25-OHD concentration. 584 mother-infant pairs were recruited. 25-hydroxyvitamin D (25-OHD) at first trimester in serum and cord blood were analyzed. Maternal diet was obtained with food frequency questionnaire (FFQ). Principal component analysis was used to formulate dietary patterns (DPs). The relationship between different determinants and 25-OHD in cord blood was analyzed with linear regression. Mean (SD) maternal 25-OHD concentration was 89 (25) nmol/l, in cord blood 77 (25) nmol/l. Maternal 25-OHD associated with cord blood 25-OHD (β [95 % CI]) 0.277 [0.258-0.460]. Altogether five maternal DPs were extracted. These DPs were interpreted as 'goodies and snacks', 'health conscious', 'meat', 'sandwich' and 'alcohol'. Of these, health conscious DP (0.103 [95% CI: 0.541-4.518] and sandwich DP (0.086 [0.110-4.093]) were associated with cord blood 25-OHD. In addition, vitamin D intake from supplements was a strong predictor for 25-OHD in cord blood (0.231 [0.221-0.451]). Cord blood 25-OHD concentration is determined by maternal vitamin D status, vitamin D intake from supplements, health conscious DP rich with vegetables, fruits and fish; and sandwich DP rich with bread, cheese, vitamin D fortified dietary fats and milk products. The results emphasize the importance of vitamin D supplementation to pregnant women.

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[P061] Validation of a food frequency questionnaire for the assessment of vitamin D using the method of triads

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The supply of vitamin D-fortified dairy products has increased in Finland. We developed a 98-item food frequency questionnaire (FFQ) with a question on supplementation to assess dietary and supplemental vitamin D intake in a Finnish population during dark season (limited sunlight; 60N). For the first time, the method of triads was applied to assess the validity of the vitamin D-FFQ against 3-day food records (FRs) and biomarker of vitamin D status, serum 25-hydroxyvitamin D (S-25(OH)D) concentrations (n=50). The method has been less used due to lack of reliable biomarkers on many nutrients. We determined the validity coefficients between the true intake and three different assessment methods for intake. We used Spearman correlations to calculate the validity coefficients, and the data was bootstrapped to calculate 95% confidence intervals. The results showed a mean of 1.00 (95% confidence interval 0.59-1.00) and a range from 0.33 to 1.00 for the validity coefficients for the FFQ. The validity coefficient for the FRs was good (0.67; 95%CI 0.10-0.54), but S-25(OH)D did not seem to reflect well the true intake (0.34; 95%CI 0.22-1.00). Also other methods (correlation coefficients, cross-classification, Bland-Altman) showed good validity and reproducibility for the FFQ. As the same question on supplement use was applied in the FRs and the FFQs, the correlating errors between the methods may have caused an overestimated value for the validity coefficient for the FFQ. Based on the results, the method of triads could be recommended to be used in the validation of FFQs when biomarker data is available.

[P062] Plasma Alkylresorcinols, biomarkers of whole grain wheat and rye intake and risk of developing type 2 diabetes in Scandinavian men and women

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Whole-grain (WG) intake has been associated with lower risk of developing type 2 diabetes (T2D) in different populations. Few studies have investigated different cereals separately, and none have assessed WG intake using dietary biomarkers. The aim was therefore to examine the association between plasma alkylresorcinols (AR), biomarkers of WG rye and wheat intake, and risk of developing T2D among Scandinavian women and men. The aim was further to examine the association between the AR C17:0/C21:0, an indicator of relative WG rye over WG wheat intake, and

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T2D. AR and C17:0/C21:0 were determined in fasting plasma samples in 931 cases and 931 matching controls in a case control study nested within the Scandinavian Helga-cohort. Odds ratios (OR) were calculated for AR concentration quartiles and C17:0/C21:0 using conditional logistic regression adjusting for likely confounders. High plasma AR concentrations were not associated with lower odds of developing T2D (OR=1.34, CI: 0.96-1.88) in a multivariable adjusted model. Surprisingly, a higher odds (adjusted OR=4.01, CI: 1.85-8.66) was found among Swedish men when comparing the highest vs. the lowest AR quartile. The C17:0/C21:0 ratio was associated with lower diabetes risk (OR= 0.54, CI: 0.37- 0.78) for the highest vs. lowest quartile in multivariate models. WG wheat and rye intake, measured with a biomarker, appears not be associated with risk of developing T2D in this population, but AR C17:0/C21:0 was inversely associated with T2D risk. This may indicate that a high WG rye intake, at the expense of wheat may be favorable for type 2 diabetes prevention.

[P063] Relationships between fasting serum amylase and ghrelin, peptide YY3-36 levels in healthy men

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Objectives
Appetite and carbohydrate metabolism are important contributors to the development of obesity. Recently, low serum amylase was shown to be associated with obesity and metabolic disorder. We investigated the relationship between amylase and ghrelin, peptide YY (PYY) levels in healthy men.

Methods
Twenty-one men were enrolled in this cross-sectional study; all subjects were asymptomatic with no medical history. Fasting serum amylase, ghrelin, PYY3-36, anthropometry and nutrition intake were measured. Linear regression analyses were performed to examine associations between amylase and ghrelin or PYY3-36.

Results
The mean age and waist circumference (WC) of the subjects were 51.5 ± 10.9 years, and $87.0 ± 4.4$ cm. Amylase was found to be correlated with WC (r = -0.438, P = 0.054), ghrelin (r = 0.533, P = 0.015) and PYY3-36 (r = -0.511, P = 0.021). Multivariate linear regression analysis revealed a negative association between amylase and PYY3-36 ($\hat{I}^2$ = -0.428, P = 0.045), but a non-significantly positive association between amylase and ghrelin ($\hat{I}^2$ = 0.260, P = 0.146).

Conclusions
Amylase levels were found to be associated to ghrelin and PYY3-36 in healthy men. Amylase, ghrelin, and PYY3-36 may play role in obesity, further research is required to identify the underlying mechanism.

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[P064] Does dietary assessment of sodium intake provide a useful assessment of individual 24-hr urinary excretion in a sample of free-living Australian adults?

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Background

Accurate measurement of the dietary intake of sodium is important for populations and individuals to compare to targets and monitor any changes in intakes. Our aim was to compare dietary assessment of sodium intake to the gold standard of 24-hr urinary excretion.

Methods

Daily sodium intake was assessed using dietary methodology (two 24-hr dietary recalls) and urinary excretion (single 24 hr urine collection).

Results

In 194 free-living Australian adults (135 females, 59 males; mean age 57.2 (8.0) SD years), mean dietary sodium intake (113.2 (45.5) mmol/day was 13% lower than the mean daily urinary sodium excretion (129.4 (55.7) mmol/day). The magnitude of the individual difference between sodium intake assessed using dietary and urinary assessment varied depending on the urinary tertile and gender. The level of agreement was poor at the individual level (95% limits of agreement: -126 to 94 mmol). Despite significant correlations between intakes assessed by the two methods (r=0.42, P<0.001), dietary assessment methodology considerably underestimates sodium intake as assessed by urinary excretion. Despite this, more than 70% of participants still had a sodium intake over the World Health Organization recommended level of 90 mmol/day when assessed by dietary methodology.

Conclusion

Dietary assessment, although commonly used to estimate intakes of sodium, underestimates mean sodium intake. 24 hr urinary

[P065] Plasma phospholipid omega-3 and omega-6 fatty acid status and mortality: comparing relative with absolute fatty acid status

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When investigating associations with health, some studies express fatty acid (FA) status in absolute levels whereas others use relative levels. However whether different associations result depending on whether absolute or relative FA levels are used is not known. We aimed to explore this by comparing associations of overall mortality with omega-3 and omega-6 FA status when results were expressed in absolute (μg/mL) and relative levels (% of total FAs) in a prospective community cohort of Australian adults aged 25-79 years. Serum FAs were measured in 1996 and subsequent deaths were monitored until 2014. FA levels were divided into thirds and multivariable analyses were stratified by sex as significant interactions were observed. Of 1009 participants (44% men), 179 (55% men) died in the 17-year follow-up period. Men with highest compared with lowest serum levels of

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eicosapentaenoic acid showed the lowest risk of death using either method: absolute HR 0.52 (95% CI 0.30-0.89; p-trend=0.018); relative HR 0.57 (95% CI 0.34-0.96; p-trend=0.034). Among men, the absolute total omega-6 FA status showed an inverse non-significant association whereas the relative level showed a non-significant positive association. In general, in men and women, directions and magnitude of associations between absolute and relative FA levels and mortality were comparable. Thus, choice of method to express FA status in relation to health outcomes like mortality does not appear to affect overall results. This is reassuring evidence that comparison of relevant studies of FA and health is possible even if different FA measurements have been used.

[P066] Relation between dietary intake and serum prealbumin levels in patients with Alzheimer's disease

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Background

Patients with Alzheimer's disease (AD) show decreased swallowing function, decreased dietary intake, and increased risk for malnutrition as the disease progresses. To determine whether the amount of decrease in weekly dietary intake results in decrease in serum prealbumin (PA) level in long-term admitted AD patients.

Methods

Seventy-three AD patients who consume only food provided in a Japanese long-term care hospital were included in this study. We investigated relation of eating rate and energy and protein intake, which were calculated from dietary intake determined by actual measured values in an eating survey conducted on 7 consecutive days in April 2013 and serum PA level measured at the end of the dietary intake survey.

Results

The group of patients with energy intake was less than 25 kcal/kg/day had a significantly lower serum PA levels as compared with the group with energy intake of 25 to 30 kcal/kg/day and those with 30 kcal/kg/day or more (P=0.010, P=0.003, respectively). The group of patients with protein intake of less than 1.0 g/kg/day had a significantly lower serum PA levels as compared with those with protein intake of 1.0 to 1.2 g/kg/day and those with 1.2gl/kg/day or more (P=0.008 P=0.014, respectively). There was no significant correlation between eating rate and serum PA levels (P=0.191).

Conclusion

The study showed that serum PA level was significantly low among AD patients, when energy intake from food was decreased to less than 25 kcal/kg/day or when protein intake from food was decreased to less than 1.0 g/kg/day.

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[P067] A clinical assessment tool to identify young women at increased risk of iron deficiency with or without anaemia

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Background
Young women of reproductive age have higher iron requirements due to menstruation, and often restrict energy and iron rich foods due to weight concerns. They are therefore at a greater risk of iron deficiency (ID) and iron deficiency anaemia (IDA), both of which often go undiagnosed.

Objectives
A non-invasive method of assessing risk of ID in young women would be a valuable clinical tool. This study aimed to develop a short, inexpensive clinical assessment to identify young women at increased risk of ID/IDA. Design: As part of a large (n=300) cross-sectional study of young (18-35y), healthy weight (HW) (BMI 18.5-25) and obese (OB) (BMI≥30) women designed to investigate the relationship between iron status and cognitive function, a food frequency questionnaire (FFQ) (DQESv2 Cancer Council) to assess iron intake and a blood draw to assess iron status were undertaken.

Outcomes
Thus far, a total of 262 young women (HW: n=147; OB: n=115) completed the FFQ and blood draw. Of these women, 15% had ID and 6.6% had IDA. The mean intake of iron was significantly lower in those with ID/IDA (10.8±6.0 mg/day) versus those with normal iron status (13.7±7.1 mg/day) (p=0.007). With regards to intakes measured by FFQ, 32% with ID and 35% with IDA had an iron intake below the Estimated Average Requirement (EAR). The HW and OB groups had similar proportions of women with ID/IDA. Modelling to assess the potential contribution of heavy menstrual loss for improving the capacity of FFQ data to inform risk of ID/IDA in young women will be presented.

[P068] 24-hour urinary iodine concentration and 24hr urinary iodine excretion in a sample of Australian primary school children

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Background
The most common method for determining a population's iodine status is median Urinary Iodine

Concentration (UIC, mcg/L) determined in spot urine samples. Urinary Iodine Excretion (UIE, mcg/day) derived from 24 hr urine collections is likely to provide a more accurate measure of iodine status as it captures variations in excretion over the whole day, however few surveys have utilised 24hr urine collections to determine UIC.

Aim

To assess the UIC (mcg/L) and UIE (mcg/day) in 24hr urine collections obtained from a sample of Victorian primary schoolchildren and to determine whether the sample is iodine sufficient, when compared with WHO guidelines.

Methods

As part of a cross-sectional study, 24-hour urine samples were collected from primary school children aged 5-13 years from 42 schools across Victoria.

Results

The sample included 650 children, 359 boys and 291 girls (mean (SD) age 9.20(1.87), years). The mean (SD) urine volume was 873(424) mL. The mean (SD) UIE and median (IQR) UIC were 112 (59) mcg/day 124 (82,172) mcg/L respectively. The median UIC of the children falls between 100-199 mcg/L, indicating adequate iodine status. Using UIC 36% of participants were classified as having a UIC less than 100mcg/L with only 8% having a UIC less than 50mcg/L.

Conclusion

In comparison with the WHO guidelines for assessing the iodine status of a population, this group of Victorian school children is iodine sufficient.

[P069] Biomarker-calibrated intake of total sugars and risk of coronary heart disease or stroke in the Women's Health Initiative Observational Study

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Background

The inconsistency of evidence from observational studies linking total or added sugars consumption to cardiovascular disease (CVD) risk may be due to measurement error (ME), inherent to dietary intake assessment via self-report.

Methods

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In a cohort of 67,355 postmenopausal women aged 50-79 who participated in the Women's Health Initiative Observational Study (WHI-OS), we investigated the relation between coronary heart disease (CHD) and stroke risk, and food frequency questionnaire-measured intake of total sugars corrected for ME using biomarker-based calibration equations for total sugars and energy intake. We report hazard ratios (HRs) of CHD or stroke risk for the 5th (highest) vs. 1st (lowest) quintile of calibrated total sugars (g/1000 kcal) adjusted for age, calibrated total energy intake, body mass index, race, marital status, education, smoking, hormone replacement therapy use, history of hypertension, alcohol intake, history of treated diabetes, aspirin use, hypercholesterolemia, statin use, family history of CVD, and calibrated physical activity.

Results

After up to 16 years of follow-up, we identified 4,442 cases of CHD, 1,430 cases of ischemic and 325 cases of hemorrhagic stroke. HR of CHD for the 5th vs. 1st quintile of calibrated total sugars intake was 0.85 (95% CI: 0.71, 1.02; Ptrend=0.349). We found no association between calibrated sugars intake and risk of ischemic (HRQ5 vs. Q1=0.89; 95% CI: 0.64, 1.23; Ptrend=0.374) or hemorrhagic stroke (1.40; 0.64, 3.07; 0.632).

Conclusion

In this preliminary analysis of WHI-OS, using biomarker-based calibrated intake estimates, we found no association between total sugars intake and risk of CHD or stroke.

[P071] Validation of nutrient intakes assessed by questionnaire, 24-hour recalls, and diet records compared with urinary and plasma biomarkers: Findings for Women

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We evaluated the performance of a semi-quantitative food frequency questionnaire (SFFQ), web-based 24-hour recalls (ASA24s), and 7-day dietary records (7DDRs) compared to biomarkers among 627 women. Two paper SFFQs (SFFQ1 at the beginning, SFFQ2 at one year later), four ASA24s, two 7DDRs, four 24-hour urine samples, one doubly-labeled water (repeated among 76 participants), and two fasting blood samples were collected over a one-year period. For protein, sodium and potassium density, most specific fatty acids, carotenoids, α-tocopherol and folate, SFFQ2 had modest-to-strong correlations with biomarkers (energy-adjusted and de-attenuated Spearman r ranged from 0.25 for linoleic acid to 0.65 for alpha-tocopherol with supplements). In general, relative to biomarkers, averaged ASA24s had lower validity than SFFQ2; SFFQ2 had slightly lower validity, while the averaged SFFQs had similar validity with one 7DDR; and the averaged 7DDRs had the highest validity (e.g. r between beta-carotene intake and plasma levels is 0.47 for SFFQ2, 0.50 for averaged SFFQs, 0.24 for one ASA24, 0.36 for averaged ASA24s, 0.50 for one 7DDR, and 0.58 for averaged 7DDRs). Lower correlations with biomarkers were observed for nutrient intakes that were not well reflected

by biomarkers, such as retinol. Further adjustment for errors in the biomarkers using the method of triads gave substantially increased estimated correlations between SFFQ2 and true intake (e.g., the validity coefficient of SFFQ2 is 0.77 for beta-carotene). These data indicate that the SFFQ2 provides reasonably valid measurements for most nutrients compared to nutrient biomarkers among women. The ASA24 needs further evaluation for use in large population studies.

Theme 06: Dietary Patterns

[P072] Influence of the socioeconomic environment on the evolution of dietary patterns over time: A latent transition analysis

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Background
Socioeconomic factors are associated with dietary behavior, but little is known on how they influence its evolution over time.

Methods
We derived 4 mutually exclusive dietary patterns from a latent transition analysis and studied their evolutions over a 12-year period (1993 to 2005) among 58193 women from the E3N cohort. We also determined 3 socioeconomic patterns from a latent class analysis.

Results
The 'Mediterranean Pattern' (27%) was characterized by high intakes of fruits/vegetables, fish and olive oil; the 'Western Pattern' (25%) by frequent snackings, large consumption of processed meat, sandwiches; the 'Low Pattern' (20%) by low food diversity/energy intakes, fairly high consumption of healthy products; and the 'Average Pattern'(28%) by average energy intake/food diversity, low consumption of fruits/vegetables. Women from the socioeconomic 'Rural Pattern'(28%-Living/working in small cities, with parents working more frequently as farmers) were more likely to adopt or stay adherent to the 'Western pattern' than women of the other profiles (27.0% vs. 22.2%, p<0.001). As compared to women in the other groups, women from the 'Family Pattern' (30%-Less educated and less frequently active, with three or more children) moved more frequently or stayed to the 'Low dietary pattern' (29.7% vs.22.0%, p<0.001), while women from the 'Urban Pattern'(42%-High education level, living/ working in large cities, more frequently single and smokers) were more likely to adopt or stay in the 'Mediterranean Pattern' (28.2% vs. 26.4%, p<0.001).

Conclusion
Socioeconomic environment may, even in a homogeneous population, be a key determinant of the evolution of dietary patterns. Nutritional recommendations should be targeted according to socioeconomic profiles.

[P073] Prospective changes in diet quality in mid-age Australian women and its association with weight change during nine years of follow-up

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Background
Few epidemiological studies have examined longitudinal changes in diet quality in relation to weight change in mid-age women.

Aim
To examine whether change in diet quality, as measured by the Australian Recommended Food Score (ARFS), is associated with change in weight status in mid-age women (52± 2 years) from the Australian Longitudinal Study of Women's Health over nine years.

Methods
ARFS scores were derived from a response to a Food Frequency Questionnaire in 2001 and 2010, with weight self-reported at both times and changes calculated. ARFS contains seven subscales and scores from zero to 74. Women were eligible if they reported no medical conditions at baseline, (eg. diabetes, heart disease), and had plausible Total Energy Intakes. Multivariate linear regressions were used to evaluate the relationship between change in diet quality, by tertiles, and change in weight.

Results
Participants (n=2381) in the top ARFS tertile of change improved their diet quality (7±4 points), while those in the lowest and middle tertiles had worse scores respectively (-9 ±5 points) and (-1±2 points). Average weight gain was 2.25 ± 7.17kg, with the top tertile of ARFS change having significantly lower weight gain compared with the lowest tertile ; Î² = -1.2 kg (95% CI: -2.31, -0.112; p=0.031).

Conclusion
Mid-age women who improved their diet quality over nine years gained the least weight. Targeting improvements in diet quality may be an important strategy to reduce weight gain at this life stage.

[P074] Using two different approaches to assess dietary pattern: Hypothesis-driven and data-driven analysis

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Background
To capture the diet complexity, two main approaches have been widely used to assess dietary patterns: data-driven and hypothesis-driven analysis.

Objectives
To compare the results of two statistical methods applied to assess the dietary patterns, based on

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the usual intake. Methods: Data of adolescents from a cross-sectional survey were analyzed. To estimate the usual intake, one to five food record (24HR) and a FFQ were collected. In the hypothesis-drive analysis, the National Cancer Institute method estimated the Brazilian Healthy Eating Index Revised (BHEI-R) components distribution. In data-driven analysis, the Multiple Source Method used, beside the 24HR data, a FFQ as covariate information to improve the model of consumption probability and intake amount.

Results

In data-driven analysis, BHEI-R mean score (47.1points), indicating lower consumption of Whole grains (0.3), Total vegetables (1.0), Total fruit (1.3) and Whole fruit (0.4); and higher intake Sodium (2.2), Saturated fat (5.8) and SoFAAS (4.5), comprising calories from solid fat, alcohol and added sugar. Hypothesis-drive approach identified two dietary patterns, explaining 17.1% of variation intake: Traditional diet (characterized by beans, rice, coffee/tea, sugar, butter/margarine, beef and cookies) and; Dual diet (chocolate powder, vegetables, whole milk, salad-dressing, cheese, processed meats/cold cuts, breads/toasts/crackers, candies, juices and white meat.

Conclusion

Both approaches provided consistent and complementary information about adolescent eating behavior. Their poor dietary habit was characterized by low fiber intake (especially from fruits and whole grains) and high intake of sodium, fats and sugars. Thus, these results can be used to develop public health programs, preventing and treating diet-related chronic diseases throughout the life course.

[P075] Population's distribution scores of Brazilian healthy eating index-revised (BHEI-R) components estimated by usual dietary intake among elderly of Sao Paulo Brazil

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Introduction

Understanding the dietary patterns among elderly is useful to drive public health and nutrition programs in order to prevent diet-diseases.

Objective

To assess the usual dietary quality among elderly population living in with city with high Human Development Index.

Methods

Population based cross-sectional design in 295 community-dwelling older individuals at Sao Caetano do Sul. Dietary intake measured by R24h was used to calculate the BHEI-R that consisted of 12 components based on Brazilian Dietary Guidelines. A repeated administration of the R24h (31%) allowed removing the within-person variation intake. Also, the FFQ was used as covariate information to improve the modeling of consumption probability and intake amount. The MSM method was applied to assess usual intake of each BHEI-R component score. Associated variables were gender and family chef education level (p<0.05).

Results

The mean BHEI-R score was 71.9 (range from 33.2 to 89.6), with no difference between female

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(72.1) and male (70.1) (p>0.05). The components mean that total scores range from 0-5 were: total fruit (4.5±1.4), whole fruit (4.2±1.6); total grains (4.6±0.6), whole grains (1.4±1.8). The components that range from 0-10 were: milk (7.6±2.4), total vegetable (4.8±0.9), dark-green and orange vegetables (4.2±1.8), meat (8.8±2.1), sodium (2.8±2.5), saturated fat (7.2±2.6), oils (9.7±1.4).

Conclusion

Beside the higher consumption of fruits, vegetable, milk and meat, the dietary quality among the elderly population comprised higher intake of sodium, fats and sugar. The present results can be used to the development of public health programs that aim to reduce the risk of chronic diseases.

[P077] Weaning diets in the first year of life: An Asian perspective

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Background

Little is known about the feeding patterns of Asian infants in the first year of life and their associations with socio-demographic factors and body mass indices (BMIs) in early life. This was examined in the Singapore GUSTO (Growing Up in Singapore Towards healthy Outcomes) mother-offspring cohort.

Methods

Cross-sectional dietary patterns were derived by factor analysis using 24-hour recalls conducted at 6, 9 and 12 months of age. Associations with socio-demographic variables and anthropometric measurements of infants were assessed using general linear models.

Results

In n = 486 infants, four dietary patterns were identified at 6 and 9 months: 'predominantly breastmilk' characterized by mainly breastmilk and less formula milk; 'guidelines' characterized by rice porridge, vegetables and low-fat fish and meat; 'noodles and seafood'; and 'convenience foods' characterized by bread, biscuits and cakes. The latter two groups are similar to adult dietary patterns. At 12 months, an additional 'pulses and grains'pattern emerged. Chinese infants scored higher on 'guidelines' and 'noodles and seafood' patterns, while Indian infants scored higher on the 'convenience foods' and 'pulses and grains' patterns. Across all ethnicities, higher maternal education, higher household income and maternal unemployment were associated with the predominantly breastmilk pattern at all ages (p<0.05). This pattern was associated with lower BMI z-score at 12 months (p=0.03) but not at 24 and 36 months.

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Conclusion

Dietary patterns in early life are largely influenced by maternal socio-demographic and cultural factors. Diets with predominantly breastmilk are associated with lower infant BMI at 12 months of age.

[P078] Adaptation of the Australian Recommended Food Score Diet Quality Index to a web-based tool with real-time feedback: the healthy eating quiz

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Background

Diet quality tools are used in epidemiology to provide an overall measure of nutritional quality and food variety, using a single continuous variable. Higher diet quality is associated with lower risk of all-cause and disease specific morbidity and mortality. The Australian Recommended Food Score (ARFS) is a validated diet quality index. The aim is to describe adaptation into the web-based Healthy Eating Quiz (HEQ) format.

Method

The 70-question ARFS was derived from a validated food frequency questionnaire with eight food group sub-scales (vegetables, fruit, meat/flesh foods, non-meat/flesh protein foods, breads/cereals, dairy foods, water and spreads/sauces). Total score ranges from 0 to 73.

Results

ARFS was adapted into the HEQ (www.healthyeatingquiz.com.au) using an iterative process between the programmer and researchers. Individuals register a profile including demographics and consent. HEQ takes 5 minutes to complete. User feedback from version 1 was incorporated and version 2 released in February 2013. The final format presents questions across eight screens and takes 5-minutes to complete, with system-generated real-time feedback and advice in a personalised report that can be printed or emailed. Version 2 provides extended feedback on important of foods in each why subscale, with drop-down menus added to reveal, How to improve your score and Did you know. HEQ is linked to websites (e.g. Back to Basics, Healthy Dads Healthy Kids), and via media articles on nutrition. Since February 2012 >70000 people have completed it.

Conclusions

The HEQ has broad reach and appeal as a novel tool to evaluate diet quality.

[P079] Characteristics of coffee consumers and non-consumers from the Federal District, Brazil

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Coffee is a source of antioxidants, licit stimulants, fluid and nutrients. The present study aimed to describe demographics of consumers and non-consumers, the reasons for consumption and non-consumption, methods of preparation and foods associated with coffee intake among adults from the Federal District (FD), Brazil. This is a cross-sectional population-based survey. The sample was randomly drawn from mobile and residential telephone (n=1,368). We collected information on detailed coffee intake, socio-demographic, physical activity, cigarette smoking, alcohol intake, self-reported weight and height. Our sampling adequately represents the adult coffee consumption in the FD, according to a comparison performed with the prevalence of coffee consumption obtained by the 2008-2009 Household Budget Survey in the FD. In regard to the personal characteristics, individuals were more likely to drink coffee at an older age (68%) and with higher body mass index (58%). The most cited reason for consuming coffee was the 'personal pleasure' (48%), followed by 'habit/tradition' (32%) of consuming coffee. Among non-consumers of this beverage, the main reason was not liking the taste and / or aroma of coffee (67%). The method of coffee preparation used was by infusion (86%) and sugar was the main sweetener (83%). The majority of consumers reported consuming coffee with certain foods, and the most common of these are bakery products (47%). In conclusion the popularity of this beverage can be attributed to its taste, personal pleasure and habit, and consumption is more likely to occur with the advance in age and when any type of food is consumed.

[P080] Application of the Food Standard Agency Nutrient Profiling System: consistency with nutritional recommendations in French children

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Introduction
Preventing and reducing children obesity is a priority in developed countries. In France, the French National Nutrition and Health Program (PNNS) is a nutrition policy including quantified priority nutritional goals. Nutritional profiling systems can be used to help children choosing foods and reaching healthy diet.

Objectives
We assessed whether the use of the nutrient profiling system from the U.K. Food Standard Agency (FSA) applied to individual diets is consistent with the 9 French nutritional recommendations.

Method
The ENNS-children survey was a national cross-sectional multistage sampling representative survey in 3-17 year-old children living in mainland France (N=1,675). Food intake was estimated using three 24h recalls. Each food was computed for its FSA score. Aggregated score was computed at the individual level using arithmetic energy-weighted means. Percentage of children in accordance with French nutritional recommendations was described by tertiles of individual diet FSA score. Sampling scheme and weighting were taken into account for descriptions and comparisons across tertiles.

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Results

In the first tertile (less favorable), 6.1% of 3-10 y and 7.8% of 11-17 y consumed at least 5 servings per day of fruit and vegetables and 18.5% and 26.5% in the highest tertile, respectively. For 'bread, cereals, potatoes and legumes', percentage of children who consumed 3 to 6 servings a day were 12.9% (3-10 y) and 20.3% (11-17 y) in the first tertile, and 27.8% (3-10 y) and 36.5% (11-17 y) in the third tertile. Sweetened beverage consumption decreased when tertiles increased: -105 ml/d in 3-10y and 208 ml/d in 11-17 y. Higher intakes of calcium were observed with increasing FSA tertiles: +169 mg/d in 3-10y and +104 mg/d in 11-17 y. All differences were statistically significant (P<0.0001). **Conclusion**

Our results show that diet quality assessed using the FSA nutrient profiling system applied to individual diet was in accordance with the French nutritional recommendations in children.

[P081] Application of the Food Standard Agency Nutrient Profiling System: consistency with nutritional recommendations in French adults

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Introduction
Nutritional profiling systems can be used to help the consumers choosing a healthy diet in accordance with the dietary guidelines.

Objectives
We assessed whether the nutrient profiling system from the U.K. Food Standard Agency (FSA) applied to individual diets is consistent with the French nutritional recommendations.

Methods
The ENNS survey was a national cross-sectional multistage sampling representative survey in 18-74 year-old adults living in France. Each food was computed for its FSA score. Aggregated score was computed at the individual level. Percentage of adults in accordance with French nutritional recommendations was described by quartiles of individual diet FSA score.

Results
In the less favorable FSA score quartile, 11.4 % of men and 16.4 % of women ate at least five servings of fruits and vegetables a day and 67.4% and 67.2% in the highest quartile, respectively. Moreover 18.3% of men and 24.4% of women consumed seafood at least twice per week in the lowest quartile whereas they were 34.6% of men and 45.1% of women in the highest quartile. In the less favorable FSA score quartile, 10.5% of men and 12.5% of women had a ratio vegetable oil/total added fat>0.5 vs respectively 31.0% and 36.3% in the highest quartile. Adults with more favorable FSA score had a higher adherence to global nutritional recommendations measured with the PNNS-Global Score.

Conclusion
Our results show that diet quality assessed using the FSA nutrient profiling system applied to individual diet was in accordance with the French nutritional recommendations in adults.

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[P082] Application of the Food Standard Agency Nutrient Profiling System: consistency with nutritional recommendations in French children

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Introduction
In France, the French National Nutrition and Health Program (PNNS) is a nutrition policy including quantified nutritional goals. Nutritional profiling systems can be used to help children choosing foods and reaching healthy diet.

Objectives
We assessed whether the use of the nutrient profiling system from the U.K. Food Standard Agency (FSA) applied to individual diets is consistent with the French nutritional recommendations.

Method
The ENNS-children survey was a national cross-sectional multistage sampling representative survey in 3-17 year-old children living in France (N=1,675). Each food was computed for its FSA score. Aggregated score was computed at the individual level. Percentage of children in accordance with French nutritional recommendations was described by tertiles of individual diet FSA score.

Results
In the first tertile (less favorable), 6.1% of 3-10 y and 7.8% of 11-17 y consumed at least 5 servings per day of fruit and vegetables and 18.5% and 26.5% in the highest tertile, respectively. For bread, cereals, potatoes and legumes, percentage of children who consumed 3 to 6 servings a day were 12.9% (3-10 y) and 20.3% (11-17 y) in the first tertile, and 27.8% and 36.5%, respectively in the third tertile. Sweetened beverage consumption decreased when tertiles increased: -105 ml/d in 3-10 y and 208 ml/d in 11-17 y. Higher intakes of calcium were observed with increasing FSA tertiles: +169 mg/d in 3-10 y and +104 mg/d in 11-17 y.

Conclusion
Our results show that diet quality assessed using the FSA nutrient profiling system applied to individual diet was in accordance with the French nutritional recommendations in children.

[P083] Dietary patterns and risk of cardiometabolic diseese in the Swedish Malmo Diet and Cancer cohort

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Objective

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To examine if specific dietary patterns associate with weight gain, incidence of type-2-diabetes (T2D) or cardiovascular disease (CVD) in a Swedish population.

Design

We included 12,463 women and 8,037 men from the Malmo Diet and Cancer (MDC) cohort, aged 45-74 years, free of diabetes and CVD at baseline (1991-96) and who did not report previous dietary changes. Dietary data were collected using a modified diet-history method. During 14 years follow-up 2,001 T2D cases and 2,707 CVD cases were identified. Data on weight change after 17 years were available in 2,630 individuals. Principal component analysis was used to reduce 33 energy-adjusted food groups into factors representing dietary patterns, separately in women and men. The factors were categorized into quintiles.

Results

We identified six similar dietary patterns in women and men. The first pattern, explaining 7% of the variance in the data in both genders, was mainly characterized by high intake of fiber-rich bread, but also with high intakes of breakfast cereals, fruits, vegetables, fish and fermented low-fat milk. This pattern associated with 22% lower T2D incidence (P-trend=0.01 in both women and men) and fewer coronary events (P-trend=0.03, 0.07), and in men also with less pronounced weight gain (P-trend=0.047) and lower incidence of ischemic stroke (P-trend=0.001). The other five patterns did not show significant associations with cardiometabolic diseases.

Conclusion

Our main finding was that in the MDC cohort a data driven dietary pattern indicating health conscious food choices was associated with lower risk of cardiometabolic diseases in both women and men.

[P084] The ability of a beverage intake questionnaire (BEVQ-15) to rapidly assess beverage consumption patterns via the Healthy Beverage Index (HBI) in a sample of Virginia adults

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Introduction

The Healthy Beverage Index (HBI), an emerging approach to assessing beverage pattern quality, has been associated with reduced cardio-metabolic risk using a cross-sectional sample of NHANES dietary recall data. Similar to the Healthy Eating Index (HEI), the HBI is comprised of ten components, including individual beverage categories, total beverage energy, and fluid requirements. The total score ranges 0-100, with higher scores indicating greater adherence to proposed beverage recommendations. However, as with the HEI, assessing intake patterns is resource-intensive due to the extensive dietary data needed. The BEVQ-15, a beverage intake questionnaire, may be utilized to rapidly measure HBI scores.

Objective

To determine the utility of the BEVQ-15 (three-four minute administration time) to generate HBI scores as compared to three 24-hour dietary recall (thirty-sixty minutes) derived HBI scores.

Methods

Adult participants completed three 24-hour dietary recalls and the BEVQ-15. HBI scores were

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generated by both methods, and compared via paired-samples t-tests and correlations.

Results

Among 279 adults (mean age=41.5±13.3 years), total mean HBI scores were 57.01±11.10 for the BEVQ-15 and 61.55±14.01 for the recalls (mean difference=4.55±13.33; r=0.46; both p<0.0001). Although the majority of individual HBI components were significantly different between the BEVQ-15 and recalls, the differences were minimal, ranging 0.25-1.99. BEVQ-15 and recall component scores demonstrated significant correlations ranging 0.27-0.66 (p<0.0001), with the exception of 100% fruit juice (r=0.13; p=0.03).

Conclusion

The BEVQ-15 can be used to rapidly generate HBI scores for large populations. Future work should prospectively assess if changes in HBI are associated with improvements in health outcomes.

[P086] Evaluating the discrimination of nutrient thresholds in the 2014 Health Canada Surveillance Tool Tier System

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In 2014, Health Canada released the first Canadian nutrient profiling Tier System to assess the adherence of dietary intakes with Canada's Food Guide. This System classifies foods into one of four Tiers with upper and lower thresholds for sodium, fat, saturated fat and sugar. This study presents the first application of Tier system to assess (i) the dietary patterns of Canadians, and (ii) the applicability and relevance of this system as a measure of diet quality among 33,661 Canadians2 years in the Canadian Community Health Survey 2.2. Within the fruit and vegetables group, Tiers 1-4 foods comprised 76%,15%,6%, and 3% of foods, respectively, with majority of potatoes being from Tier 4. For grain products, meat and alternatives, and milk and alternatives, 66%, 76% and 70% of foods were from Tiers 2-3. Individuals whose diets included more Tiers 1-3 foods, were more likely to be older, female and non-smoker (p<0.05). In addition, moving from the 1st to the 4th quartile of unhealthy Tier 4 and 'other foods', there was a trend towards increasing calories (1876kcal vs. 2290kcal) and 'harmful' nutrients (e.g., sodium) as well as decreasing 'beneficialnutrients'. Compliance to the Tier System was not associated with obesity risk (p>0.05). Future nutrient profiling systems need to incorporate both 'positive' and 'negative' nutrients and an overall score. In addition, a wider range of nutrient thresholds should be considered for the Tier system to help capture product differences, prevent categorization of most foods as Tiers 2-3 and provide incentives for reformulation.

[P087] Main meal vegetable consumption is associated with favorable nutrient intake and healthy body measures in Australian adults: Results from Australian Health Survey Nutrition And Physical Activity 2011-12

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This study examined the intake of vegetables and vegetable dishes in Australian adults and associations with nutrient intake and body measures. The study used a 1-day dietary recall from the Australian Health Survey Nutrition and Physical Activity 2011-12 for adults ages 19+ (n=9341). Mean daily vegetable intake was 172 g. However, vegetables were the most frequently consumed foods during main meals such as lunch and dinner. Most commonly consumed vegetables were potatoes, vegetable salads, tomatoes, leaf vegetables and other fruiting vegetables. The study population was classified as either a vegetable eater (n=6858, 73.5%) or a non-vegetable eater (n=2483, 26.5%) at main meals. Adults who reported eating any amount of vegetables/vegetable dishes during meals were classified as vegetable eaters. Adults who ate vegetables had significantly higher intake of Dietary Fiber, Vitamin A, C, E, B3, B6, Folate, Iron, Magnesium, Potassium and Zinc and significantly lower intake of Carbohydrates, Sugar, Saturated Fat and Sodium compared to non-vegetable eaters after adjusting for total calorie intake (<0.05). Among vegetable eaters, vegetables were key contributors to daily nutrient intake - 24% of Dietary Fiber, 41% of Vitamin A, 32% of Vitamin C, and 21% of Potassium. After adjusting for covariates, vegetable eaters were less likely to be overweight or obese (<0.0001). These data suggest that as part of an overall healthy diet, the vegetable intake at main eating occasions, may help adults manage their body weight and contribute to improved intake of essential nutrients.

[P088] Dietary intake of fish, n-3 polyunsaturated fatty acids, and n-6 polyunsaturated fatty acids and breast cancer risk: the Japan Public Health Center-based (JPHC) Prospective Study

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While physical activity has generally been accepted to play an etiological role in breast cancer, studies on the association between dietary patters and breast cancer have been limited and inconsistent. This is the first study to analyze the association between fish, n-3 polyunsaturated fatty acids (PUFA), and n-6 PUFA intake and breast cancer with estrogen (ER) and progesterone (PR) sub-analyses on the Japanese population characterized by high PUFA intake. We assessed dietary intake through a validated self-administered food frequency questionnaire which inquired about 138 food and beverage items. We used multivariate Cox proportional hazards regression models to estimate the hazard ratios for the association between intake of fish, n-3 PUFA (including eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), docosapentaenoic acid (DPA), alpha linolenic acid (ALA)), and n-6 PUFA and breast cancer with sub-analyses on ER PR status. We investigated 38,234 Japanese women aged 45-74 years from the JPHC study; during 14.1 years of follow-up time, 556 breast cancer cases were newly diagnosed. Breast cancer risk was not associated with the intake of

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total fish, n-3, PUFA, and n-6 PUFA when analyzed in totality. However, dietary intake of n-6 PUFA was positively associated with the development of ER+PR+ tumors [HR Q4 vs Q1= 3.24 (95% CI: 1.45-7.26; p(trend) =0.01)], and intake of EPA was associated with decreased breast cancer risk for ER+PR+ tumors [HR Q2 vs Q1= 0.47 (95% CI: 0.25-0.90; p(trend) =0.14)]. This study highlights that changes in dietary intake of PUFAs may have the potential to alter breast cancer risk.

[P089] Patterns of meal timing in Australian adults: a latent class analysis approach

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Background

There is some evidence that large energy intakes (EI) towards the end of the day are associated with adverse health outcomes, however studies of meal timing across the day are rare. This study examines the meal timing patterns of Australian adults using a latent class analysis (LCA) approach.

Methods

This cross-sectional study analysed dietary data (n=2402 men and n=2840 women, ≥19 years) from two 24-hour recalls collected during the 2011-12 Australian National Nutrition and Physical Activity Survey. LCA was performed to identify distinct meal timing patterns based on whether or not an eating occasion [EO] occurred within each hour of the day. F-tests assessed differences in sociodemographics, total EI and meal patterns (e.g. meal, snack, total EO frequency) between latent classes.

Results

Three meal timing patterns, labelled 'Conventional' (men: 43%, women: 41%) 'Later lunch' (men: 34%, women: 34%) and 'Grazing' (men: 23%, women: 25%) were identified. Men and women with a 'Grazing' pattern were significantly younger (P<0.001), had a higher EO frequency (P<0.01) and snack frequency (P<0.001) than the 'Conventional' and 'Later lunch' patterns. The 'Grazing' pattern was also characterised by consuming a higher proportion of total EI from snacks but a lower proportion of total EI from meals (P<0.001).

Conclusions

This study identified three distinct meal timing patterns in adults that varied by age, EO frequency, snack frequency and EI pattern. LCA is a useful approach to capture differences in meal timing patterns across the day. Future research should examine associations between meal timing patterns and health outcomes.

[P090] Does the choice of meal definition influence how meal patterns are characterised?

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Background

Previous research suggests consensus is needed on a standard approach for defining meals. This

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study examined the influence of differing meal definitions on the characterisation of meal patterns.

Methods

Dietary data from two 24-hour recalls collected during the 2011-12 Australian Nutrition and Physical Activity Survey (n=5242 adults, â‰¥≥19 years) were analysed. Eight meal definitions were applied. Frequency of, and energy intake (EI) from, meals, snacks and all eating occasions (EOs), were estimated. Differences were tested using F-tests, stratified by sex and age group. Agreement of meal and snack frequencies between definitions were assessed using intra-class correlation coefficients (ICC). For each meal definition, the proportion of variance in total EI (kJ) and amount of food/beverage intake (g) predicted by frequency of EOs and meals and snacks was estimated using linear regression.

Results

Among both sexes and across all age groups, meal frequency differed between the participant-identified and time-of-day definitions (mean difference range=0.1-0.3; p<0.001). There were significant differences between EO frequency across the six neutral definitions (p<0.001). There was good agreement for snack frequency (men: ICC=0.89; women: ICC=0.87) but not meal frequency (men: ICC=0.38; women: ICC=0.36) between the participant-identified and time-of-day definitions. The neutral definition (15-minute time interval plus energy criterion) best predicted variance in total EI (R^2 range=19.3-27.8). Results were less consistent for total amount of food/beverage intake with multiple definitions performing well.

Conclusions

Different approaches to defining meals affect how meal patterns are characterised. Future research should examine how different meal definitions impact on associations with health outcomes.

[P091] Dietary patterns of a small group of young Australian men

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This study aimed to examine the dietary patterns of a small group of young Australian men.

Methods

Thirty five young men aged 18 to 24 years completed a four-day food record using estimated household measurements. All food and drink items consumed by each participant were allocated to food groups, the amounts consumed were converted to serving sizes and a four-day average was estimated and compared to the Australian Dietary Guidelines.

Results

Almost 60% of the participants consumed the minimal number of serves of cereals and the average number of serves of cereals consumed (6.6) by the participants was above the recommended number (6). In contrast, the mean intake of dairy (2.4 vs. 2.5), meat (2.6 vs. 3), fruit (1.6 vs. 2) and vegetables (2.6 vs. 5.5) was below the recommended number of serves. Less than 10%, 30%, 30% and 40% of the participants consumed the recommended number of servings of vegetable, fruit, meat and dairy, respectively. Processed foods, sugary drinks and alcohol were consumed by 100%,

94.3% and 45.7% of the participants and the mean number of serves consumed were 4.2, 1.3 and 0.9, respectively.

Conclusion

The dietary intake of the participants did not meet the recommendations of the Australian Dietary Guidelines except for the cereals food group. The high consumption of discretionary foods, sugary drinks and alcohol that are energy-dense and nutrient poor is a concern as it increases the risk of excess weight gain and can reduce micronutrient intake.

[P092] Adherence to personalised dietary recommendations and changes in healthy eating index within the Food4Me Study

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Adherence to dietary recommendations may impact the effectiveness of personalised nutrition (PN) advice. The aim of the present analysis was to characterise groups of individuals based on adherence to European dietary recommendations and to determine whether changes in Healthy Eating Index (HEI) scores in response to a PN intervention varied between groups. Using cluster analysis and a diet quality score, 1480 participants from the Food4Me study were grouped according to whether their baseline dietary intakes met recommendations for fruit and vegetables, wholegrains, oily fish, dairy products and red meat intake. Dietary, demographic and health-related characteristics of these groups were defined. Changes in HEI scores between baseline and month 6 were compared between groups and stratified by whether individuals received generalised dietary advice or PN advice. Individuals in cluster 1 (C1) met all recommended intakes except for red meat, cluster 2 (C2) met two recommendations (wholegrains and red meat) and those in cluster 3 and 4 (C3, C4) met one recommendation each (wholegrains and red meat, respectively). C2 consumed less fried foods than C4 ($P<0.05$). C1 were lighter, had lower BMI and waist circumference than C3 and were more physical active than C4 ($P<0.05$). Fewer individuals in C1 were smokers and wanted to lose weight than C4 ($P<0.05$). Participants who received PN advice in C4 and who had low diet quality scores

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reported greater improvements in HEI at month 6 compared with C1 and those with high scores (P<0.05). There was no difference between groups for participants randomised to non-personalised advice.

[P093] Dietary quality estimation of worksite foodservice menu

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Total Diet Studies (TDS) are national surveys recommended by the World Health Organization and the European Food Safety Agency in order to provide information on chronic dietary exposure of a population to food contaminants like toxic elements, mycotoxins, persistent organic pollutants (POPs), pesticide residues, and food additives necessary to perform risk assessment. In line with the effort to reduce hazardous materials (HM) in foods, this study was designed to estimate the exposure of the general population to 25 hazardous materials such as trans fat, furan, heterocyclic amines (HCAs), acrylamide, polycyclic aromatic hydrocarbons (PAHs), aldehydes, ethyl carbamate, biogenic amines, nitrosamines, trihalomethanes (THMs), ethylene oxide, benzene, 3-MCPD, and 1,3-DCP first during 3 years, from 2013 through 2016, as a Total Diet Study (TDS). At the second stage, from 2016 to 2017, appropriate measures for reducing exposure to contaminants of concern will be devised. In TDS, dietary intake data from 2008-2011 Korea National Health and Nutrition Examination Survey was used to select representative foods (RF). Collection and preparation of RF samples are conducted in 3 rounds handling different food groups in each year. After analysis of RF samples for contaminants, comprehensive exposure for each HM is estimated at individual & population level based on the individual food intake and HM content in RF using best-fit mapping between RF and other foods.

[P094] Meal pattern in workplace foodservice: the Korea National Health and Nutrition Examination Survey (KNHANES) 2010-2013

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Meal at workplace (MAW) is an important part of health and well-being of workers. Because the industry for food service at workplace has been expanding markedly in recent years, work site cafeterias could be strategically important venues to expose individuals to healthier food choices. As more women enter the workforce and more people use workplace food service for lunch, we attempted to analyze and compare the pattern of MAW between men and women. Dietary intake of a national sample of 1,725 adults (1,089 men and 636 women, 19-64 years) who had MAW was analyzed using 1-day 24hr-recall data from KNHANES 2010 through 2013. Individual weights assigned by stratified multi-stage sampling were applied in statistical analyses using SAS. The proportion of men was 70.8% and 57.2% of the subjects were 30-49 years old. The mean energy intake from MAW was 984 kcal/d and its contribution to total daily intake (40.4%) was different

between gender and occupation groups: 'office workers and professionals (OP)', 'service workers and sales clerks (SS)', and 'tech/machinery/labor workers (TL) '. Although fat intake was higher in OP than other groups in men, SS showed the highest intake in women. For vitamins and minerals, MAW provided 25~100% of recommended intake (RI) depending on nutrients. Dish groups consumed most frequently were cooked rice, kimchi, soup, stir-fries, and salads in all occupation groups except women TL where cooked & seasoned vegetables replaced stir-fries. Fruits were consumed more frequently by women and, by OP than SS or TL. Among the most frequently consumed 10 dishes by each occupation group, 3-4 kinds of soups were included in women compared to 1-2 kinds in men. Also, coffee from vending machine ranked 4th or 5th in men while it was not included in top 10 list for women OP. It is revealed that MAW contributes substantially to daily intake of many nutrients for Korean workers and, the extent of contribution is different between gender and occupation groups possibly due to differences in meal pattern.

[P095] The effect of dietary patterns on emerging biomarkers of health: A systematic literature review and meta-analysis

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Consumption of a dietary pattern rich in fruits, vegetables and wholegrains, such as the Mediterranean diet, has been associated with a range of health benefits including reduced risk of cardiovascular disease and metabolic syndrome. These conditions are underpinned by a state of low-grade inflammation, which can be identified using a suite of emerging biomarkers. The aim of this study was to conduct a systematic literature review and meta-analysis on the effect of dietary patterns on emerging biomarkers of health in adults. A systematic search of Scopus, PubMed, Web of Science and Cochrane Central Register of Controlled Trials (all years to April 2015) was conducted. Inclusion criteria were: randomised controlled trials; assessed the effects of dietary patterns on: C-reactive protein (CRP), total adiponectin, high molecular weight (HMW) adiponectin, tumour necrosis factor-alpha (TNF-α), adiponectin:leptin, resistin, or retinol binding protein 4 (RBP4). Random effects meta-analyses were conducted to assess the weighted mean differences (WMD) (with 95% confidence intervals) in change or final mean values for each outcome. Seventeen studies were included in the review. Dietary patterns investigated included the Mediterranean diet, Nordic Diet, Tibetan diet, and the Dietary Approaches to Stop Hypertension (DASH) diet. Consumption of a healthy dietary pattern was associated with significant reductions in CRP (WMD: -0.76 [95% CI:-1.16, -0.35]). Non-significant changes were found for all other biomarkers. There is evidence to suggest that dietary patterns have favourable effects on emerging biomarkers of health. However, the current body of evidence is limited, with additional controlled studies with larger sample sizes required.

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[P098] Diet assessed prior to pregnancy is associated with development of hypertensive disorders during pregnancy: Results from the Australian Longitudinal Study on Women's Health

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Introduction
Hypertensive disorders of pregnancy (HDP) are common obstetric complications associated with adverse health outcomes for mothers and their children. It remains unclear how dietary patterns assessed prior to pregnancy may influence risk of developing HDP. This study aims to examine this association.

Methods
Our study includes 3,582 women participating in the Australian Longitudinal Study on Women's Health. Baseline pre-pregnancy diet was assessed in 2003 using a validated 101-item FFQ. Exploratory factor analysis was used to identify dietary patterns. Factor scores were divided into

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quartiles indicating the degree of consumption of foods in each pattern. HDP were self-reported for each pregnancy between 2003 and 2012 and validated in a subsample. Generalised estimating equations analyses were used to estimate associations of pre-pregnancy dietary patterns with incidence of HDP. We adjusted for dietary, reproductive, socio-demographic and lifestyle factors.

Results

Among 3,582 women we documented 305 HDP cases (8.5%) in 6,149 pregnancies. We identified four dietary patterns labelled as 'Mediterranean-style', 'Meat, high-fat and sugar', 'Fruit and low-fat dairy' and 'Cooked vegetables'. The latter three dietary patterns were not associated with HDP risk. The 'Mediterranean-style' dietary pattern (characterised by high consumption of vegetables, legumes, nuts, tofu, rice, pasta, red wine, fish) was associated with 42% (95% CI 0.42, 0.81) lower risk of HDP when comparing the top with bottom quartile. This association was confirmed in analysis using repeated FFQs.

Conclusions

Our findings highlight the importance of examining dietary patterns prior to pregnancy and indicate that a pre-pregnancy 'Mediterranean-style' dietary pattern may be associated with risk of developing HDP.

[P099] MIND, Mediterranean and Nordic dietary indices in relation to cognitive decline: A population-based longitudinal study

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Background

The effect of dietary patterns on cognitive decline remains unclear. We aimed to compare the adherence to three different dietary pattern indices including the Mediterranean (MeDi), Mediterranean-DASH Intervention for Neurodegenerative Delay (MIND) and Nordic, diet (ND) in relation to global cognitive changes among dementia-free older adults.

Methods

Within the population-based Swedish National study on Aging and CareKungsholmen, 2223 dementia-free participants aged ≥60 years were identified at baseline, and followed up for 6 years. Global cognitive functioning was assessed with Mini Mental State Examination (MMSE) at baseline and follow-ups. Data on dietary intake were collected through a validated semi-quantitative food frequency questionnaire (98 items), and the scores of MeDi, MIND and ND were assessed (standard criteria) at baseline. Each dietary score was categorized according to its tertiles indicating low, moderate, and high adherence levels. Data were analyzed using the multilevel Mixed-effects linear regression with adjustment for potential confounders.

Results

The mean MMSE score was 29.2±0.8 at baseline, and 27.9±2.7 at 6-year follow-up. In multi-adjusted Mixed-effects model, high adherence to MeDi (B:0.11, 95% CI:0.032-0.179, p=0.005) and MIND (B:0.14, 95% CI:0.070-0.203, p <0.001) were significantly associated with less global cognitive

decline over time, but not ND (B:0.06, 95% CI:-0.004-0.132, p=0.067) after adjustment for total energy intake, demographics, physical activity, smoking, anthropometrics, chronic conditions, APOE É›4 allele, vitamin or mineral supplement intakes, and food groups beyond each index components.

Conclusion

High adherence to the MIND or MeDi diet, but not ND, is associated with less cognitive decline among dementia-free older adults.

[P100] Using principal component analysis and a diet quality index to identify change in the dietary patterns of older Australians

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Purpose

This study examined changes in dietary patterns (DP) determined by principal component analysis (PCA) and the revised Dietary Guideline Index (DGI-2013) among older adults over four years.

Methods

Australians aged 55-65 years completed a 111-item food frequency questionnaire in 2010, 2012 and 2014 (n=2542). DP were identified by PCA, stratified by sex. Factor scores were calculated at each time point (using the 2010 factor loadings) for DP that were present across all time points. Diet quality was assessed using the DGI-2013 reflecting compliance to the Australian Dietary Guidelines. Changes in DP and DGI-2013 scores were assessed by mixed-effect multi-linear regression.

Results

Two PCA-derived DP were identified at each time point in men (PCA1: vegetables, fruit, fish and poultry; PCA2: red or processed meat, white-bread, fried fish and hot chips) and two in women (PCA1: vegetables, fruit and fish; PCA2: cakes, processed meat, hot chips and confectionary). Factor scores for all DP decreased over time ($\hat{I}^2$; 95% confident interval: PCA1: -0.07; -0.08, -0.05 and PCA2 -0.04; -0.05, -0.03 for men and PCA1 -0.03; -0.04, -0.01 and PCA2 -0.01; -0.02, -0.01 for women, all P<0.001). The DGI-2013 scores increased in men (0.42; 0.16, 0.69; P=0.002) and did not change in women (0.07; -0.19, 0.33; P=0.584).

Conclusions

Given the data-driven nature of PCA, comparisons over time are difficult and DP assessed using diet quality scores may be easier to interpret. Comparison studies such as this will help inform decisions about DP methods to best suit different research aims.

[P101] Adaptation and validation of a nutrient based diet quality index "The PANDiet" for UK young children aged 12-18 months

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Objectives

Using calculations developed by the Institute of Medicine, a nutrient-based diet quality index assessing the Probability of Adequate Nutrient Intake (PANDiet) has been developed and previously validated on adult populations (France, US and Italy). The PANDiet provides a score ranging from 0 to 100; the higher the score, the better the nutrient adequacy of the diet. In order to study the nutrient adequacy of the diet of young children in the UK, the PANDiet needed to be adapted and re-validated.

Methods

The adapted PANDiet was based on 25 nutrients, using the UK and EFSA nutritional recommendations for children aged 12-36 months. Validity of the PANDiet was assessed by studying associations between the PANDiet and energy intake, food intakes and child and maternal characteristics known to be linked to diet quality. The analysis was undertaken on 1152 young children aged 12-18 months from the UK Diet and Nutrition Survey of Infants and Young Children (DNSIYC, 2011).

Results

The Spearman correlation between the PANDiet score and energy intake was not significant. The higher the PANDiet score, the lower the intake of whole milk, sugar and confectionery, burgers and kebabs, biscuits and soft drinks, and the higher the intake of vegetables, fruits, young child formula and commercial infant foods. Determinants of having a lower score included being older, having siblings and having a younger mother with a lower educational level.

Conclusions

The PANDiet is a valid indicator of the nutrient adequacy of the diet of UK young children aged 12-18 months.

[P102] Factors associated with eating behavior in users of fitness centers of Taubat City SP

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Introduction

Researches confirm that the regular practice of physical activity and a balanced diet influence directly in disease prevention.

Objective

To identify the factors associated with eating behavior of users of fitness centers from Taubaté city, SP.

Methods

There was a cross-sectional study with a non-probabilistic sample involving 160 users of fitness centers from Taubaté city. Data were collected using a questionnaire multiple choice questions. Furthermore, they were used the test 'What's your diet like?' present in the pocket edition of the Brazilian Dietary Guideline, and the International Physical Activity Questionnaire. For anthropometric assessment were used weight and height to calculate the BMI (Body Mass Index)

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and skinfolds thicknesses to estimate the percentage of body fat (%BF). It was used the chi-square test to determine the association and cluster analysis.

Results

The average age users of fitness centers was 39.4 years old. There was predominance of the feminine gender, high schooling and high family income. The most of them were found eutrophic and presents normal %BF. According to the test classification 'What's your diet like?' 59.4% presented healthy eating . Regarding to hydration, 48,8% of the users mentioned to ingest 500 ml of water during the period of activities.

Conclusion

The present research permits to identify that the age and the nutritional status were associated to physical activity and to factors related to the diet. Attend gyms did not ensure the adequate eating behavior of these individual from Taubaté city.

Theme 07: Benchmarking Food Environments

[P103] Vending machines provide effortless access to unhealthy choices on university campuses: A cross-sectional study

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The current generation of young adults are a population group at high risk for weight gain and incident overweight and obesity. It is hypothesised this is due to their exposure to our current obesogenic environments which have persisted and worsened since the 1980s. It is important to benchmark food environments with which young adults interact and the tertiary sector is one such setting. The aim of this research was to determine if vending machines contribute to an unhealthy food-scape at universities and if this was reflected in sales data. An audit of the nutrient composition, availability, promotion and cost of vended products was conducted with our pre-validated audit tool at a large university and sales data was electronically recorded. Sixty-one vending machines were identified, 95% (n=864) of snacks and 49% of beverages (n=455) were less healthy items. Ninety-six percent of snacks (n=29723) and 42% (n=31721) of beverages purchased were less healthy options. All snack promotions were for less healthy snacks and 46% of beverage promotions were for less healthy beverages. The mean difference in cost of healthy items was 6.5% lower for beverages and 4.5% greater for snacks. Snack vending machines contribute to an unhealthy food environment almost exclusively selling and promoting less healthy options. Beverage vending machines were comparatively healthier providing and promoting healthy and less healthy options almost equally. However overall, unhealthy beverage sales exceeded unhealthy snack sales and consequently should not be ignored in interventions to improve the contribution that vending machines make to the university food-scape.

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[P104] Developing and piloting a report card on healthy food environments and nutrition for children in Canada

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Background

Benchmarking and publicizing efforts to support healthy dietary behaviours and body weights among children may support stronger government action in this area. The purpose of the Report Card on Healthy Food Environments and Nutrition for Children is to provide policy-relevant benchmarks that can be used to gauge the state of children's food environments and progress in developing policy over time, and to simulate solutions-oriented dialogue.

Methods

We reviewed the literature and consulted experts to develop indicators of the quality of children's food environments. Indicators chosen were evidence-based, policy-relevant, feasible targets for data collection, quantifiable and replicable across settings. Scoring systems used to monitor and report on progress on public health issues informed development of a grading scheme. The indicators and grading scheme were revised following review by an Expert Advisory Committee. During pilot testing, indicators were further refined for clarity and to reflect data availability.

Results

The Report Card assigns grades of A through F to policies and actions undertaken within 4 micro-environments (physical, communication, social, economic) and within the political macro-environment. Grades reflect achievement of, supports for, and monitoring of 41 indicator-specific benchmarks, plus composite grades. Data collection and grading for the 2015 Report Card are complete. The Report Card will be disseminated to policymakers, practitioners and the public.

Conclusions

The Report Card provides a means to monitor children's food environments and related policies, inform stakeholders of their current status, engage society in solutions-oriented discussion, and outline a policy-relevant research agenda for future study.

[P105] Assessing the quality of methods and tools used for monitoring and evaluating the implementation of policies to promote healthy food environments

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Background

Policies to create healthy food environments are recognized as a critical part of efforts to prevent obesity and diet-related non-communicable diseases. However, there has not been any systematic

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review of quality of studies that assess the implementation of such policies. This study aimed to assess the quality of methods and tools used for monitoring and evaluating the implementation of policies to create healthy food environments.

Methods

A systematic literature search of multiple databases, including grey literature was conducted. Comprehensiveness, internal validity, external validity and feasibility were criteria of assessment. The overall quality of studies was rated as 'high', 'medium' or 'low' based on the sum of the assessment for these four individual criteria.

Results

Fifty four articles were assessed. Only sixteen studies provided sufficient information for the assessment. Eight studies were rated as 'high' which represented the studies that met at least three of all individual criteria. The tools being used in these studies included INFORMAS Healthy Food Environment Policy Index, the Obesity Action Checklist by Martin et al., Global Nutrition Policy Review Questionnaire tool of World Health Organization, and the 96 items Wellness School Assessment Tool. Three studies met two criteria for 'medium' quality. Five studies were low quality where only one or no criterion was passed.

Conclusion

There was a lack of information on some individual criteria especially internal validity. There is a need for studies to reporting such information to help identify appropriate methods and tools from among the available alternatives for use across different contexts.

[P106] Development of methodology to understand semi-urban school food environments in Thailand

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School food environments affect Thai students, including those who are vulnerable to poor nutrition. Child overweight/obesity is the compelling health issue affecting future of our population and health care system. Thailand is one of the countries involving in the International Network for Food and Obesity/non-communicable diseases (NCDs) (INFORMAS). This study aims to develop practical methodology to examine environmental school food availability and food outlets in relation with population-level childhood obesity. We sampled 317 private and government primary schools in semi-urban areas in Central, Northern, North-eastern and Southern regions of Thailand. The school lunch and foods that are available in schools will be identified on quality and availability in relation with nutritional student status. Food outlets, including fast foods, food stores, street food stalls, or portable/hawker stalls, within 100 meters outside schools will be identified as healthy or unhealthy foods. Geographical Information Systems will be used to calculate a range of measures of those food outlets accessibility and availability. Distance to the nearest, accessibility, and density measures on

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each child residence will be all tested. Schools are often the target of population level programs and policy strategies to promote health and health equity. Understanding the ways in which the food environments impact childhood obesity is a key component to designing interventions that increase the availability of healthy and affordable foods, thus improving the health of semi-urban school communities. It is anticipated that policy makers will consider national application of this approach for food and nutrition planning and preventing NCDs for children.

[P107] Predictors of family meals frequency of Brazilian adolescent girls from disadvantaged backgrounds: baseline results of the 'Healthy Habits, Healthy Girls' Brazil study

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Background
Evidence suggests that family meal (FM) and home environment has an impact on adolescent girls eating behaviors. The purpose was to examine associations of FM environment with FM frequencies of adolescent girls.

Methods
This is a cross-sectional baseline analysis of a school-based obesity prevention intervention 'Healthy Habits, Healthy Girls – Brazil', for adolescent girls (16.05 ± 0.85 years) from schools in disadvantaged neighbourhoods of city of Sao Paulo. An adapted self-reported questionnaire was used to assess FM frequency (having 7 or more meals together) and environment (13-items categorized into the following: priority; structure; atmosphere and TV use). Descriptive statistics and Poisson regression were used with significance level of 5%.

Results
Among the adolescents 81 (32.02%) realize regular FM. The predictor factors for FM were importance (PR 7.32; 95%CI 2.75-19.49, p<0.001), obligation (PR 1.67; 95%CI 1.15-2.42, p=0.008), rules during the meal (PR 2.12, 95%CI 1.38-3.26, p=0.001), eat in the kitchen/dinner room table (PR 1.72; 95%CI 1.18-2.56, p=0.006), eat all the foods served (PR 1.67; 95%CI 1.17-2.37, p=0.005) and eat bring people together in an enjoyable way (PR 2.94; 95%CI 1.24-6.98, p=0.014). The importance of having FM was the predictor that most contributed to realize FM (PR 5.37, 95%CI 2.01-14.3, p-0.001) in opposition for the difficulty of having FM (PR 2.38; 95%CI 1.52-3.70, p<0.001).

Conclusion
Regular FM frequency is factors associated to the physical structure, the parental agenda availability and the priority to realize FM.

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Theme 08: Dietary Interventions: Limitations and Improvements

[P108] Dietary intake of Brazilian adolescent girls attending a randomized control trial: post-intervention changes

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Background

Poor dietary habits and unhealthy weight gain are prevalent among Brazilian adolescents from disadvantaged backgrounds.

Purpose

To evaluate the post-intervention impact of a multiple component physical activity and nutrition intervention on dietary intake in a sample of adolescent girls.

Methods

'Healthy Habits, Healthy Girls (H3G)' was evaluated using a randomized controlled trial with 253 adolescent girls (16.05±0.85 years) attending public schools in disadvantaged backgrounds from Sao Paulo, Brazil. Diet was assessed using a validated semi-quantitative food frequency questionnaire (FFQ-FP). Foods were aggregated into the Brazilian Food Pyramid groups and energy-dense nutrient poor foods (EDNP). The kilocalories of total energy intake were calculated. Data were checked for normality and those that were not normal distributed were square root transformed. Statistical analyses followed intention-to-treat principles, and were conducted using linear mixed models, adjusted for school clustering. Alpha levels were set at $p<0.05$.

Results

Statistically significant group-by-time effects, in favor of the H3G-Brazil intervention were found for fruits [8.80kcal (SE 7.11); p=0.006], vegetables [12.48 (SE 7.86); p=0.005] and sweets [-53.98kcal (SE 50.70); p=0.036]. Although, there were no statistically group-by-time effects, changes were in favor for H3G-Brazil for EDNP [-65.18kcal (SE 93.34); p=0.], sweet beverages [-4.29 (SE 16.37); p=0.865], and salty snacks [-24.41 (SE 49.87); p=0.450].

Conclusion

The girls attending 'Healthy Habits, Healthy Girls – Brazil' program enhanced their dietary habits after an intensive 6-month intervention. H3G-Brazil might serve as a model for other programs in poor-and-middle-income countries.

[P109] Supporting Queensland school canteens to be healthy - Tackling the limitations

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1 in 4 children are overweight or obese. School environments are crucial in promoting

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healthy/unhealthy behaviours for school aged children. Canteens (tuckshops) impact childrens food intake, through contribution of energy dense, nutrient poor foods. Availability and accessibility to such foods contributes significantly to childrens poor dietary habits. Supporting school canteens to offer healthy options, (as per Queensland Government Smart Choices Healthy Food and Drink Supply Strategy for Queensland Schools) is one strategy for reducing childhood obesity but it is reported (Woods et al, 2014) that the majority of school canteens were not complying with relevant state or territory guidelines. NAQ Nutrition assists Queensland schools in ensuring their school environment encourages healthy eating, including supporting canteens to promote and provide healthy food items (as per Smart Choices criteria). Limitations for schools, canteens, non-government organisations in building capacity to ensure canteens offer healthy choices include:
- Lack of appropriate facilities
- Lack of volunteers to assist with healthy food preparation
- Perceived lack/actual lack of community demand for healthier food
- Perceived risk of decreased profitability
Key strategies can be effectively implemented within whole school environments to improve childrens healthy choices and behaviours by working closely with school principals, parent organisations/committees, canteen convenors with ongoing support and monitoring.

Theme 09: Using Images for Dietary Assessment

[P110] A brief tool for assessing diet quality and selected nutrient intakes from image-based dietary records: Design and preliminary results from use in pregnant women

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Background
The Selected Nutrient and Diet Quality (SNaQ) analysis tool provides a snapshot of food group and key nutrient intakes evaluated from image-based dietary records. This study describes the development of the SNaQ tool for use in pregnant women and preliminary results.
Methods
The SNaQ tool quantifies image-based records using food group equivalents and reference food images depicting serve sizes. The SNaQ links with food and supplement composition data to estimate nutrient intakes. Pregnant women collected an image-based dietary record over three non-consecutive days using a smartphone app. Analysis was performed independently by two dietitians using the SNaQ tool and results conferred. Intakes were compared to national nutrition guidelines.

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Results

Nineteen pregnant (aged 29±4 years; gestation 6-24 weeks; 11 used supplements) women collected 3-day image-based records. Compared to guidelines, mean food group intakes were below recommendations for grains (4.8±1.8 serves/day), vegetables (2.2 ±1.4serves/day), lean meats and/or alternatives (2.0±1.0 serves/day), milk and/or alternatives (1.9±0.9 serves/day), with only fruit (1.9±1.5 serves/day) close to recommendations. Intakes of unsaturated spreads and oils and energy-dense, nutrient-poor foods exceeded recommendations (2.1±1.5 and 3.5±1.6 serves/day; respectively). The proportion of women with inadequate micro-nutrient intakes (i.e. below Estimated Average Requirements) was greatest for iron (79%, n=15), followed by calcium (53%, n=10), folate (47%, n=9), iodine (42%, n=8), and zinc (11%, n=2).

Conclusion

The SNaQ tool suggests diet quality may be sub-optimal with inadequate iron intakes common amongst pregnant women in this group. Evaluation of the tool is continuing and will include comparison to other dietary assessment methods.

[P111] Pilot testing an electronic food diary app in nine to twelve-year-old children

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Objective

Childhood obesity is a global issue largely determined by diet. Therefore accurate and practical dietary assessment tools are needed to determine what children are currently consuming. Therefore the aim of this study was to investigate if iPod-based food diaries are appropriate to measure nutrient intake in nine to twelve year old children from Dunedin, New Zealand.

Design

An Evernote app based food diary was designed that incorporated pictures of all foods and drinks consumed over a four day period with supplemental short typed descriptions, if necessary. Sixteen participating children completed an estimated written food diary for four non-consecutive days, and then completed the iPod diary for another four days, over a two-month period. A subsample of the children and their parents were invited to a group interview session post study to provide feedback about using the iPod diary and to discuss any issues that arose.

Results

There was high compliance for both methods, with 13 of the 16 children having full diet records for all required days for the iPod and written food dairies. Nutrient intakes were broadly similar between the two diaries but additional foods were picked up from photographs that were not described in the text. Commonly omitted items from descriptions included tomato sauce, lettuce in sandwiches and drinks consumed with meals. Feedback from group interviews indicated that participants found the electronic food diary easy to use and preferred it to the written diary.

Conclusions

iPod-based diaries are likely to be suitable for measuring nutrient intake in children after additional testing.

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[P112] Feasibility of using photo-based dietary assessment in New Zealand adolescents - a pilot study

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Objective

To investigate the feasibility of an electronic photo food record to measure food intake in New Zealand adolescents.

Design

Ten participants aged 16 to 19 years completed a photo-based food record on an iPad for four days and an iPod touch for four days. Participants took photos of the foods they were about to eat, and filled in a brief food log underneath each picture. Participants also attended a group interview to give feedback on the usability of the food record.

Results

Compliance was high with all participants recording believable intakes on at least six days. 79% of photo entries could be used alone as they contained photographs with excellent image clarity. Energy intake measured from both devices was similar and relistic for this age group (iPad 8114kJ/day, iPod 8546kJ/day) Participant feedback indicated that they enjoyed using this method and that if they only had time to take a photograph of food consumed, they would go back later in the day and fill in the description. Participants also liked the fact that they could also access their records via a desktop computer and add descriptions there, as well as on the iPad or iPad. Most participants preferred to use the iPod for recording.

Conclusion

The use of food photography appears to be a feasible way to measure food intake in the adolescent population, as evidenced by the relatively high compliance to using the device, believeable energy intake and positive feedback from participants using the device.

[P113] A comparative study of dietary assessment by using camera phone-based assessment method and the conventional method

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This study aimed at examining the validity of the camera phone image-based food record in comparison with the weighed food record method and also examining the differences due to proficiency in analysis of camera phone image-based food record between first-year college students majoring in Food and Nutrition (thereafter students) and registered dietitians with more than 5-year career (thereafter RD). As a results, among 38 nutrients in Tables of Japanese Food Compositions 2010, we observed a significant difference in the mean value of 17 nutrients by students and 28 nutrients by RD between the camera phone image-based food record and weighed food record, the estimated nutrients by camera phone image-based food record tended to be higher

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than that by the weighed food record in both students and RD groups. On the other hand, data from 43 subjects showed that each participant's 2-day nutrient intakes assessed by the camera phone image-base food record and weighed food record methods were well correlated, the maximum value of correlation coefficient was cholesterol in both students and RD groups ï¼ˆr=0.895,ã€€rï¼•0.920, respectivelyï¼‰and the minimum value was sodium chloride equivalent ï¼ˆr=0.457ï¼‰ in student group, retinol equivalent ï¼ˆr=0.604ï¼‰ in RD group, the correlations between 2 methods were more significant in the RD group than student group. The present findings suggest that the camera phone image-base food record may be a valid tool for evaluating population dietary intake.

[P114] Use of image-based food records to develop dietary assessment and feedback skills of dietetic students

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The availability of high-quality cameras within mobile devices has allowed the increased availability and use of dietary images. The CHAT study (1) developed an image-based mobile device food record application (mFRapp).   The availability of this mFRapp led to the development of a research-translation learning activity for Curtin University nutrition and dietetic students. The aim was to develop a peer-learning activity between first year nutrition and dietetic students based on mFRapp collected dietary images. Evaluation of this activity explored how the use of dietary images could develop the skills of dietetic students in 1) using images as the basis of dietary assessment 2) providing food-based tailored dietary feedback. Twenty six nutrition students, who had previously done a conventional food record, used the mFRapp to collect four days of dietary images. Thirty six dietetic students were trained in the use of mRFapp and ten dietetic students volunteered to participate in the image review and feedback component of the project. These dietetic students reviewed the image-based food records via an iPad with the students, conducted an image-based food group assessment of the food records and developed a brief tailored feedback message on intake of fruit, vegetables and junk foods (discretionary foods), using a provided feedback- template. Evaluation of the learning experience of the dietetic students participating in the image review and feedback component found 87% of respondents agreed the activity was valuable to their learning in dietetics and all respondents were confident in using image-based food records in their dietetic practice. 1.BMC Public Health 2012, 12:477

Theme 10: What Should We Measure and Why?

[P115] Accuracy of the visual estimation method used by nurses to measure plate waste containing a mixture of many food types in patients with Alzheimer's disease

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Background

In Japanese hospitals, no studies have been performed to investigate plate waste surveys conducted by nurses using visual estimation under routine conditions in which there are multiple food types.

Aim

A comparison was made between plate waste measurements based on visual estimation by nurses and plate waste measurements based on actual measurements by registered dietitians in long-term inpatients with Alzheimer's disease (AD) in a Japanese hospital under routine conditions.

Methods

In 82 patients with AD who were taking only foods served at a long term care hospital in Japan, plate waste was measured by nurses using visual estimation for total 21 days were included in the analysis.

Results

For the 3,984 meals included in the analysis, the agreement rate of the 2 measurements methods was 78.4%. Disagreement of measurements consisted of 3.8% of underestimation and 17.8% of overestimation. The percentage of overestimation was higher. As far as the plate waste group was concerned, the agreement rate was as low as 25.5% or below, which corresponded with up to 85.6% of overestimation.

Conclusion

To increase the accuracy of plate waste measurement by nurses using the visual estimation method, it would be necessary to measure plate waste for each food type, with continuous training and motivating of nurses by recognition of the importance of the nursing record.

[P116] Validation of a WHO complementary feeding indicator against two-day food weighing in a sample of Malaysian children

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2 *International Life Sciences Institute Southeast Asia Region*

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Background

Breastfeeding and complementary feeding are major factors in child survival, growth and development. Beyond 6 months of age, breastfeeding alone is unable to support optimal growth. Complementary feeding thus plays a significant role in reducing undernutrition in this age group.

Objectives

The objectives were to: 1) Estimate energy, protein, and micronutrient intakes from complementary foods among breastfed and non-breastfed children aged 6-23 months using dietary assessment measures (weighed food records); 2) Determine whether infants/children who are identified as adequately fed using a WHO complementary feeding indicator (Minimum Acceptable Diet) also have adequate diets on the basis of dietary intake measures.

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Methods

All food and beverage intakes of children aged 6 to 23 months (n=120) were measured by two-day food weighing. Their mothers were asked questions regarding the child's frequency of consumption of different food items, derived from the Demographic and Health Survey (DHS) questionnaire. Dietary adequacy was assessed using the WHO definition for Minimum Acceptable Diet and compared against results obtained from two-day food weighing.

Results

The indicator Minimum Acceptable Diet was associated with adequate intakes of a limited number of nutrients obtained from two day food-weighing: protein, vitamins A, C, D, E, and folate but not for other nutrients.

Conclusion

Among Malaysian children, the WHO indicator Minimum Acceptable Diet can be used as a rapid screening tool for protein intake and a few micronutrients. Additional dietary assessment tools are needed to complement the information provided by this indicator in order to assess adequacy of complementary feeding.

[P117] Vitamin intakes among adults in The Netherlands by dietary supplement use. Results of The Dutch National Food Consumption Survey 2007-2010

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Objective

To examine differences in habitual intakes of vitamins and EPA&DHA between users and nonusers of dietary supplements among Dutch adults.

Method

In the Dutch National Food Consumption Survey 2007-2010, two non-consecutive 24-hour-dietary recalls were carried out in a representative sample of the population, added by information on the frequency of dietary supplements use. Data on adults (19-69 y) were analyzed, using the Dutch food and supplement composition databases. The habitual intake distributions were modelled using SPADE (Statistical Program to Assess Dietary Exposure). Mean habitual vitamin intakes from foods and dietary supplements as well as prevalence of inadequate habitual intakes were compared between users and nonusers of dietary supplements.

Results

Mean habitual intakes of vitamins from foods only among males and females were higher among users as compared to nonusers of dietary supplements. Only among women the intakes of folate equivalents, RAE, vitamins B2, C, D and EPA&DHA from foods only was significantly higher among users as compared to nonusers. The prevalence of inadequate intake (below EAR) of folate equivalents from foods was significantly lower among female users compared to nonusers. The mean vitamin intake from foods and supplements was significantly higher compared to the intake from foods only. The intake of EPA&DHA was below AI among all adults.

Conclusions

Although not significant, adults who use dietary supplements tend to have higher vitamin intakes

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from foods only, than those who do not use supplements. For most vitamins, the prevalence of inadequate intakes does not differ between supplement users and nonusers.

[P118] Obesity interventions among Pacific Islanders: A systematic literature review

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Purpose

Obesity among Pacific Islanders is a serious problem. The most obese countries in the world are located in the Pacific region. This paper attempts to identify obesity interventions among Pacific Islanders, assess the quality of the interventions, and identify positive health outcomes as a result of the interventions.

Methods

Four online databases were used to identify obesity interventions among Pacific Islander - PubMed, Active Living Research, Hawaii Initiative for Childhood Obesity Research and Education (HICORE), and University of Hawaii's OneSearch.

Results

14 studies met the inclusion criteria and assessed for quality and health outcomes. All the interventions used behavioral and/or environmental components as well as anthropometric measurements to identify changes in health outcomes.

Conclusion

All identified positive changes in health outcomes - some reported significant positive changes. Interventions focusing primarily on diet and physical activity reported significant positive outcomes, thus a recommendation that future interventions focus on diet and physical activity.

[P119] Strategies for measuring dietary intake in the Cancer Prevention Study - 3 (CPS-3) Cohort

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In 2013 the American Cancer Society (ACS) completed recruitment of its newest prospective cohort study, Cancer Prevention Study-3 (CPS-3, n=304,000). Men and women 30-65 years of age of various racial / ethnic backgrounds from across the US and Puerto Rico with no personal history of cancer were eligible. At baseline, mean age was 48 years, 25% were male, and 17% were minority. The ACS Epidemiology Research Program conducted several activities to guide the modification of an existing food frequency questionnaire (FFQ) to assess diet of this contemporary, relatively diverse cohort. Three primary approaches included analyses of the most recent US National Health and Nutrition Examination Survey (NHANES) dietary data, collection and analysis of 24-hour recalls in a random subset of CPS-3 members (n=605), and separate focus groups with male and female white, African American and Hispanic CPS-3 participants. Analyses focused on dietary contributors to several

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cancer- related nutrients (energy, folate, calcium, phytonutrients) with emphasis on capturing cultural variation in food and nutrient consumption. FFQ modifications included splitting line items (e.g., flour and corn tortillas), adding and eliminating foods, and incorporating new concepts into the diet section (e.g., location, timing and frequency of eating, use of organic foods, high school diet). A validation study in a racially and ethnically diverse subset of CPS-3 participants (n=750) is currently underway to evaluate the revised FFQ. The validation study is being conducted in five areas across the US and includes two FFQ administrations, repeated telephone 24-hour dietary recalls, and blood and 24-hour urine collections.

[P120] Food group and dietary pattern analyses in liver transplant recipients highlight a novel target for dietary intervention

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In liver transplant recipients' (LTR), survival is compromised by cardiometabolic risk factors, such as obesity, fatty liver, and type 2 diabetes, which emerge within 6 months of transplant. A shift toward a more cardiometabolic-protective diet, such as the Mediterranean dietary pattern, may mitigate risk. Post-transplant dietary intakes of LTR are largely unknown. Assessment of food group and dietary patterns within the first year of surgery may identify links between dietary behaviours and metabolic complications. This observational study aimed to prospectively assess the dietary patterns of 17 LTR at 6 months post-transplant. Dietary data, collected via diet histories, were assessed using food group analysis based on the Australian Health Survey's food grouping convention. Compared with the Australian adult population, LTR had similar intakes of meat, fruit, vegetables, and oils, consistent with a Western-style pattern favouring saturated fat sources. Patients had significantly lower intake of cereal-based foods, nuts, eggs, and fish; and approximately 40% higher intake of dairy products. A legacy of food choices resulting from pre-transplant dietary education for high protein intake (meat and dairy) and early post-transplant education regarding risk of food-borne pathogens (such as in eggs and seafood) seems to persist at 6 months. These results suggest significant manipulation of food intake is needed to achieve a cardioprotective Mediterranean dietary pattern such as decreasing red meat and dairy; and substituting with increased fish, nuts, and unsaturated oils. Our detailed and robust assessment of the food groups and dietary patterns of LTR has revealed a novel target for dietary intervention.

[P121] Dietary surveys are important for benefit-risk assessment

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Food contains a mixture of nutrients, non-nutrients, additives and environmental contaminants, and can therefore not be categorized into healthy or unhealthy. Benefit-risk assessments take account of both pros and cons of foods and are increasingly in demand. Risk assessment comprises four steps: hazard identification and characterisation, exposure assessment and risk characterisation. The exposure assessment is performed using knowledge of how much consumers eat of specific foods combined with the amount of the substance in the specific foods. The quality of the exposure assessment is dependent on the dietary assessment, and relies on available intake data for the foods containing the substance(s) and for intake data covering the whole population, also the high consumers. Fish is a good example. Benefits of fish intake are well documented; however, fish, like all other food, also contains environmental contaminants like mercury and dioxins. The content of contaminants differs between fish species, and different organs of the fish. Cod filet is a main source for mercury, while for dioxins cod liver is the most contaminated organ. Filet is frequently eaten by many Norwegians, and will for the consumers be the main source of exposure. Cod liver is eaten by few, but gives a large exposure for those eating it several times per year. Asking questions of both fish-filet and -liver will give the best basis for the benefit-risk assessment. It is important to design and perform dietary surveys in such a way that the data can be used for both health benefit and risk assessments.

[P122] Salt-eating habit and 24-hour urinary sodium excretion in Korea

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Objectives

Excessive sodium intake is a well-known risk factor for hypertension, cardiovascular diseases, kidney diseases, and gastric cancer. For assessing the association between sodium intake and such diseases, it is needed to accurately identify the individual sodium intake. A 24-hour dietary recall method has been used to estimate population mean intake of sodium in the Korea National Health and Nutrition Examination Survey (KNHANES), but it is less appropriate to estimate individual sodium intake. The present study aimed to examine the appropriateness of salt-eating habit questionnaire as a tool for measuring the individual sodium intake.

Methods

We recruited 334 volunteers above 19 years old among participants in the 2014 KNHANES. Daily sodium intake was estimated from a 24-hour urinary sodium, a 24-hour dietary recall, and semi-quantitative food frequency questionnaire (FFQ). Participants were asked the salt-eating habit using the 8-items questionnaire with 5-point Likert scale.

Results

The mean age of participants was 46.2 ± 12.9 year and men were 41.2%. The average daily intake of from a 24-hour dietary recall sodium was 4,520 mg (5,739 mg for men; 3,667 mg for women), which was similar to the mean sodium intake estimated from a 24-hour urine after considering sodium

losses through feces and sweat of approximately 15% (4,530 mg for all participant; 4,978 mg for men; 4,218 mg for women). However, individual sodium intake from a 24-hour dietary recall showed a low regression coefficient ($\hat{I}^2$ = 0.12) with sodium level of a 24-hour urine. In contrast, salt-eating habit showed a high regression coefficient with sodium level of a 24-hour urine ($\hat{I}^2$ = 143.4; p-value < 0.001) and the highest tertile group of total salt-eating score showed a significantly higher sodium excretion from 24-hour urine (4,312±1,509mg) compared to the lowest tertile group (3,503±1,139mg; p-value = 0.01).

Conclusions

In conclusion, these findings suggest that salt-eating habit is a good predictor for actual salt intake from a 24-hour urine.

[P123] Validation of a single 24-hour dietary recall for assessment of total energy intake using the doubly labeled water method

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Objectives

A 24-hour dietary recall (24hr recall) has been used to assess energy intake, but validity of this method has not been examined using biomarkers in Korea. The aim of this study was to examine the validity of a 24hr recall for assessment of total energy intake using energy expenditure measured by the doubly labeled water method (DLW).

Methods

We recruited 71 normal-weight adults aged 20 to 49 years in June 2012 and June 2013. Total energy expenditure (TEE) was measured by DLW method during 14 days. Total energy intake (TEI) was estimated by three 24hrs recalls in three days (a day in the weekend (the first), 2 days in the weekdays (the second and third)) during 14 days. Participants with the TEI/TEE ratio > 0.8 were defined as underreporters while participants with the TEI/TEE ratio > 1.2 were defined as overreporters.

Results

Mean TEE measured by DLW was 2,402 ± 480 kcal. Mean TEI was 2,219 ± 935 kcal for the first, 2,041 ± 817 kcal for the second, 1,985 ± 805 kcal for third, and 2,082 ± 681 kcal for three 24hr recalls. A 24hr recall underestimated TEI by 8.1-18.1% compared with TEE measured by DLW. The rate of underreporters of a single 24hr recall was 39.4-52.1% (39.4 for the first, 43.7 for the second, and 52.1% for the third), and the rate of underreporters of three 24hr recalls was 31.0%. Pearson correlation coefficient between TEE and TEI estimated by the single 24hr recall was 0.48-0.60 (0.53 for the first, 0.48 for the second, and 0.60 for the third, p-value <0.0001), and TEE and TEI estimated

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by three 24hr recall was 0.68 (p-value <0.0001).

Conclusions

This study showed that a 24hr recall underestimated TEI compared with TEE measured by DLW in Korean adults.

[P124] Dietary assessment methods and tools used in Canada: Implications for nutrition and health research

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Tools used to assess diet vary widely, limiting our ability to compare findings and pool data across studies. Through a scoping review, we characterized self-report measures used to assess diet in Canada to illustrate current challenges and inform strategies to strengthen the impact of nutrition research. Using the research databases Medline, PubMed, PsycINFO and CINAHL, we identified Canadian studies published from 2009 to 2014 that included an assessment of dietary intake. An initial pool of 2,358 articles was screened, using predefined criteria, to identify those that included self-report measures of diet among free-living, adult, non-Aboriginal populations. A final pool of 189 publications (reflecting 95 unique studies) was examined in detail to assess the tools used and their characteristics. Numerous tools were used and these differed by study design and purpose. Tool types included food frequency questionnaires (FFQs) (38%), screeners (20%), food records/diaries (18%), 24-hour recalls (14%), and single-item questions (3%). Tool type was not stated in 7% of studies. FFQs and screeners included those developed and/or adapted for use in Canada and those developed elsewhere (typically the US). Some tools were reported to have been validated; however, few were evaluated in the specific study population. The variety of tools being used in Canadian research suggests the need for strategies to improve standardization and harmonization, while keeping context in mind. Such strategies can extend beyond Canada, with the potential to improve the comparability of research conducted across countries and thus, the overall quality of evidence on nutrition and health.

Theme 11: Measuring Physical Activity in Children

[P126] Individual factors associated with moderate to vigorous physical activity at Brazilian schools

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Objective

To investigate associations between time spent by Brazilian schoolchildren in moderate to vigorous physical activity (%MVPA) during school recess and physical education (PE) classes and individual factors.

Methods

Thirteen classes from second to fifth grades were selected from public schools in the city of Florianopolis (n=266; 45.9% boys). Children wore accelerometers for one day and time spent in MVPA during school break time and PE classes was calculated with 1s epochs and the cut-off points recommended by Evenson et al.. Linear and multiple regression analyses were performed using %MVPA as outcome, and sex, grade, BMI z-score, family income, and mother`s education as independent variables.

Results

The schoolchildren spent an average of 19.3% (95%CI: 17.6%; 20.9%) of the time in MVPA during the school break time, and 13.3% (95%CI: 12.3%; 14.3%) of the time during the PE classes. Compared to boys, girls engaged in 6.2% less MVPA during school break time (boys: 22.5%, 95%CI: 19.9%; 25.1%; girls: 16.3%, 95%CI: 14.4%; 18.3%), and 3.8% less during PE classes (boys: 15.3%, 95%CI:: 13.7%; 16.9%; girls: 11.5%, 95%CI: 10.4%; 12.6%). The school grade was a significant positive factor for %MVPA during school break time and PE classes. A lower family income was a negative factor of %MVPA at school break time and a positive factor in PE classes. The mother`s educational level and BMI z-scores were not associated with % MVPA.

Conclusion

There is an urgent need to implement interventions to increase MVPA in Brazilian schools, especially for girls and those from poorer socioeconomic backgrounds.

[P127] Accelerometry of children in Micronesia [Pohnpei, Federated States of Micronesia; The Republic of Palau (ROP), The Republic of the Marshall Islands (RMI)] : The Children's Healthy Living Program (CHL)

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Purpose

To present accelerometer-derived physical activity (PA) information from children in Micronesia (Pohnpei, ROP, RMI), and to compare demographic and jurisdictional differences. Despite links between obesity and PA there is limited data on PA in this region.

Methods

Wrist-mounted accelerometers were placed on 2-8 year old children and worn for 7 days. Data were recorded at 1-second intervals. PA was categorized into sedentary behavior (SB); light; moderate and vigorous (MV). Questionnaire assessed demographics. General linear models examined differences in MVPA and sedentary behavior (SB) by sex, age, household income, and jurisdiction.

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Results

The sample included 261 children (53% girls). Mean MVPA/d= 91.5 minutes per day (m/d) (sd=79.1); Mean MVPA/d was highest in Pohnpei (128.2 m/d), then RMI (103.4 m/d) and then ROP (74.3 m/d). Average MVPA/d, was significantly lower in ROP than Pohnpei but not RMI. No significant differences in MVPA/d were found by sex, age, or household income (p>.05). Significant differences were observed in children meeting US national recommendations of 60 m/d of MVPA (p=0.008): RMI (78%), followed by Pohnpei (75%), and ROP (58%). Mean SB was highest in RMI (683.1 m/d), and lowest in Pohnpei (586.6 m/d). Mean SB in Pohnpei was significantly lower than ROP (p=0.0002) and RMI (p=0.0013). Mean SB in boys was 40.8m/d higher than girls (p=0.04).

Conclusion

On average, children met the recommended daily PA time; however, they spent over 11 hours in SB. Ways to decrease SB and sustain daily MVPA in the Pacific should be pursued.

[P128] Application of different accelerometer cut-points to estimate preschool children's sedentary time in preschool

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The accelerometers, such as the Actigraphs, are used in measuring preschool children's sedentary time. There are several cut-points age-specifically designed for preschool children, and most of these cut-points have different count per minute (cpm) estimate for sedentariness. The aim of this study was to assess preschool children's sedentary minutes derived from four different validated cut-points recommended to use for preschool children. A pilot study of the DAGIS project was conducted in 2014. The 3-6-years old children from two different preschools (N=23) wore accelerometers (Actigraph wGTX3-BT) during one day (appr. 4 hours) in preschool. The four validated cut-points were compared: Sirard (<1204 cpm), Evenson (<100 cpm), Butte's vector magnitude (VM) (<820 cpm) and Butte's X-axis (<240 cpm). The sleep time was extracted from the analyses (appr. 30 minutes). Overall, the mean minutes of sedentariness were 173 (Sirard), 122(ButteX-axis), 106 (Evenson) or 96 (Buttes VM) minutes. According to Friedman's repeated measures ANOVA, there was a statistically significant difference in sedentary minutes depending on the cut-points, $\ddot{I}$‡2(3) = 65.035, p = 0.000. Post hoc analyses revealed that Butte's VM minutes differed to Butte's x-axis and Sirard. Evenson's minutes differed to Butte's and Sirard's. There were no significant differences between Butte's x-axis and Sirard's minutes, and between Butte's VM and Evenson's minutes. The amount of measured sedentary time is depended on the cut-points used. The variation should be acknowledged when comparing results conducted by accelerometers. The consensus about proper cut-points should be achieved, which helps to design proper sedentary recommendations.

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[P129] Preschool children's moderate-to-vigorous-activity cut-points: Comparison between cut-points based on vector magnitude and X-axis cut-points

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The movement of preschool children happens on several planes more often compared school-aged children or adults. The accelerometers, such as Actigraphs, are used for measuring children's moderate-to-vigorous activity (MVPA), and the current models of accelerometers allow measuring movement on three different axis. To our knowledge, there is currently only one validated cut-point values for preschool children based on the vector magnitude calculations (Butte's vector magnitude (VM) cut-points). This study aimed to compare the MVPA minutes according to VM and x-axis cut-points. A pilot study of the DAGIS project was conducted in 2014. The 3-6 years old children (N=23) wore accelerometers (Actigraph wGTX3-BT) (approx. 3 hours 30 minutes without naps) in preschool. The children had a physical activity lesson during the day. The Butte's VM cut-point of MVPA (>6112counts per minute, cpm) were compared to Sirard's (>2457cpm), Evenson's (>2296cpm), Pate's (>1680cpm), and Butte's x-axis cut-points (>2120cpm). The mean minutes of MVPA according to Butte's VM cut-points were 29 minutes.The other mean minutes were 22, 24, 36 and 28, respectively. According to Friedman's repeated measures ANOVA, there was a statistically significant difference in MVPA depending on the cut-points, Ï‡2(4) = 79.527, p = 0.000. Pairwise comparisons showed that the Butte's VM minutes for MVPA differed to Evenson's, Pate's and Sirard's minutes. No significant difference was found between Butte's VM and Butte's x-axis cut-points. To conclude, there was variation in MVPA minutes between used cut-points. The consensus about proper cut-points should be achieved, which helps to design proper MVPA recommendations.

[P130] Relationship between physical activity, screen-based sedentary, and body fat with cardiovascular risk in rural Thai adolescents

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Background
There has been a trend on reduction in habitual physical activity (PA) and increase in time spent for screen-based sedentary (SB) among adolescents. These factors may increase the risk of cardiovascular diseases (CVD).
Objective
To determine the relationships between PA, SB, and body fat with CVD risk score and cardiorespiratory fitness (CRF). Methods: A cross-sectional study was conducted in the rural area in northeast Thailand. Moderate-to-vigorous PA (MVPA) and SB were assessed in 477 adolescents using a validated questionnaire. A composite CVD risk score was computed based on age, sex, and sexual maturation standardized triglycerides, HDL-cholesterol, LDL-cholesterol, and glucose. The Queen's college step test was conducted to measure CRF which was presented as the maximal

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oxygen consumption (VO2 max). Body fat was calculated from anthropometry data based on the Slaughter's equation. Gender-specific multiple regression analyses were performed.

Results

Neither MVPA nor SB were associated with CVD risk score or CRF in both male and female adolescents. Percent body fat, however, was inversely associated with CRF in both genders (B = -0.26, p = 0.001 and B = -0.19, p = 0.000, respectively). In addition, higher percent body fat tended to be associated with higher CVD risk score in male adolescents, (B = 0.07, p = 0.011).

Conclusions

The findings indicate the important relationship between percent body fat and cardiovascular risk among rural northeast Thai adolescents. Nevertheless, the relationship between MVPA and SB with cardiovascular risk needs to be verified with more objective measures of the PA and SB.

Theme 12: Novel Methods for Measuring Physical Activity, Sedentary Behaviour and Sleep

[P132] Gender and age differences in hourly and daily patterns of sedentary time in older adults living in retirement communities

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Background

Patterns of sedentary time may vary by gender and age with differential health risks. The purpose of this study is to describe sedentary patterns of older adults and illustrate gender and age differences in those patterns.

Methods

Accelerometer data from 307 men and women (age=84±6 years) were classified into bouts of sedentary time. Linear mixed models computed daily and hourly summaries of mutually non-exclusive bouts of sedentary time that were 1+, 5+, 10+, 20+, 30+, 40+, 50+, 60+, 90+ and 120+ minutes in duration.

Results

Age was positively associated with sedentary time, but only in bouts of 20+, 30+, 40+, 50+, and 60+ minutes. Men accumulated more sedentary time than women in 1+, 5+, 10+, 20+, 30+, 40+, 50+ and 60+ minute bouts; the largest gender-differences were observed in 10+ and 20+ minute bouts. Women had more daily 1+ minute sedentary bouts than men (71.8 vs. 65.2), indicating they break up sedentary time more often. Men and women were more often sedentary after 13:00. Gender differences in intra-day sedentary time were observed before 11:00 with women accumulating less sedentary time overall, but having significantly more 1+ minute bouts.

Conclusions

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Patterns of sedentary behavior associated with age and gender can be identified by examining bouts of sedentary time; awareness of these patterns can help interventionists better target sedentary time and may aid in the identification of health risks associated with sedentary behavior. Future studies should investigate the impact of patterns of sedentary time on healthy aging, disease, and mortality.

[P133] Energy expenditure of the dominant and non-dominant wrist recorded by commercial accelerometers compared to indirect calorimetry

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Introduction
As technology advances, so the market for wearable commercially available accelerometers is growing. However, very little research information is available on these devices. Therefore the aim of this study was to determine the validity of the commercially available accelerometer Garmin Vivofit for energy expenditure.

Methods
Ethical approval for this study was obtained from the University of Otago Human Ethics Committee. Nineteen volunteers provided written informed consent before participating in the study. Participants characteristics were then entered into the Garmin Connect App. A Garmin Vivofit was positioned on each wrist and an expired air sample was collected using indirect calorimetry (Metalyser 2, CORTEX, Leipzig, Germany). Participants completed 6 minutes of treadmill walking at 4.8 km.h-1 and 0.5 % incline. The number of steps and energy expenditure was downloaded and recorded for each device. Statistical analysis: One way ANOVA were used to determine differences between devices. Significance was set at $P<0.05$, data presented mean ± standard deviation.

Results
No significant difference was seen between the dominant and non-dominant wrist for steps (dominant 570.1 ± 176.1 steps, non-dominant $554.2 ± 213.4$ steps, p= 0.598). There was however, a significant difference for energy expenditure (dominant 34.4 ± 6.5 kcals, non-dominant $25.1 ± 7.5$ kcals, p<0.001). Compared to the Metalyser ($29.0 ± 6.8$ kcal), there was no significant difference between the non-dominant wrist, (p=0.134), but there was for the dominant wrist, (p=0.043).

Discussion
These data suggest that the Garmin Vivofit should be worn on the non-dominant wrist when assessing energy expenditure during walking activities.

[P134] Comparison of physical activity adult questionnaire results with accelerometer data

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Background

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Discrepancies between self-reported and objectively measured physical activity are well-known. For the purpose of validation, this study compares a new self-reported physical activity questionnaire with an existing one and with accelerometer data.

Methods

Data collected at one site of the Canadian Health Measures Survey in 2013 were used for this validation study. The International Physical Activity Questionnaire (IPAQ) was administered to respondents during the household interview, and the new Physical Activity for Adults Questionnaire (PAAQ) was administered during a subsequent visit to a mobile examination centre (MEC). At the MEC, respondents were given an accelerometer to wear for seven days. The analysis pertains to 112 respondents aged 18 to 79 who wore the accelerometer for 10 or more hours on at least four days.

Results

Moderate-to-vigorous physical activity (MVPA) measured by accelerometer had higher correlation with data from the PAAQ (r = 0.44) than with data from the IPAQ (r = 0.20). The differences between accelerometer and PAAQ data were greater based on accelerometer-measured physical activity accumulated in 10-minute bouts (30-minute difference in MVPA) than on all minutes (9-minute difference). The percentages of respondents meeting the Canadian Physical Activity Guidelines were 90% based on self-reported IPAQ minutes, 70% based on all accelerometer MVPA minutes, 29% based on accelerometer MVPA minutes accumulated in 10-minute bouts, and 61% based on self-reported PAAQ minutes.

Interpretation

The PAAQ demonstrated reasonable validity against the accelerometer criterion.

[P136] Application of the sedentary sphere concept to automatically classify sleep from GENEActiv data in children and adults

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Twenty-four hour wear protocols are recommended when assessing physical activity (PA) and sedentary behaviour (SB) necessitating the removal of sleep from data before calculating PA and SB outcomes. Automatic detection of sleep and wake removes the need for sleep logs simplifying data collection and analysis. The aim of this study was to evaluate the concurrent validity of sleep classified by the GENEActiv relative to the Multimedia Activity Recall for Children and Adults (MARCA). Twelve adults (20-60 y) and 51 children (10-12 y) wore a GENEActiv on their non-dominant wrist for 1-4 days and completed the MARCA. Sleep was calculated from the GENEActiv data using the Sedentary Sphere concept with a low (L) and high (H) threshold. There was strong intra-individual agreement of synchronised 5 min epoch data from the MARCA and GENEActiv, slightly stronger for the higher threshold (Adults: sensitivity L:79±12%, H:89±9; specificity L:95±5% H:91±8; and kappa L:0.79±0.34, H:0.81±0.29. Children: sensitivity L:75±18%, H:86±10; specificity L:95±5% H:94±6; and kappa L:0.71±0.37, H:0.78±0.32). Sleep duration was shorter than recalled in the

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MARCA in adults when using the L threshold (460±100 min vs 523±90 min, p=0.002) and in children for either threshold (L:504±129 min vs 630±55 min, p<0.001; H:586±79 p=0.003), but not different when using the H threshold in adults (544±128). In conclusion, the Sedentary Sphere concept enables the automatic detection of sleep and wake in free-living adults and children. Application of this concept will facilitate efficient processing of PA and SB outcomes from free-living wrist-worn GENEActiv data collected using 24 h wear protocols.

[P137] Reliability and validity of the ActivPAL Activity Monitor for office-based tasks

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The ActivPAL physical activity monitor has been previously reported as a reliable and valid tool to measure everyday physical activities. The aim of this study was to examine the reliability and validity of the ActivPAL during typical office-based activities. A convenient sample of 10 adults participated in this study with two ActivPAL units attached to the participants right thigh. Participants completed 6 minutes of specific office-based tasks such as typing an email, writing on a whiteboard, collecting printing and running a small errand with instructions provided through an audio recording. Each bout was filmed with time of sitting, standing and walking visually assessed using the same categories provided by the ActivPAL analysis. Reliability between ActivPAL recordings was assessed via Wilcoxon comparisons and intraclass correlation coefficients (ICC). Relative error was calculated as the difference between visual observations and ActivPAL recordings. Validity was assessed via Wilcoxon comparisons between ActivPAL recordings and video observations. There were no significant differences between ActivPAL units for sitting (196.2+/-5.0 vs. 195.9+/-5.1 seconds), standing (121.8+/-4.8 vs. 122.3+/-6.9 seconds) or walking (42.0+/-6.1 vs. 41.9+/-7.1 seconds) activities. Significant ICC were detected for sitting (0.928), standing (0.849) and walking (0.849) time. In contrast, the ActivPAL recordings for sitting, standing and walking time were significantly different to visual observations (p<0.05) with an average relative error of >3.8%, >24.5% and >54.1%, respectively. The current study has identified ActivPAL units as reliable tools to document physical activity. However, the ActivPAL underestimated sitting and walking time, and overestimated standing time during office-based tasks.

[P138] Physical activity levels of pre-menopausal New Zealand European women differ across age groups

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Background

Physical activity (PA) influences predictors of long-term health outcomes, particularly cardiorespiratory and metabolic health. This report investigates objectively measured PA levels in healthy, pre-menopausal women participating in the women's EXPLORE (Examining the Predictors Linking Obesity Related Elements) study.

Methods

In this cross-sectional study, 210 healthy New Zealand European women aged 16-45y were classified into three age-groups (16-25; 26-35; 36-45y). Triaxial accelerometers were worn for 7 days to assess levels of sedentary, light, moderate and vigorous PA (0-99, 100-2019, 2020-5998, ≥5999 counts/min, respectively). Data were analysed using two-way ANOVA.

Results

Half (49.5%) of the women performed ≥10 min vigorous PA, whilst 22.4% engaged in no vigorous PA. Furthermore, 25% of women did not meet PA guidelines for moderate (150 min/wk) or vigorous (75 min/wk) PA, however moderate and vigorous PA differed only non-significantly between age-groups. The 36-45y women engaged in less sedentary behaviour compared to 26-35y (mean ±SD; 4050 ±749; 4355 ±761 min/wk, respectively (P=0.038, 95% CL)) and more light PA relative to 16-25y and 26-35y (2609 ±560 v 2142 ±441, 2244 ±542 min/wk, respectively (P=0.000, 95% CL)).

Conclusion

Alarmingly, 25% of pre-menopausal New Zealand European women failed to meet PA guidelines recommended to be beneficial for cardiorespiratory and metabolic health. Across age-groups, PA levels varied unexpectedly, with the older women less sedentary and performing more light PA than their younger counterparts. Given the importance of light PA as well as reduced sedentary time in reducing mortality, these older women could gain protective health effects from their levels of PA.

Theme 13: Measurement of Energy Expenditure: Prediction Equations

[P139] How many days of monitoring are needed to assess energy expenditure in young adults using the SenseWear?

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Purpose

The SenseWear Armband is a versatile monitor that integrates motion sensors with heat-related sensors. It collects measures of free-living physical activity and energy expenditure. Little research however has examined the most appropriate wear time needed to examine energy expenditure. The aim of this study was to determine how many days of monitoring are needed to reliably estimate young adults' energy expenditure.

Methods

The energy expenditure of young adults was measured for seven consecutive days (n=90) using the SenseWear Armband (BodyMedia Inc, USA). BodyMedia Proprietary software (version 7) was used to determine energy expenditure values. Seven valid day wear time criteria were examined (8hrs/day, 9hrs/day, 10hrs/day, 11hrs/day, 12hrs/day, 13hrs/day, 14hrs/day). Intra-class correlation

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coefficients estimated the reliability for any individual day for each wear time criteria. The Spearman-Brown prophecy formula was used to determine the number of days of monitoring needed to achieve reliability estimates of 0.7, 0.8 and 0.9.

Results

The number of days needed to reliably estimate energy expenditure decreased as the daily valid wear time criteria required increased. To achieve a reliability of 0.9, 4.5 days of at least 11hrs/day wear time was required (93% of compliance). In contrast, 100% of the sample was retained when using a reliability of 0.8 and 2.8 days of 8hrs/day wear time.

Conclusions

These initial findings suggest that to reliably assess energy expenditure in young adults using the SenseWear Armband with a reliability estimate of 0.9, 5 days of 11hrs/day wear time is required.

[P140] Under-reporting of energy intake in Australia

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Misreporting of energy intake is a common source of measurement error found in dietary surveys. Basal metabolic rate (BMR) contributes to a very large portion of total daily energy expenditure. BMR can be estimated using prediction equations that take into account an individual's age, gender, height and weight. Prediction equations vary in their accuracy; many overestimate BMR, especially in modern obese populations. The aim here is estimate the level of under-reporting and over-reporting of food intake by population subgroups, and to investigate whether some of the misreporting can be partly explained by people attempting to lose or gain weight via dieting. The Mifflin-St Jeor equation, which has been shown to be unbiased in both obese and non-obese adults, is used and the Goldberg cut-off method is then applied to identify those who reported implausible intake amounts. Data from the 2011-12 National Nutrition and Physical Activity Survey (NNPAS) are used; energy intake is reported through 24-hour dietary recall. Sixty-four per cent of all 12,153 respondents also participated to a second 24-hour recall. The findings in this study will help future research reconcile the discrepancy between reported energy intake and reported energy expenditure for a given individual.

Theme 14: Advances in Technologies for Physical Activity Assessment

[P141] Wearable activity trackers sold by the millions; How do they stack up? A validation pilot study

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Background

Wearable technology, such as activity trackers and some smartphone applications have become technology available to all consumers for self-monitoring of physical activity and other health indicators. They represent affordable physical activity measurement devices for research purposes. However, many of these devices and applications lack assessment of their measurement properties.

Methods

Ten participants (5 females) completed two walks and two jogging bouts on a 500m outdoor course. Participants wore 4 wearables (Fitbit Charge (FBC), Garmin Vivofit (GNV), Jawbone UP24 (JBU) and Misfit Shine (MFS)) on the wrist; a GT3X and Fitbit Zip (FBZ) on the hip; and held an iPhone, running Health (IPH) and Moves (IPM) applications, in the hand. Steps taken were recorded manually by an observer. Readings of step counts were taken from each device or application at the beginning and end of each activity. Descriptive statistics of steps counts and percent error, relative to the GT3X, were calculated for each of the measures. The presence of systematic bias was examined using Bland-Altman plots.

Results

Preliminary results show mean errors, relative to the GT3X, ranging from -6.3 to 4.1% and -4.0 to 6.2% for walking and jogging, respectively. Bland-Altman analyses for each device, application and observation demonstrated that no evident bias pattern could be seen. None of the measurement methods had more than 2 observations outside the 95% limits of agreement. Four of the devices malfunctioned on 2-5 occasions (failure to sync with iPhone was most common problem), hence failed to provide step counts.

Conclusion

Our results provide some indication of device and application validity, compared to the GT3X. However, there was substantial variation in the absolute measures, whilst device malfunction resulted in the loss of a notable number of observations. Nevertheless, our results are initially promising and provide direction for future studies including larger samples and over longer periods in free-living situations.

[P142] Validation of the 'Short questionnaire to assess health enhancing physical activity' (SQUASH) in a multi-ethnic population using a combined accelerometer and heart rate monitor

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Aim

To investigate the validity of the SQUASH (Short QUestionnaire to ASses Health enhancing physical activity) in a multi-ethnic population living in Amsterdam, the Netherlands using an objective

measure of physical activity (PA).

Methods

We included 470 participants: Dutch (n=114), Turkish (n=93), Moroccan (n=72), South Asian Surinamese (n=98), African origin Surinamese (n=93), aged 40-54 years. The SQUASH was self-administered twice (4-10 weeks interval) and participants wore a combined accelerometer and heart rate meter (Actiheart) for five days. Test-re-test reliability was assessed with Intraclass Correlation Coefficients (ICC) for continuous outcomes and Cohen's Kappa for categorical variables. Limits of Agreement between SQUASH and Actiheart measures of PA were calculated.

Results

The SQUASH had a poor to fair test-re-test reliability, ICC for moderate intensity PA ranged from 0.05 in Moroccan to 0.41 in South Asian Surinamese women. Cohen's kappa for meeting the PA norm ranged from 0.01 in South Asian Surinamese to 0.48 in African Surinamese men. Compared to Actiheart measures, the SQUASH underestimated light intensity PA in all groups and overestimated moderate intensity activity in the ethnic minorities. Differences between Actiheart and SQUASH measures in moderate intensity PA in ethnic minority compared to Dutch participants were not statistically significant in men; in women these were explained by differences in age.

Conclusion

We found low validity of the SQUASH questionnaire by ethnic group, which could be explained by background characteristics. Measuring PA in ethnic groups by accelerometry and heart rate monitoring is advised whereas caution should be performed using the SQUASH questionnaire.

Theme 15: Active Transport and the Built Environment

[P143] Higher transport-related physical activity levels are associated with lower prevalence of cardiovascular risk factors in Chile

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Lack of physical activity (PA) is one of the main risk factors for developing cardiovascular disease. However, little is known about the relationship between PA and cardiovascular risk factors in the Chilean population. Therefore, the aim of this study was to investigate the association between

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different levels and intensities of PA and the prevalence of cardiovascular risk factors in Chilean adults. Participants from the National Health Survey 2009-10 (n=5,157) were included in this study. The prevalence of type 2 diabetes, hypertension, metabolic syndrome and dyslipidemia were determined using international criteria. PA levels were determined using the Global Physical Activity Questionnaire (GPAQ v2) and different levels of PA were derived from this questionnaire (transport-related, moderate and vigorous PA). Quartiles of PA were determined to investigate the association between PA and cardiovascular risk factors. 23.1% of women and 17.1% of men did not meet the PA recommendation (≥600 METs.min.week-1). When prevalence of CV risk factors were compared between inactive individuals (<600 METs.min.week-1) and active individuals (≥9500 METs.min.week-1) a significant reduction in the prevalence of diabetes (6.2% and 10%), hypertension (18.0% and 12.4%) and metabolic syndrome (8.9% and 12.1%) for women and men, respectively was found in the active participants. Similar results were found for high versus low transport-related PA. Increasing moderate to vigorous or transport-related PA is associated with significant reductions in the prevalence of cardiovascular risk factors in Chilean adults.

[P144] A systematic review of economic analyses of active transport interventions that include physical activity benefits

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Physical inactivity is one of the leading causes for the growing prevalence of non-communicable diseases worldwide and there is a need for more evidence on the effectiveness and cost-effectiveness of interventions that aim to increase physical activity at the population level. This study aimed to update a systematic review published in 2008 by searching peer-reviewed and unpublished literature of economic evaluations of transport interventions that incorporate the health related effects of physical activity. Our analysis of methods for the inclusion of physical activity related health effects into transport appraisal over time demonstrates that methodological progress has been made. Thirty-six studies were included, reflecting an increasing recognition of the importance of incorporating these health effects into transport appraisal. However, significant methodological challenges in the incorporation of wider health benefits into transport appraisal still exist. The inclusion of physical activity related health effects is currently limited by paucity of evidence on morbidity effects and of more rigorous evidence on the effectiveness of interventions. Further scope exists to improve both the consistency and transparency of reporting of transport economic evaluations. Overall, our analysis further demonstrates that transport interventions that incorporate physical activity related health benefits can be cost-effective. The magnitude of the contribution of the physical activity effects to cost effectiveness is dependent on other factors, such as the intervention costs and the other benefits and disbenefits included.

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[P145] A model to estimate physical activity effects on health

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Aims
There is growing evidence to support investment in urban infrastructure and policies that promote physical activity. Economic models that incorporate health outcomes of environmental interventions vary in their approaches. This study aimed to develop a model that evaluates the impact of environmental interventions on health outcomes through changes in physical activity levels.

Methods
An existing multi-state life table model (ACE-Prevention physical activity 2003) was updated with: epidemiological data from the Global Burden of Diseases 2010 study (GBD), physical activity prevalence data from the Australian Health Survey (AHS) 2011-12 and population and mortality estimates from the Australian Bureau of Statistics. Four categories of physical activity were incorporated (compared to three in the original model) to match relative risks from the GBD study. Health outcomes attributable to changes in physical activity are measured in terms of averted disability adjusted years (DALYs) and health adjusted life expectancy (HALE) due to changes in mortality and morbidity of five physical activity related diseases (ischemic heart disease, ischemic stroke, type 2 diabetes colon cancer and breast cancer). Changes in health care costs can also be estimated.

Implications
 The model developed is a flexible tool that can be used to assess the health outcomes of interventions and policies aiming to increase physical activity at a population level. It can be also applied in economic evaluation to calculate cost effectiveness and cost utility ratios (AU$/DALY).

Theme 16: Physical Activity Interventions: Limitations and Improvements

[P146] Effect of after-school program on health education and cardio-respiratory fitness in primary school children in Qatar

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1 *Aspetar, Healthy lifestyle program*

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Introduction
Participation in regular physical activity (PA) has numerous health benefits for children.From recent survey, the normal school day did not provide complete 60 minutes of moderate to vigorous PA for children as the national physical activity guidelines recommended in Qatar. One strategy to increase

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PA is to promote it during after-school hours. The effectiveness of this strategy is unknown in Qatar.The aim of this study is to develop an interactive sport-based health program to improve health knowledge and physical fitness among primary schoolchildren.

Methods

A total of 88 students were recruited from 4 different primary schools aged from 9-12 (mean10.7±1.4) yrs. old. An 8 week interactive sport-based health program was implemented 2 days/week for 60 minutes/day. Physical and health knowledge assessments were done twice, 1st week and 8th week of the program. A short 8-item questionnaire to assess knowledge of participants on adequate PA, nutrition and sleep was administered. Physical testing included 20m shuttle run and 20m sprint that were collected using stop watches by trained PE Teachers. A repeated measure ANOVA was performed using SPSS software.

Results

A total of 51 students (18 boys and 42 girls) were available for testing at the end of 8th week. The participants improved sprint time on 20m sprint from 5.5±0.1 (s) to 4.7±0.1 (s) and performance on 20m shuttle run from 3.9±0.3 (level) to 5.5±0.3 (level), P0.001. The absence of interaction with gender suggests that, the positive improvements in BMI and physical performances were similar in boys and girls. Although both boys and girls showed better knowledge after the program (P<0.001), the girls showed relatively higher change than the boys (P=0.047).

Conclusion

This study proves that after school program can increase the physical fitness and provides opportunity for health education. Further research should consider large sample and implement the intervention at primary schools as a venue.

[P147] Physical activity and screen activities of Brazilian adolescent girls attending a randomized controlled trial: post-intervention changes of the 'Healthy Habits, Healthy Girls' Brazil program

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Background

Inadequate physical activity and time spent on screens are prevalent among Brazilian adolescents, especially girls from disadvantaged backgrounds.

Objective

To evaluate post-intervention changes of multiple-component school-based intervention on physical activity and screen activities in a sample of adolescent girls.

Methods

'Healthy Habits, Healthy Girls-Brazil'(H3G-Brazil) was evaluated using a randomized controlled trial with 253 adolescent girls (16.05±0.85 years) attending schools in disadvantaged backgrounds from Sao Paulo. Physical activity and screen activities were assessed using a validated self-reported questionnaire. Moderate and vigorous physical activity was categorized into the following: i)

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inactive, ii) insufficiently active and iii) active. The average time spent per day in front of the TV, the computer and sum of activities during weekdays and weekends was calculated. Statistical analyses followed intention-to-treat principles, and were conducted using chi-square tests and linear mixed models with alpha level set at p<0.05.

Results

There were statistically significant group-by-time effects for time spent on the computer on weekdays [-0.43 hours (SE 0.28); p=0.033] and weekends [-0.14 hours (SE 0.27); p=0.024] and for total screen-time on weekends [-0.78 hours (SE 0.37); p=0.006], favoring H3G-Brazil group. Statistically significant differences for light (x2= 20.95; p=0.007) and vigorous (x2= 8.09; p=0.017) physical activity were found. Proportionally, girls from H3G-Brazil increased their time spent on vigorous PA, in comparison to those in the control group (3.5%-9.9% vs. 2.7%-1.0%).

Conclusion

H3G-Brazil assisted adolescent girls to reduce their computer-based screen-time and increased their physical activity frequency. H3G-Brazil might serve as a model for other programs in poor-and-middle-income countries.

[P150] Effects of a physical activity intervention aiming to increase step count on the quality of daily physical activity and physical fitness in young adult women

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Objective

To assess the effects of a free-living physical activity (PA) intervention aiming to increase step count (SC) on changes in daily PA and physical fitness (PF).

Methods

Twenty-eight healthy young adult women were randomly assigned to an 8-week of intervention group (n=15) that wore an accelerometer and were instructed to increase their SC by at least 21,000 steps/wk from their baseline, or a control group (n=13). Aerobic capacity and lower limb strength were assessed by the lactate threshold (LT) using a bench-stepping test and by a 30-s chair stand test, respectively. The daily changes in the time spent engaging in PA of light intensity (LPA), moderate-to-vigorous intensity (MVPA), at the LT intensity or above (LTPA), and sedentary activity (SA) were measured by the accelerometer and self-report.

Results

MVPA and LTPA, expressed as a percentage, of the total time during which the accelerometer was worn were significantly increased compared with the baseline values, whereas the %SA was significantly decreased. In contrast, no significant groupÃ—period interactions were observed in the PF. However, a significant correlation was found between the changes in time for â‰¥LTPA and in aerobic capacity scores (r=0.542, p<0.05) in the intervention group.

Conclusion

These results indicated that this intervention increased SC, accompanied by an increase in the proportion of MVPA, and a decrease in the proportion of SA of day-time PA. However, a sufficient

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increase in time for LTPA, which would lead to obvious effects on PF, was not observed in the group of healthy young adult women.

[P151] Physical activity as medicine: Are we prescribing an overdose?

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2015 will mark the twentieth anniversary of the internationally accepted physical activity guidelines of 150 minutes of moderate intensity activity per week. These guidelines are the first choice of treatment for a range of non-communicable diseases, but are they effective? Recent debate over the value of physical activity as medicine for the management of non-communicable diseases does not pertain to activity per se; but rather how physical activity as medicine is prescribed. This presentation reflects on the hundred-year development of the current guidelines; from their origins in Bonn, Germany at the end of the nineteenth century; through the formative epidemiological studies in the 1950-70s that defined frequency, intensity and duration of physical activity; to the 1995 publication of the guidelines and their subsequent updates. We discuss the recent anthropomorphic changes in our society due to the global rise in obesity and speculate whether the current physical activity guidelines remain fit for purpose. Body mass is increasing, and with it the energy cost of exercise. As a result, adults today are potentially overdosing on exercise, creating the high dropout and injury rates, poor outcomes and encouraging compensatory behaviours like increased appetite. We highlight the limitations of the current evidence base for physical activity then propose a shift to individualised physical activity prescription based either on BMI or one or more of the other factors that affect energy expenditure.

[P152] Does level of obesity influence reduction in anthropomorphic outcome measures due to brisk walking in obese adults?

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The physical activity guidelines of 150 minutes each week of moderate intensity activity are derived from energy expenditure data on healthy-weight men. For obese adults, exercise is perceived as harder, with resulting poor compliance and outcomes. This systematic review examined whether walking is an effective intervention for obese adults and if increasing obesity correlated to a change in body weight, composition or waist circumference. The electronic databases AMED, CINAHL, MEDLINE, PEDro, SPORTDiscuss were searched from inception to December 2014 with keywords and synonyms of: 'obese' and, 'walking'. Primary outcomes were change in body weight, BMI, waist circumference and body composition (body fat percentage, fat mass and, fat-free mass). After screening, 20 studies comprising 1,417 participants with BMIs from 30.0 to 41.6kg/m2 were included. The average dose of walking was 3 hours per week over 22 weeks at 73% maximum heart rate. Standardized mean difference was calculated for change in body weight (SMD=-2.26), waist

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circumference (SMD=-3.04) and, body composition: fat mass (SMD=-2.59) and, fat-free mass (SMD=0.29). Linear regression established that baseline BMI accounted for none of the explained changes in all outcomes other than fat-free mass (27%). Walking for obese adults was clinically effective with change in body composition; loss of body fat whilst gaining fat-free mass, suggesting a greater health benefit than is evident when measuring weight or BMI alone. Significant heterogeneity (I2 >80%) limited our attempt to track the influence of BMI on change in outcomes, possibly due to individual studies clustering participants into a single homogenous obese category.

[P153] Implications for physical activity interventions: what can we learn from women's perceptions of their physical activity?

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Purpose

This study investigated mental health and sleep quality in women with varying levels of perceived physical activity (PA).

Methods

103 women (age: 23.3 + 3.0 y; BMI: 22.8 + 3.8) compared their PA levels (Poor, Fair, Good, Very Good, Excellent) to that of their peers and were accordingly classified as having perceived levels of low (LPA), moderate (MPA) or high (HPA) PA. Questionnaires were completed addressing mental health (Depression Scale developed by the Center for Epidemiological Studies; Body Satisfaction Scale) and sleep quality (Pittsburgh Sleep Quality Index). Chi-squared assessments were used to identify significant differences in depression, body satisfaction, and sleep quality between PA groups ($p < 0.05$).

Results

Chi-squared analysis detected fewer scores of depression for the HPA group (39.4%) compared to MPA (72.5%) and LPA (53.3%), $X2(2, N= 103) =8.2$, $p = 0.016$. The HPA group had fewer scores of body dissatisfaction (15.2%) compared to MPA (37.5 %) and LPA (43.3%), $X2(2, N = 103) = 6.63$, $p = 0.036$. The LPA group had more scores of poor sleep quality (76.7%) compared to MPA (52.5%) HPA (48.5%), $X2(2 = 103) = 6.02$, $p = 0.049$.

Conclusions

Women with lower self-perceived PA seem to be at greater risk for depression, body dissatisfaction and inferior sleep quality compared to women perceiving higher PA. The co-existence of circumstances contributing to poor health can pose as barriers to initializing and maintaining PA. Future programs should address health in a comprehensive way with goals beyond the narrow scope of PA and weight-loss.

[P154] How accurate is self-reported physical activity data?

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Imprecise measurement of physical activity variables might attenuate estimates of the beneficial effects of activity on health-related outcomes. We aimed to compare the metabolic traits dose-response relationships for physical activity and sedentary behaviour between accelerometer- and questionnaire-based activity measures. Physical activity and sedentary behaviour were assessed in 317 adults by 7-day accelerometry and International Physical Activity Questionnaire (IPAQ). Fasting blood was taken to determine insulin, glucose, triglyceride and total, LDL and HDL cholesterol concentrations and HOMA-IR. Sedentary behaviour was significantly associated with all measured risk factors. However, for HOMA-IR and insulin the regression coefficients were >50% lower for the IPAQ-reported compared to the accelerometer-derived measure ($p<0.0001$). The relationships for moderate-to-vigorous physical activity (MVPA) and risk factors were less strong than those observed for sedentary behaviours, but significant negative relationships were observed for both accelerometer and IPAQ MVPA measures with metabolic markers. However, regression coefficients for HOMA-IR, insulin and triglyceride were 43 50% lower for the IPAQ-reported compared to the accelerometer-derived MVPA measure ($p<0.01$). Using the IPAQ to determine sitting time and MVPA reveals some, but not all, relationships between these activity measures and metabolic markers. Using this self-report method to quantify activity can therefore underestimate the strength of some relationships with risk factors.

Theme 17: Measurement Error and New Statistical Modelling

[P155] Validity of self-reported weight and height by schoolchildren using a web-based questionnaire: the WebCAAFE study

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Objective

To assess the validity of web-based self-reported weight, height and resulting body mass index (BMI) compared with standardized measurement.

Methods

A total of 2230 Brazilian schoolchildren (7-10-y-old) from 34 public schools participating in the WebCAAFE study completed a web-based questionnaire designed to assess food consumption, physical activity and weight status. Children's weight and height were objectively measured by researchers using standardized procedures, and the information given to participants on the same day that they completed the questionnaire. To compare data, the following indicators were computed: intraclass correlation coefficient (ICC); Bland Altman limits of agreement for weight, height and BMI as continuous variables; kappa statistics and percentage agreement for validity, sensitivity and specificity of BMI categories (normal, overweight, obese).

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Results

Validity was high compared to measured data, with ICC ranging from 0.97 for height to 0.99 for weight. Limits of agreement (Â± 2 SD) for weight varied between -4.9 and +5.2kg; for height between -0.4 and +0.4m. BMI classification was correct in 94% of cases; kappa was 0.85 for overweight and 0.93 for obesity. Of 2230 participants, 22.9% were classified as overweight (without obesity) with measured data vs 22.2% with web-based self-reporting (sensitivity of 87%; specificity of 97%). For obesity, 14.3% vs 14.6% were classified as obese, respectively (sensitivity of 95.4% and specificity of 98.9%).

Conclusions

Web-based self-reported weight and height data from the WebCAAFE study can be considered as sufficiently valid to be used for monitoring weight status.

[P156] Scale development for measuring the quality of food consumption using a two-dimensional item response modeling: an application to Brazilian schoolchildren

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Objective

To develop a scale for assessing the compliance of food consumption by schoolchildren according to Brazilian Food Guidelines (BFG), using a two-dimensional item response theory (IRT) modeling.

Methods

Brazilian schoolchildren aged 7-10 years (N=2,159, 2nd to 5th elementary grades) completed a web-based questionnaire consisting of 32 food items, categorized as recommended - RFIs (dairy products, cereals, beans, meat/poultry/fish/eggs, fruits, and vegetables) and less recommended items - LRFIs (sweets, sodas/sweetened beverages, ultra-processed foods, salty snacks). Full information factorial analysis (FIFA) was applied to identify the appropriate dimensionality of the latent trace. A two-dimensional polytomous ordinal IRT compensatory model was fitted to develop the scale and estimate the quality of the schoolchildren's food consumption.

Results

Two dimensions were identified by FIFA, one related to the RFIs and the other to the LRFIs. One of the six RFIs also showed some factorial load on the dimension defined by the LRFI, and the opposite occurred with two of the four LRFI. On the dimension of RFI, the fitted model showed that children adhering to the recommendations for fruits and vegetables are also more likely to consume the other RFIs. On the dimension of LRF, children not consuming sodas/sweetened beverages are more likely not to consume the other LRFIs. The estimates of the two-dimension latent trace showed that data from this sample pointed to more appropriate food consumption with regard to the LRFG than to the RFG.

Conclusions

Fitting the two-dimensional IRT model showed that our sample had insufficient information for some of the higher scoring items.

[P157] Physical activity in Vietnam: Estimates and measurement issues

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Aims
Our aims were to provide the first national estimates of physical activity (PA) for Vietnam, and to investigate issues affecting their accuracy.

Methods
Measurements were made using the Global Physical Activity Questionnaire (GPAQ) on a nationally-representative sample of 14706 participants (46.5% males, response 64.1%) aged 25âˆ'64 years selected by multi-stage stratified cluster sampling.

Results
Approximately 20% of Vietnamese people had no measureable PA during a typical week, but 72.9% (men) and 69.1% (women) met WHO recommendations for PA by adults for their age. On average, 52.0 (men) and 28.0 (women) MET-hours/week (largely from work activities) were reported. Work and total PA were higher in rural areas and varied by season. Less than 2% of respondents provided incomplete information, but an additional one-in-six provided unrealistically high values of PA. Those responsible for reporting errors included persons from rural areas and all those with unstable work patterns. Box-Cox transformation was the most successful method of reducing the influence of large values, but energy-scaled values were most strongly associated with pathophysiological outcomes.

Conclusions
Around seven-in-ten Vietnamese people aged 25-64 years met WHO recommendations for total PA, which was mainly from work activities and higher in rural areas. The GPAQ can be utilised to provide information on PA, but with some issues in measurement and reporting identified.

[P158] Assessing and reporting uncertainties in dietary exposure analysis - Mapping of uncertainties in a tiered approach

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Uncertainty analysis is an important component of dietary exposure assessments in order to understand correctly the strength and limits of its results. Often, standard screening procedures are applied in a first step which results in conservative estimates. If through those screening procedures a potential exceedance of health-based guidance values is indicated, within the tiered approach more refined models are applied. However, the sources and types of uncertainties in deterministic and probabilistic models can vary or differ. A key objective of this work has been the mapping of different sources and types of uncertainties to better understand how to best use uncertainty analysis to generate more realistic comprehension of dietary exposure. In dietary exposure assessments, uncertainties can be introduced by knowledge gaps about the exposure scenario, parameter and the model itself. With this mapping, general and model-independent uncertainties have been identified and described, as well as those which can be introduced and influenced by the specific model during the tiered approach. This analysis identifies that there are general uncertainties common to point estimates (screening or deterministic methods) and probabilistic exposure assessment methods. To provide further clarity, general sources of uncertainty affecting many dietary exposure assessments should be separated from model-specific uncertainties.

[P159] Functional data analysis methods for physical activity measurements using accelerometers

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Purpose

To propose a novel functional data analysis framework to fully characterize activity intensity, duration and frequency based on accelerometer data.

Background

Traditional approaches reduce accelerometer data into simple summary measures, such as time and bouts in intensity categories (sedentary, light, moderate and vigorous activities). However, these approaches depend on specifying cut points for intensity or thresholds for bout length (e.g., 10 minutes), which are often subjective, and often omit refined information within categories.

Methods

6507 women aged 63 to 99 years wore an Actigraph GT3X+ accelerometer in the Objective Physical Activity and Cardiovascular Health Study (OPACH). Accelerometer data were transformed and analyzed by a functional data analysis framework. Two functional indices were proposed to characterize the distribution of intensity and bout length continuously, free of cut points or thresholds. Functional principal component analysis and functional regression models were adapted to understand major modes of variations of activity profile and their association with health outcomes. These methods were applied to accelerometer data from the OPACH.

Results

The functional indices demonstrated the distribution of activity intensity and bout lengths of older

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women. Two principal components were found to explain most variation in activity intensity profile, one indicating the overall activity level across all intensity categories and the other describing relative shifts of light versus moderate and vigorous activities. These components were significantly associated with glucose and insulin levels among older women.

Conclusions

A flexible and interpretable modelling framework was proposed to utilize the rich information in high resolution accelerometer data.

[P160] Methods for estimating the usual intake of foods: MSM versus NCI

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To compare two different methods for estimating the usual intake of foods in the prediction of individual consumption. Food consumption data were obtained by two 24HR and a Food Frequency Questionnaire (FFQ) applied in a cross-sectional population-based survey performed in 2008 with 488 adults and older adults living in Sao Paulo, Brazil. Two foods with different percentage of non-consumption in both 24HR and FFQ (milk and soda) were selected to compare the estimates provided by MSM and NCI methods. The amount of each food consumed in each one of the two 24HR was included for analysis and the frequency obtained in the FFQ was added as covariate in the probability and in the quantity models in both methods. The percentage of zero for milk was 22.2% in both 24HR and 13.5% in the FFQ. For soda, the percentage of zero was 72.2% in both 24HR and 26.9% in the FFQ. There was a high correlation for the prediction values between methods (Spearman, r=0.95 for milk, r=0.92 for soda). Significant difference in the mean estimated from the methods was observed only for milk (MSM = 128.2mL; NCI = 117.6mL). The intraclass correlation coefficient was 0.91 for milk and 0.86 for soda, and the kappa value was 0.70 for milk and 0.58 for soda. Both methods provided similar estimates for the population group with the worst estimates when the proportion of zeros is higher. However the individual estimate presents major differences between the methods that need to be considered in association studies.

[P161] Improvement of FFQ dietary intake estimates by the combination of approaches

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Food Frequency Questionnaires (FFQ) are commonly used for dietary intake assessment in

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epidemiological studies, being an important method for investigating the relation between diet and diseases. Our aim was to test the performance of the FFQ using two approaches: food portions obtained in a subsample and application of calibration equations. We selected 1312 participants from HIM Brazilian cohort that answered the first FFQ. HIM Study is a prospective multicenter cohort designed to investigate the natural history of HPV infections in men. A subsample of this cohort answered at least two 24 hours recall (24HR). From 24HR data we estimated new FFQ portions and derived calibration equations through linear regression models. Nutrient intake means derived from the 24HR (reference method) was compared with FFQ-standard portions and calibrated, FFQ-24HR portions and FFQ-24HR portions and calibrated. To test correlation between FFQ and 24HR data we used Spearman coefficient, and Kappa coefficient was used to assess if the FFQ-based methods were capable of classifying individuals in the same intake levels of 24HR. From the three FFQ-based methods, FFQ-24HR portions and calibrated had similar results to the reference method: only mean values of folate and iron were different. For Spearman coefficients, higher correlations with the reference method were found for FFQ-24HR portions and calibrated; with coefficients varying from 0.27 (total fat) to 0.57 (iron). Kappa coefficients were also higher for FFQ-24HR portions and calibrated. FFQ-24HR portions and calibrated presented better dietary intake estimates, with more similar values to the reference method than other FFQ-based methods.

[P162] Using Australian nutrition survey data and the NCI method for food regulatory risk assessments

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The National Cancer Institute (NCI), USA, has developed the NCI Method for estimating usual intakes of nutrients and foods. Food Standards Australia New Zealand (FSANZ) conducts risk assessments for a range of food chemicals for many reasons including food regulatory purposes. Food consumption data from national nutrition surveys (such as the new Australian 2011-12 data) are combined with food chemical concentrations to derive dietary intakes from which usual intake can be estimated using the NCI method. FSANZ has translated the NCI Method from SAS into R language, with comparable results. Usual intakes of nutrients were evaluated for use in food regulatory risk assessments, for example for nutrient fortification of food. The NCI method was also evaluated as a risk assessment tool for other commonly consumed food chemicals (e.g. contaminants) where long term exposure estimates are required, and such methods have not been used as extensively internationally to date. In testing the NCI method for food regulatory risk assessments, the method produced distributions of nutrient intakes, intakes of other food chemicals and food consumption that are narrower than when using a single day of data or a two day average, with comparable population mean intakes. For usual intakes there is a lower proportion of respondents outside health based guidance values for excess and insufficient intakes. In conclusion, the NCI method can effectively be used for estimating usual intakes of foods and a range of food chemicals for food regulatory risk assessments, including with the most recent national nutrition survey data.

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[P163] Effects of training and measurement equipment on technical errors from anthropometric measurements

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Background

The International Society for the Advancement of Kinanthoropometry (ISAK) emphasizes an importance of standardization of protocol and training through an international anthropometric accreditation scheme. On the other hand, many surveys and health screening in Japan have been conducted without prior training on anthropometry and standardization of measurement equipment. The aim of the present study was to examine differences in technical errors (TEM) derived from skill of anthropometrist and equipment used.

Methods

Two ISAK level 3 (Instructor) anthropometrists, six ISAK level 1 anthropometrists (Trained), six regular measurers who conduct anthropometric measurements in their work (Experienced), and six less-experienced measurers who were either students or had measured less than 1 year (Less-experienced) participated in the study. Participants conducted anthropometric assessments on two skinfolds (triceps and subscapular) and three circumferences (relaxed arm, waist and calf) of 10 or 14 model subjects. Skinfolds were measured using Slim Guide (Creative Health Products), Eiken Caliper (Yagami), Harpeden (Harpenden), and Adipometer (Medical Science Publications) whereas circumferences were taken using anthropometric steel tape or poly-fibre tape.

Results

Trained anthropometrists showed better inter- and intra-tester TEMs than Experienced and Less-experienced measurer. Both Experienced and Less-experienced groups showed smaller intra- and inter-tester TEM when Slim Guide was used. The greatest intra-tester TEM was found with Adipometer, and the greatest inter-tester TME was found with Harpenden.

Conclusion

The TEM of measurers can be reduced by experiencing structured training. Appropriate equipment should be chosen according to the skill of the measurer.

[P164] Validation study of a national Food Frequency Questionnaire for The Netherlands, FFQ-NL1.0, A comprehensive FFQ for adults

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Background

A standardized national 160-item FFQ, the FFQ-NL1.0, was developed for use within Dutch cohort studies. The objective of this study was to validate the FFQ-NL1.0 against repeated measurements of urinary nitrogen and potassium, plasma carotenoids and fatty acids, and multiple telephone- and web-based 24-hour recalls.

Methods

The Nutrition Questionnaires plus (NQplus) study is an ongoing Dutch longitudinal study. The FFQ-NL1.0 was filled out by 149 men and 234 women, aged 25 to 70 years. Per person, 1-2 urinary and blood samples were available, as well as 1-5 telephone-based and 1-7 web-based 24-hour recalls. Validity of the FFQ was studied by estimating group-level bias, attenuation factors, correlation coefficients, and ranking agreement.

Results

The FFQ-NL1.0 underestimated protein intake with on average 16% as compared with the urinary biomarker. Attenuation factors for protein and potassium were 0.44 and 0.46 respectively compared to their recovery biomarkers. Compared with the 24-hour recalls, reported intake of most nutrients was higher in the FFQ, but <10% for energy and macronutrients. Attenuation factors ranged between 0.26 for folic acid to 0.78 for alcohol (en%). Spearman correlation coefficients were 0.41 between fish intake and plasma EPA and DHA and 0.43 between fruit and vegetable intake and plasma carotenoids. Cross-classification showed good ranking agreement for most nutrients and food groups.

Conclusion

The overall validity of the newly developed FFQ-NL1.0 was acceptable to good and the FFQ was able to rank subjects according to their dietary intake. The FFQ-NL1.0 is well-suited for future use within Dutch cohort studies among adults.

[P165] Comparison of the validity of absolute intake and nutrient density of protein, potassium and sodium assessed by various dietary assessment methods

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It is often suggested that nutrient densities could reduce the impact of measurement errors on estimates of dietary exposure. We compared the validity of absolute intakes and nutrient densities of protein, potassium and sodium for different dietary assessment methods. For 69 Dutch subjects, two duplicate portions (DPs), five to fifteen 24-hour recalls (24hRs) and two food frequency questionnaires (FFQs) were collected and compared to duplicate urinary biomarkers and one or two doubly labelled water measurements. Multivariate measurement error models were used to

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estimate attenuation factors, validity coefficients and error components. Attenuation factors for energy, protein and protein density, potassium and potassium density, sodium and sodium density for a single DP measurement were 0.46, 0.78 and 0.30, 0.45 and 0.25, 0.50 and 0.39; for the FFQ: 0.51, 0.65 and 0.52, 0.49 and 0.45, 0.51 and 0.71; for the 24hRs they were: 0.15, 0.37 and 0.26, 0.33 and 0.18, 0.25 and 0.13. This indicates that in this study population using nutrient densities instead of absolute intakes did not improve the attenuation factor for any of the three methods and nutrients considered; sodium assessed by the FFQ was the only exception to this pattern. Thus, using nutrient densities rather than absolute intakes does not necessarily improve the performance of the DP, FFQ or 24hR.

Theme 19: Measuring Activity and Diet in Athletes

[P166] The development of an Athlete Diet Index (ADI) to assess diet quality in high performing athletes

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Background
High level training is associated with increased nutritional requirements, while optimal nutrition enhances athletic training and performance. Athletes have unique dietary requirements based on daily and seasonal variations in training. Despite this, there are limited tools available to assess the diet quality of athletes.

Objectives
To develop a valid and reproducible dietary assessment tool, the Athlete Diet Index (ADI), to assess diet quality in high performing athletes.

Design
The ADI has been developed in consultation with sports nutritionists and dietitians, athletes and sports personnel. Diet quality is assessed on the basis of meal and snack consumption, dietary intake in comparison to the New Zealand food and nutrition guidelines, and food variety within food groups. Additional sections include training (sport, level of competition, volume), special diets and supplement use, self-reported body composition and demographics (age, ethnicity). The final ADI will be available on-line and take approximately 10 minutes to complete. Athletes will receive a score and feedback regarding their dietary intake. The ADI will be validated on 100 high performance athletes using a food frequency questionnaire and 24 hour food recalls. Reproducibility will be assessed by athletes completing the ADI on two occasions, 4-8 weeks apart.

Outcomes
The ADI has several potential applications. These include the identification of athletes who would benefit from further dietary input, as an interactive dietary education tool, and finally as a research tool to obtain insight into the dietary intakes of athletes.

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[P167] Nutritional and anthropometric profile of school-aged baseball players

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Baseball competition emphasizes strength, power, speed and mental focus. Adequate nutrition is an important issue for exercise performance and health during the growth of young players. However, nutrition assessment in school-aged player is still unclear.

Purpose

To investigate the diet and anthropometric profile in young baseball players (BPs) for the nutrition education reference.

Methods

Two hundred twenty-seven BPs (11.0 ± 0.05 years) were recruited. Weight and high measurements were performed. Food frequency and eating behavior questionnaires conducted by trained surveyors. The independence t-test was used to examine variables different between BPs and general students (GSs, data from Nutrition and Health Survey in Taiwan Elementary School Children).

Results

Weight and height in BPs are higher than GSs, but body mass index is no difference between two groups. Daily products, vegetable and fruit intake in BPs were higher than those in GSs. However, the amount of protein, carbohydrate, vegetable and fruit consumed in BPs were lower than Dietary Reference Intake. BPs pay more attention to choose food and eating behavior easily be influenced by motion and environment.

Conclusion

Protein, carbohydrate, vegetable and fruit intake were not enough in BPs. We suggest that establishment of friendly eating environment are important to improve BPs eating behavior, especially in protein, carbohydrate, vegetables, and fruits intake.

[P168] A study of relationship between running and weight control

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The purpose of this study was to investigate the impact of weight control on the 2014 Hello Kitty Run event, held in Kaohsiung, Taiwan. Specifically, the study explored weight control, activity procedure, and effect of Hello Kitty Run. Hello Kitty Run is an important symbol of gentle fashion in history, Taiwan Kaohsiung was chosen to be the second stop of the global running party. The population of this research was the runners of Hello Kitty Run Kaohsiung in 2014, random interview and observation were used to gather the data, a significant relationship between running and weight control was found. The results show that regardless of their age and gender, participants want to feel motivated, entertained and challenged. The study investigated the effect of running on weight control and the methods of improving the positive effects of running on weight control. It makes

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people further understand the effect and importance of running on weight control. The researchers concluded that Hello kitty Run used exercise to get fresh feeling of pleasure for participants.

[P169] Dietary supplement use amongst tertiary institution athletes in Singapore: Emerging trends and gender differences

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Background

Dietary supplements (DS) usage is increasingly common in tertiary institution athletes, and gender differences have been reported in some Western countries. Current literature available in Asians remains sparse.

Objectives

The primary objective is to describe trends and patterns in DS usage amongst tertiary institution athletes. The secondary objectives are to identify gender differences in knowledge, attitudes and perceptions towards DS.

Methods

This is a cross-sectional study of tertiary institution athletes across 29 educational institutions, with a mean age of 20.4 ± 2.8 years. 284 participants (135 males; 149 females) completed an online survey questionnaire, which sought information including demographics, sports characteristics, DS usage patterns, reasons, knowledge, attitudes and perceptions.

Results

The overall prevalence of DS usage was 90.8% (258) with 23 products used. The most common reason for DS usage was 'recovery from training'• at 52.3% (135). Internet websites were the most common source of DS information at 45.0% (116). Online shops were the most common source of purchase at 28.3% (73). 46.5% (120) did prior research and 56.6% (146) read the safety label. In terms of attitudes and beliefs, females had lower self-perceived knowledge of DS, and regarded DS usage as less important than males in terms of sporting performance and physical appearance.

Conclusion

Prevalence of DS usage in tertiary institution athletes is high. Significant gender differences exist in the DS knowledge, attitudes and perceptions. Advice and counseling related to dietary supplementation need to be more targeted in addressing the needs, concerns and beliefs of these athletes.

[P170] Weekly training habits of Pan Pacific Masters Games competitors

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As events such as the Pan Pacific Masters Games (PPMG) were seen as contributing to the health of older individuals it was considered important to report the training habits of competitors. It was hypothesized that the training habits of PPMG competitors would in general meet recommended guidelines, such as the World Health Organization (150min/wk moderate or 75mins vigorous intensity exercise). Data was collected from a total of 1590 competitors, (739 male and 851 female, age mean=49.1yrs, SD±9.0, range=25-83) competing at the 2010 PPMG, on training activities completed in preparation for the event. Male and female competitors reported similar mean training days per week, 3.97 and 4.04 respectively. Older athletes on average trained slightly (+4.6%) more than their younger counterparts (4.11 vs. 3.93 days/wk, p=0.035). There were also a number of significant differences in the types of training performed by the two genders and some differences in training type associated with age. Male athletes competing were older than females (50.8 vs. 47.6yrs, p<0.001). Provided average time training per training day was at least 40mins and of at least moderate intensity it was apparent the majority of athletes would meet guidelines for substantial health benefits (150min/wk), but it would require at least 75min/day or vigorous intensity for the average competitor to gain more extensive health benefits (300min/wk of moderate or 150min/week vigorous). The training activities of PPMG respondents would appear on average to meet health guidelines for substantial health benefits, conversely many would fail to meet requirements for more extensive health benefits.

Theme 20: Measuring Diet and Phyiscal Activity During the Life Course

[P171] Accelerometer-determined physical activity of working adults: A cross-sectional study

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Physical activity (PA) is an essential component of health and wellness in schoolchildren for prevention of obesity and other chronic diseases. The aim of this investigation had twofold: firstly to evaluate the relationship of locomotive and non-locomotive PA patterns and secondly, to document relationship of locomotive and non-locomotive activities between MVPA. A total of two hundred twenty four elementary school-going children aged from 6 to 12 years old (boys: 118; girls: 106) were voluntarily recruited from four primary schools in Tokyo Metropolis. The PA was assessed by a triaxial accelerometer (Active Style Pro HJA-350IT) during waking hours for 7 days that distinguishes

locomotive and non-locomotive PA using 10s epoch length. The mean age of the subjects were 9.3±1.7 and BMI (kg/m2) were 16.7±2.8. The results revealed that there was significant relationship on time spent on loco- and non-locomotive activities were evident when compared with LPA (r=0.16; p>0.05), MPA (r=0.28; p<0.001) and VPA (r=0.79; p<0.001) after controlling for age. Correlation between locomotive MVPA vs non-locomotive LPA was poor and not statistically significant (r= -0.09; p>005). While, total MVPA vs locomotive LPA revealed a strong correlation (r=0.67; p<0001). Total MVPA vs locomotive MVPA had a strong correlation (r=0.94; p<0001). In conclusion, locomotive and non-locomotive PA revealed the actual activeness of the children objectively. Data of locomotive and non-locomotive PA among children is vital for distinguish the actual habitual physical activity and such data will provide an evidence for appropriate PA intervention in order to prevent lifestyle disease in their later age.

[P172] Dietary patterns, the prevalence of physical activity and sedentary behavior in young age Saudi women

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Background
The prevalence of sedentary behavior and physical inactivity is rising among adults worldwide. In addition, it is well known the risk of physical inactivity and sedentary behavior on individual health. Globally, physical inactivity is one of the leading risk factor for Non-communicable diseases (NCDs) and premature death. For example, in Saudi Arabia more than 17% of total mortality, among adults with age 30-70 years, is results of NCDs such as CVD and type 2diabetes. This linked to physical inactivity. However, there is a gap in documenting the prevalence of physical activity and sedentary behavior in Saudi population especially among young women.

Aim
To explore dietary patterns, physical activity and sedentary behavior patterns among university student in a pilot cross-sectional study.

Methods
A pilot study will carry out in June 2015 at the King Abdul-Aziz University in Jeddah. This study will randomly invite at least 100 female students aged 19 -26 years to participants in this study. Diet intake data will derive from an interviewer-administered food-frequency questionnaire (FFQ).The FFQ consisted of 206 food items and was developed based on local foods and habits. Participants will self-report their daily activity, using the Arabic version of the valid International Physical Activity Questionnaire (IPAQ). For sedentary behavior, participants will report their sitting time of watching TV, using smart phone, sitting in the car.

Conclusion
This study will provide valuable evidence not only on the prevalence of physical activity but also the quality of diet consume by young university student from Saudi Arabia. Also, it will provide voluble information for our future intervention study to implant a physical activity program to promote health.

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[P173] Development and validation of a semi-quantitative Food Frequency Questionnaire to assess nutrient intake of adult New Zealand women

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Background

In New Zealand (NZ), there are few up-to-date, culturally appropriate food frequency questionnaires (FFQ) for assessing dietary intake in adult women. This study aimed to develop and validate a multi-nutrient, culturally appropriate, semi-quantitative FFQ for use in young adult NZ women.

Methods

Participants (n=110) were women (16-45 years) of Maori, Pacific or European ethnicity. They completed a FFQ assessing dietary intake over the previous month, and a four-day weighed food record (WFR). Validity was evaluated by comparing nutrient intakes from the FFQ with the WFR using paired t-tests, Pearson correlation coefficients, cross-classification, Bland-Altman and weighted Kappa statistics.

Results

Nutrient intakes were significantly higher from the FFQ compared with the WFR for all nutrients (range: 1.01 times higher for iron to 1.64 times higher for vitamin A), with the exception of polyunsaturated fat and alcohol ($p<0.05$). Pearson correlation coefficients between the FFQ and WFR ranged from 0.10 (iron) to 0.80 (vitamin A). Correct quartile classification ranged from 22% (phosphorus) to 47% (saturated fat). Correct classification into same and adjacent quartiles ranged from 62% (iron) to 86% (saturated fat). Gross misclassification into opposite quartiles ranged from 3% (saturated fat) to 10% (iron). Using weighted Kappa statistics, saturated fat had moderate agreement (0.41-0.60), and other nutrients had fair agreement (0.21-0.40).

Conclusion

The FFQ overestimated the intake of the majority of nutrients. While not suitable for assessing absolute intake, it is a suitable tool for ranking participants based on nutrient intake, demonstrating adequate validity for this purpose.

[P174] Body weight status and under-reporting of energy intake among Malaysian adolescents living in day-school hostels

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Nutrition survey is an important tool in the development, monitoring and improvement of health and nutrition policies, with under-reporting an often reported key issue. Applying a multi-stage stratified cluster sampling method, this nationwide study aimed to determine influence of body weight status on under-reporting of energy intake among Malaysian adolescents living in day-school hostels. Energy intake was assessed using 24-hour dietary recall while body weight status was

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determined using WHO Growth Reference. Ratio between energy intake and basal metabolic rate was used to determine under-reporting of energy intake. A total of 4189 adolescents (mean age: 13.0 Â± 0.3 year old) living in day-school hostels were recruited. There was a predominance of female (59.5%) and Malay ethnicity (70.4%). About one in four adolescents were overweight and obese. Mean energy intake of adolescents was 2071 Kcal (95%CI: 2045, 2097). Approximately 30% of the adolescents under-reported their energy intake. Bivariate analysis showed that under-reporting of energy intake was higher in males [36.9% (95%CI: 34.5, 39.3)], and overweight or obese adolescents [45.6% (95%CI: 42.4, 48.8)]. There was no significant association found between ethnicity and overweight or obese. Complex samples logistic regression analysis reported that overweight and obese adolescents were 2.5 times (95%CI: 2.1, 2.9) more likely to under-report their energy intake than their non-overweight or non-obese counterparts, after adjusted for sex. In conclusion, appropriate adjustment method is needed to minimize influence of body weight status while reporting energy intake among adolescents based on 24-hour dietary recall.

[P176] Development and validation of a dietary diversity questionnaire for young adult New Zealand women

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Background
Dietary diversity refers to the variety within and between food groups, with high dietary diversity reflecting nutritional adequacy. This study aimed to develop and validate a dietary diversity questionnaire (DDQ) that accurately reflects variety, nutritional adequacy and optimisation of New Zealand women's diets.

Method
Women aged 16-45 years (n=101) completed a DDQ and four-day weighed food record (WFR) as reference method. Two measures of dietary diversity (dietary diversity scores, DDS; food variety scores, FVS) were calculated from the DDQ and WFR. Nutrient adequacy and optimisation ratios were calculated and used to report dietary mean adequacy and optimisation ratios (MAR; MOR) from the WFR to assess the construct validity of the DDQ using Spearman correlation coefficients.

Results
The median (25, 75 percentile) DDS (food groups) from the DDQ and adjusted WFR (score for seven days) was 23 (21, 23) (maximum 25) and 31.3 (29.8, 33.3) food groups, respectively (r=0.328; P<0.001). The median (25, 75 percentile) FVS from the DDQ and mean±SD from the adjusted FR was 75 (61, 87) (maximum 237) and 78.2 ± 17.7 food items respectively (r=0.216, P<0.03). The diet's truncated MAR (mean± SD) was 0.94 ± 0.04 and MOR was 0.84± 0.16, suggesting a near adequate diet. Nutritious DDS (DDQ) were significantly correlated to both the MAR and MOR (WFR) for micronutrients, r=0.199 (P=0.046) and r=0.258 (P=0.009), respectively, indicating that higher DDS is likely to result in nutritional adequacy.

Conclusion

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The DDQ can provide an estimate of diet quality and has relative validity in describing dietary diversity compared with a WFR.

[P177] Association between waist circumference with energy intake, energy expenditure and energy balance: Findings from the Malaysian Overweight and Disordered Eating Survey among Teens (M.O.D.E.S.T)

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This study determined the association between waist circumference (WC) with energy expenditure (EE), energy intake (EI) and energy balance (EB) in Malaysian adolescents. A total of 9492 respondents (43.0% males and 57.0% females) aged 12 to 19 years were recruited from all states in Malaysia. Overall, 58.1% of the respondents were Malay, 19.4% Chinese, 8.2% Bumiputra Sabah, 6.4% Indian, 5.1% Bumiputra Sarawak, and 2.8% other ethnicities. The 24-hour dietary recall and physical activity recall were used to assess dietary intake and physical activity respectively. Mean for WC was 70.08±11.37 cm. Mean for EI, EE and EB were 1951±905 kcal/day, 1808±613 kcal/day and 143±1099 kcal/day, respectively. After controlling for body weight, mean of EI and EE were 41±23 kcal/kg and 36±8 kcal/kg, respectively. There was a weak association between WC and EI (r=-0.075, $p<0.001$). However, after controlling for the body weight, there was a significant, negative and moderate association between WC and EI (r=-0.414, $p<0.001$). Conversely, there was a strong and positive association between WC and EE (r=0.608, $p<0.001$), however, after controlling for body weight, the association became negative and weak (r=-0.157, $p<0.001$). Meanwhile, there was a significant negative and moderate correlation between WC and EB (r=-0.401, $p<0.001$). Further studies should be conducted to determine other possible associations between waist circumference with energy intake, energy expenditure and energy balance in Malaysian adolescents.

[P178] Incidence and risk factors of type 2 diabetes mellitus in transitional Thailand: Results from the Thai Cohort Study

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Background
The global prevalence of type 2 diabetes mellitus (T2DM) is high and increasing rapidly in countries undergoing a nutrition transition like Thailand. This study aimed to assess the relationship between T2DM and factors associated with the nutrition transition among Thai adults.

Methods
Data were from Thai Cohort Study participants surveyed in 2005,2009 and 2013 (n=39,519).

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Cumulative incidence of diabetes was calculated and multivariable analyses were conducted using logistic regression.

Results

T2DM incidence (per 1000) was higher in males (24.9 versus 11.9). The factors most strongly associated with T2DM in both sexes were increasing age and BMI but, amongst males, smoking (Odds Ratio (OR)=1.70,95% CI 1.29-2.24) and alcohol intake (OR=1.67,95% CI 1.00-2.82) were also associated with increased risk. Infrequent gardening, low vegetable intake, and urban childhood residence were also related to T2DM risk however these associations attenuated after adjusting for BMI. Among females, high income was associated with T2DM (OR=1.72,95% CI1.03-2.89). Urban childhood residence and education were also associated with T2DM however these associations were slightly attenuated after adjusting for BMI.

Conclusion

The factors associated with T2DM risk in our study are consistent with findings from previous studies conducted in countries undergoing a nutrition transition. With the prevalence of these factors projected to increase it is likely that the incidence of T2DM will keep rising. This may be of particular concern for Thai men who appear to be in the earlier stages of the nutrition transition. Our study suggests that females are at a more advanced stage of the nutrition transition.

[P179] Development of a food frequency questionnaire for celiac patients in the Netherlands

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To study the relationship between diet and health outcomes in celiac patients, a food frequency questionnaire (FFQ) would be helpful. To fit dietary habits of celiac patients, a validated Dutch FFQ was adjusted by adding specific gluten free foods. The Dutch National Food Consumption Survey 2010 (DNFCS) conducted among 10 participants who were on a gluten free diet and 27 food records of celiac patients, collected in a hospital, were used to select foods. These data showed that for some patients gluten containing foods needed to be inquired. Therefore, two versions of the FFQ were designed, one including gluten containing foods and one without these foods; the first version consisted of 20 items more than the second one. The first question inquired whether any gluten containing foods had been used in the past month. Depending on the participants response they received the first or second version. A dietician specialised in celiac patients evaluated the FFQ. The FFQ was pre-tested in six celiac patients from the area of Wageningen. Finally the FFQ was completed by more than 500 participants. The nutritional data of the questionnaires was analysed using the Dutch Food Composition Table (2010). The intake of energy was on average 9.5MJ, of protein 14% of energy (en%) of total fat 36en%, of carbohydrates 46en%, of dietary fibre 2en% and of alcohol 3en% and comparable to energy and macronutrients reported in the DNFCS. We conclude that the FFQ for celiac patients is a feasible questionnaire, but needs further validation.

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Eat well, be active. How do you measure up?

[P180] Are physical activity guidelines associated with body fatness in non-obese women?

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The purpose of this study was to investigate the associations among objectively measured activity levels and markers of body composition in non-obese, New Zealand European women. Anthropometric measures were performed in 107 women (16-45 years). Total percentage body fat (PBF) was assessed using air-displacement plethysmography. Tri-axial accelerometers were worn over 7 days to assess sedentary, light, moderate and vigorous activity levels. Independent t-tests compared activity levels between participants with normal (<30%) and high (â‰¥30%) PBF. Additionally, PBF was compared between participants who achieved recommended levels of physical activity and those who did not. Partial correlations examined associations of activity levels and PBF. Participants with normal PBF (N=67) completed significantly more moderate to vigorous physical activity (MVPA) minutes per week (P=0.002) than those with high PBF (N=40). Achieving current physical activity recommendations of ≥150 minutes/week of MVPA resulted in lower PBF (P=0.038). When MVPA was divided into moderate and vigorous physical activity, those achieving ≥300 minutes/week of moderate physical activity showed a trend towards significance for lower PBF, while achieving ≥150 minutes/week of vigorous activity showed significantly lower PBF (P=0.022). MVPA was significantly correlated to PBF, independent of sedentary (r=-0.258; P=0.008) and light activity (r=-0.273; P=0.005). Our data suggest that the association between physical activity and decreased PBF is strongest for vigorous activity, and is independent of the amount of sedentary activity achieved. Thus, increasing vigorous physical activity may be important for maintaining a reduced body fat profile in non-obese women.

[P181] The Metacardis Study (2): Translation from frequencies into food and nutrient intakes for the metacardis Food Frequency Questionnaire

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Objectives
The MetaCardis study aims to investigate the role of gut microbiota in health and cardiometabolic diseases. Because gut microbiota and cardiometabolic diseases are influenced by lifestyle aspects, the longer-term dietary intake of Danish, German and French participants was assessed using three semi-quantitative web-based food-frequency questionnaires (FFQs). The methodology used to

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develop portion sizes and nutritional composition for the items of the three MetaCardis FFQs is described.

Methods

The portion sizes and the associated nutritional composition were derived from national food consumption surveys and food composition databases, taking into account the frequency and amount consumed where possible. We used the French ENNS Survey (2005-2006) and the associated food composition database, the German NVSII Survey (2005-2006) and the BLS food composition database (v3.02), the Danish DANSDA Survey (2005-2008) and the Danish food composition database (v7.01). Where information was not otherwise available, portion sizes were defined using local and published references.

Results

A set of 29 nutrients available in the three food composition databases was selected. Portion sizes and nutritional composition for 727, 3630 and 595 foods and beverages were assigned to the 159, 143 and 153 items of the French, German and Danish MetaCardis FFQs, respectively.

Conclusions

The translation of frequency data into nutrient intakes was successfully carried out using locally relevant data. The relative validity of the MetaCardis FFQ is being investigated against three self-administered web-based 24h dietary records. Note: MetaCardis is a European Union's Seventh Framework Programme (grant agreement HEALTH-F4-2012-305312) http://www.metacardis.net

[P182] The Metacardis Study (3): Relative validity of the French metacardis Food Frequency Questionnaire

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Objectives

In the MetaCardis study, dietary intakes of Danish, German and French participants were assessed using three semi-quantitative web-based food-frequency questionnaires (FFQs). The objective of this study was to assess the relative validity of the French MetaCardis FFQ against a reference method.

Methods

The MetaCardis FFQ has been described in our companion abstracts. Three self-administered web-based 24h dietary records (DRs) were used as a reference method, completed at the same time as the FFQ. Estimations for food, energy and nutrient intakes from the DR and the FFQ were calculated and compared with appropriate correction and adjustment. Concordance of food, energy and nutrient intakes were estimated using Spearman and Pearson correlations. Degree of misclassification was assessed by calculating tertiles of nutrient intakes. Agreement was evaluated using Bland-Altman.

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Results

Analysis was based on valid DRs and FFQs completed by 202 MetaCardis subjects. The FFQ tended to report higher food, energy and nutrient intakes compared to the DR. Mean correlation coefficient was 0.43 for food, 0.37 for energy, 0.49 for macronutrients, 0.63 for alcohol and 0.40 for micronutrient intakes. 44% of subjects were correctly classified whereas 13% were misclassified into thirds of nutrient intakes. Bland-Altman confirmed a general overestimation of intakes using the FFQ. Performance of the FFQ was similar after stratifying by sex.

Conclusions

The French MetaCardis FFQ was found to have an acceptable level of validity. Overestimations of intake should be taken into account when interpreting the results. Note: MetaCardis is a European Union's Seventh Framework Programme (grant agreement HEALTH-F4-2012-305312) http://www.metacardis.net

[P183] The MetaCardis Study (1): Dietary intake estimation and the development of an online Food Frequency Questionnaire

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The MetaCardis Study (1): Dietary Intake Estimation and the Development of an Online Food Frequency Questionnaire Objectives: Dietary assessment is an important element of epidemiological surveys. The MetaCardis study, a European multi-centre study in France, Germany and Denmark, investigates the role of gut microbiota in health and cardiometabolic diseases. Because gut microbiota and cardiometabolic diseases are influenced by lifestyle aspects, the longer-term dietary intake of participants is assessed to identify diet-disease relationships and analyze dietary patterns. The development of a semi-quantitative web-based food frequency questionnaire (FFQ) is described here.

Methods

The format of the MetaCardis FFQ was based on the UK-EPIC Norfolk FFQ and the content was based on relevant European questionnaires (SU.VI.MAX FFQ, German EPIC FFQ and Inter99 FFQ). The FFQ was designed to measure a participant's usual food intake during the previous year. The FFQ contains a list of around 160 foods harmonized across the study countries to increase comparability over 12 main food groups. Differences within each of the main food groups exist in order to incorporate relevant country-specific items. Nine frequency categories were provided. A serving size was assigned to each item in terms of units or common portions (e.g. one apple, one slice of bread) or household measures (e.g. medium, glass, cup, spoon).

Results and Conclusions

The MetaCardis FFQ is currently in use and an analysis system is being developed to convert

frequency data into food and nutrient intakes. A relative validity study is also being carried out. Note: MetaCardis is a European Union's Seventh Framework Programme (grant agreement HEALTH-F4-2012-305312) http://www.metacardis.net

[P184] Quartiles of sitting time reveals association between sedentary behaviour and a higher risk of type 2 diabetes independent of physical activity levels

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Prolonged sitting time is an increasing and emerging risk factor for developing cardiovascular disease. However, little is known about the relationship between sitting time and cardiovascular risk factors in the Chilean population. Therefore, the aim of this study was to investigate the association between sitting time and risk of type 2 diabetes in Chilean adults. Participants from the National Health Survey 2009-10 (n=5,157) were included in this study. The prevalence of type 2 diabetes was determined using WHO criteria. Physical activity levels and sitting time were determined using the Global Physical Activity Questionnaire. Quartiles of sitting time were determined to investigate the association between sitting and diabetes risk. 37.7% of the population reported to spend more than 4 hours sitting per day. Sitting time was significantly associated to BMI, waist circumference, glycaemia and HbA1c. Individuals who reported higher sitting time (>8 h.day-1) are more likely to develop diabetes than those in the lower quartile (<4 h.day-1) OR: 1.78 [95%CI: 1.29 a 2.44], P<0.0001). This association was independent of physical activity levels and adiposity. Prevalence of diabetes was 10.2% and 17.2% in individuals classified in the lower and higher quartiles of sitting time, respectively. Sitting time is an important risk factor for diabetes in Chilean adults. Future physical activity policies in Chile should focus on reducing sitting time and increasing physical activity levels in the population.

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