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Plenary 1: Nutrition in the Lifecycle: What are we learning?

Epidemiology to epigenetics: what we are not learning through the lifecycle

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Background

"Since the measuring device has been constructed by the observer…we have to remember that what we observe is not nature in itself, but nature exposed to our method of questioning." (Heisenberg)

Objective

To discuss how methods of questioning influence what we have "learned" or not learned in the field of nutrition; to address the need for newer and/or more stringent methods of questioning to close knowledge gaps that will otherwise remain open for the lifecycles of those in the audience.

Design

An informal, non-systematic review of nutrition during the investigator's lifecycle was conducted. A desultory search failed to find all studies. Data was highly heterogeneous. After a lackadaisical attempt at correction, personal biases remain unmodified. A No-Sweat-Analysis was performed and Forest-For-The-Trees plots drawn. Semi-qualitative point estimates will be presented without confidence limits.

Outcomes

Nutrition is the field of food, yet our knowledge of the bioactive constituents of foods is rudimentary and we cannot reliably measure what people eat in the free-living state with accuracy or precision. Randomised controlled trials testing prevailing nutrient hypotheses have regularly failed to confirm them. Tests of prevention and intervention hypotheses throughout the lifecycle have been limited by our understanding of the development of eating behaviours during critical periods of maturation, unsettled tracking of such behaviours across transitional periods of progression to (and transit through) adulthood, and our inability to reliably change eating behaviors over the long-term. Confidence in conclusions drawn from hypotheses tested in longitudinal lifestyle studies is eroded by known and unknown confounders, uncertain compliance and significant drop-outs.

Conclusion

The conditions for learning something with certainty (proof) are the same among all hard sciences. Nutrition is not excepted because satisfying the demanding prerequisites for proof may be difficult or impossible to achieve. Nutrition education, recommendations and policy should reflect explicitly the confidence limits of what we have learned by the generally applied methods of questioning.

Source of Funding

None

Diet quality – do intakes across life stage, gender and health matter?

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Background

Actual food intake is not commonly described in dietary intervention studies, partly due to cost, expertise, and time. However, unless researchers address challenges associated with measuring dietary intake, we will not be able to evaluate which aspects of dietary interventions advice have been easy for participants to adhere to, and which were the most challenging. This gap is a problem impacting on the grading of dietary recommendations in evidence based guidelines aimed at optimising nutrition-related health.

Objective

To give examples of approaches to evaluating dietary intake and changes secondary to nutrition interventions, including novel use of biomarkers. This approach allows researchers to consider how much confidence they have in the reported dietary data and evaluate the impact of mis-reporting.

Design

Examples from cohort studies, randomised controlled trials and systematic reviews with meta-analysis will be discussed.

Outcomes

Knowing which dietary habits are amenable to change can help refine dietetic treatments. For example, we have shown that parents of overweight children in the *HIKCUPS* trial can facilitate increases in child % energy consumed from fruit, vegetables, dairy products, bread and cereals from 57% at baseline to 65% at 2y, P<0.001, w a decrease in total child kJ/day. In overweight fathers participating in *Healthy Dads, Healthy Kids* pilot trial we found moderately-strong positive correlations between father-child fruit (r=0.40, P<0.01), biscuit (r=0.54, P<0.001) and potato crisp (r=0.33, P<0.05) intakes with no associations for vegetables, ice-cream, chocolate or hot chip intakes, P>0.05.

Conclusion

It is recommended that researchers measure and report their findings related to changes in food intake within their studies. This will allow evaluation of adherence to dietary intake advice given in nutrition trials and which eating patterns lead to the best trial outcomes. This will allow food based guidelines for interventions to be refined and strengthen the evidence base informing dietary guidelines. Future research priorities are to undertake trials powered for detecting dietary change as a primary outcome and reporting the effectiveness of dietary interventions.

Source of Funding

NHMRC Career Development Fellowship.

Dietary intake and hearing loss among older people: the increasing epidemiological evidence

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Background

Age-related hearing loss (HL) (presbycusis) is a common health problem in the older population. The medical and socio-economic costs are considerable, and given the increasing number of older adults, this burden is escalating. Commonly recognised risk factors for hearing loss include age, genetic risk factors, exposure to noise, and the occurrence of certain diseases (such as cardiovascular disease).

Objective

This review of the evidence from a cohort of older Australians, reports on cross-sectional and longitudinal associations between a number of dietary factors (including long chain n-3 fatty acids and Glycemic Index/Glycemic Load), dietary biomarkers (serum homocysteine and serum folate), and presbycusis.

Design

The Blue Mountains Hearing Study is a population-based survey of age-related hearing loss (1997-1999 to 2002-2004). Hearing loss was measured in 2956 participants (aged ≥50 years) and was defined as the pure-tone average of frequencies 0.5, 1.0, 2.0, and 4. kHz > 25 dB hearing level. Dietary data were collected in a semi-quantitative food frequency questionnaire.

Outcomes

In this cohort of older people the prevalence of any level of HL was 32%. Compared to people without HL, participants with any HL were older, more likely to be men, not tertiary qualified, and exposed to workplace noise. There was an inverse association between long-chain n-3 PUFA and incident HL (OR per SD increase in long-chain n-3 PUFA: 0.76, 95% CI 0.6-0.97). People in the highest quartile of mean GL intake compared to those in the lowest quartile had a 76% greater risk of developing incident HL (P-trend=0.04). Participants with elevated homocysteine (>20 µmol/L) concentrations had a 64% increased likelihood of prevalent HL and those with serum folate <11nmol/L had a 37% likelihood of mild HL.

Conclusion

These findings from a cohort of older Australians suggest that dietary factors may be important in age-related HL.

Source of Funding

Supported by NHMRC project grants and the HEARing CRC, established and supported under the Australian Government's Cooperative Research Centres Program.

DHA supplementation influences cognitive performance in healthy young adults

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Background

Docosahexaenoic acid (DHA), a long chain omega n-3 fatty acid, is important for brain structure and function and is dependent on dietary intakes. Individuals following diets low in n-3 may cognitively benefit from increased DHA intake.

Objective

To investigate whether a high DHA supplement improves cognitive performance in healthy young adults.

Design

Healthy adults (n=176, 18-45 years, non-smoking, low intake of long chain n-3) completed a 6-month randomised placebo controlled double blind trial. Subjects were matched for age and gender and randomly assigned to either DHA (1.16 g DHA/day) or placebo. Cognitive performance was assessed using a computerised cognitive test battery. Z-scores were calculated and the different tests clustered into cognitive domains: memory (word recall, picture and word recognition), working memory, attention, speed of memory and working memory and attention. Intention-to-treat analysis was performed using ANCOVA (controlling for baseline and education) and adding gender as a factor.

Outcomes

Memory and working memory improved with DHA compared to placebo in women (mean (95% CI) difference: 0.25 (0.05, 0.45) SD, P=0.01; 0.19 (0.01, 0.36) SD, P=0.04, respectively) but not in men. Speed of working memory improved with DHA compared to placebo in men (reaction time (RT) -0.56 (-0.90, -0.21) SD, P=0.002). Although speed of memory (delayed word and picture recognition) failed to reach significance between treatments (P=0.07), speed of delayed word recognition improved in women (RT -0.34 (-0.59, -0.08) SD, P=0.01). Attention was not affected.

Conclusion

DHA supplementation improved memory and speed of memory in healthy young adults whose habitual diet was low in DHA. DHA affected the memory domains differently in men and women with memory and speed of long-term memory improving only in women and speed of working memory improving in men. (Trial registration: ACTRN12610000212055)

Source of Funding: Massey University Research Fund
Efamol Ltd, Health & Herbs International Ltd

Fish oil supplementation, learning and behaviour in Indigenous Australian children from a remote community school

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Background

Indigenous Australian children have significantly lower literacy and education outcomes than non-Indigenous children. They are also at risk for malnourishment, and Australian children generally are not consuming enough of the healthy food groups rich in omega-3 polyunsaturated fatty acids (n-3 PUFA). These are critical for healthy brain function and may assist with learning and behaviour.

Objective

To investigate the feasibility of administering fish oil daily within the school environment in an open label pilot study.

Design

The study was conducted over 12 weeks in a remote Northern Territory (NT) school giving children six small fish oil capsules (providing 750mg long-chain n-3 PUFA) each school day. Assessments included reading, spelling, Ravens Coloured Matrices (non-verbal problem solving) and Draw-A-Person (DAP; non-verbal test of intelligence).

Outcomes

Forty-seven children were recruited; the majority of the school population. Thirty-seven children aged 5-14 years (M=8.49, SD=2.29) took on average more than 3 capsules per school day over 12 weeks. Children were excluded due to problems swallowing the capsules, non-attendance/ leaving the school or too young for assessments (<5 years). We identified an appropriate assessment battery within this population and school environment, focusing on literacy and non-verbal cognition. Following initial disruption the daily supplementation and compliance recording went smoothly and teachers reported that it was worthwhile, with anecdotal reports of improved learning and behaviour. Linear mixed model analyses indicated improved age-adjusted scores on reading (P=0.01), spelling (P<0.01) and the Ravens (P<0.01), indicating improvements beyond the expected trajectory.

Conclusion

Fish oil supplementation was well received within the school environment and initial outcomes for learning and behaviour are encouraging. This needs to be followed up in randomised, placebo-controlled studies, one of which is underway in four NT schools over the 2011 school year.

Source of Funding

A $10,000 University of South Australia grant with in-kind support from the NT Department of Education and Training. Supplements were supplied by Novasel Australia.

Reduced production of inflammatory cytokines accompanies fish oil-induced increases of the Omega-3 Index

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Background

Consumption of long-chain n-3 PUFA (LC n-3 PUFA) has anti-inflammatory effects although the dose required to elicit this response has not been well established. The Omega-3 Index, i.e. content of LC n-3PUFAs eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) in erythrocytes, is used as a biomarker of cardiovascular disease risk but also has the potential to quantify other beneficial effects of LC n-3 PUFA intake.

Objective

To investigate dose-response relationships between LC n-3 PUFA consumption, their incorporation into erythrocytes and production of inflammatory cytokines.

Design

A total of 67 subjects (36 male, 31 female, mean age 53 years) with BMI >25 kg/m^2 completed a randomized, double-blind, placebo-controlled intervention trial. Subjects took 2, 4 or 6 g/d of Hi-DHA (26% DHA, 6% EPA) or a placebo (Sunola oil) for 12 weeks. The production of tumour necrosis factor alpha (TNF-α), and interleukins 1 (IL-1) and 6 (IL-6) in stimulated mononuclear leukocytes was assessed at baseline and after 12 weeks.

Outcomes

Erythrocyte DHA content increased in proportion to the dose of DHA consumed (r=0·72, P<0·001). There were no significant changes in production of TNF-α, IL-1β or IL-6 with any dose of supplement. However, there were inverse associations between change in Omega-3 Index and change in both IL-6 (r = -0.339, P = 0.017) and TNF-α (r = -0.297, P = 0.038).

Conclusion

These findings support an anti-inflammatory role for LC n-3 PUFA supplementation. Although there was no significant dose response, the inverse relationship between production of inflammatory cytokines and incorporation of LC n-3 PUFA in erythrocytes highlights: a) the utility of this biomarker for monitoring compliance in clinical trials; and b) the importance of considering individual variations due to polymorphisms in genes that influence cytokine production when interpreting clinical outcomes.

Source of Funding

Australian Research Council linkage grant (LP0561211)

Hepatic fatty acid partitioning is related to CVD risk factors in women

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Background

Liver fat and plasma triacylglycerol (TG) concentrations are associated with increased CVD risk. Large very low-density lipoprotein (VLDL) particles are the major determinant of plasma TG concentrations and increased VLDL1 production has been associated with liver fat content in men. The liver produces VLDL of different size and density and these can be characterised as VLDL1 and 2. The roles of hepatic fatty acid (FA) partitioning towards esterification (liver fat or VLDL-TG), oxidative pathways or desaturation in relation to CVD risk factors has not been well characterised in women.

Objective

We aimed to investigate intrahepatic metabolism of different FA sources to VLDL1 and 2 in association with abdominal adiposity and liver fat deposition in healthy women.

Design

Fifty-eight healthy Caucasian women (49 y (range 35-65) waist circumference 83 cm (73-110)) were studied. Body fat distribution and liver fat were measured using DEXA and MRI. An intravenous infusion of [U^{13}C]palmitate was given to trace hepatic metabolism of systemic plasma non-esterified fatty acids (NEFA). The hepatic isotopic fatty acid ratio (HIFAR, [U^{13}C]16:1*n*-7 / [U^{13}C]16:0) in the TG fractions of VLDL1 and 2 were used as indices of hepatic stearoyl CoA desaturase (SCD) activity.

Outcomes

Liver fat content was related to waist (r_s 0.45, P<0.001), body fat distribution (android/gynoid fat ratio (r_s -0.42, P<0.01)) and VLDL size (TG:ApoB ratio, r_s 0.33 and 0.21 for VLDL1 and 2 respectively, P<0.05). HIFAR in VLDL1 and 2 correlated with the android/gynoid ratio (r_s 0.29 and 0.30 respectively, P<0.05), VLDL size (r_s 0.53 and 0.53 respectively, P<0.001) and inversely with plasma 3-hydroxybutyrate (r_s -0.85 and 0.84 respectively, p<0.001). The contribution of systemic NEFA to VLDL1-TG was greater compared to VLDL2-TG (87 ±2.5% vs 84 ± 2.6%, p<0.01, n=22) and was inversely correlated with liver fat (r_s -0.44 - 0.55 for VLDL1 and 2 respectively, p<0.05).

Conclusion

Our data suggest that SCD activity and the contribution of systemic NEFA to VLDL are related to CVD risk factors in women.

Source of Funding

British Heart Foundation

Validation of a semi-quantitative food frequency questionnaire to assess polyunsaturated fatty acid intakes in the New Zealand population

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Background
Current polyunsaturated fatty acid (PUFA) intakes in New Zealand (NZ) cannot be assessed as there is no valid dietary assessment tool or complete fatty acid database.
Objective
To develop, validate and test the reproducibility of a NZ-specific food frequency questionnaire (FFQ) to assess dietary intakes of PUFAs.
Design
A 36-item, semi-quantitative NZ PUFA FFQ was developed based on a validated Australian PUFA FFQ. The Australian fatty acid database was adapted to include NZ-specific data for 86% of the major sources of PUFA. Healthy subjects from Auckland, NZ (*n*=48) provided fasting blood samples for biomarker (erythrocyte PUFA) analysis, completed the NZ PUFA FFQ and a 3 d weighed food record (WFR) (validation), and repeated the NZ PUFA FFQ (*n*=41) three months later (reproducibility). The method of triads was used to assess the triangular relationship between the NZ PUFA FFQ, food record and erythrocyte PUFAs; validity coefficients represent the relationship between the NZ PUFA FFQ and true intakes.
Outcomes
The NZ PUFA FFQ adequately estimated dietary intakes with strong validity coefficients for eicosapentanoic acid (0.72 [95% CI 0.49, 0.89]), docosahexaenoic acid (0.72 [95% CI 0.53, 0.95]) and total LC n-3 PUFAs (0.68 [95% CI 0.47, 0.89]). Total PUFA, alpha-linolenic acid, linoleic acid, arachidonic acid and total n-6 PUFA were comparable between the NZ PUFA FFQ and WFR. There were no significant differences in intakes of LC n-3 and n-6 PUFAs between repeated implementations of the NZ PUFA FFQ.
Conclusion
The NZ PUFA FFQ is a valid and reliable tool to measure PUFA intakes in healthy NZ adults. Using this tool to assess PUFA intakes can provide direction for public health strategies, and will be useful in research and clinical settings.
Source of Funding
Institute of Food, Nutrition and Human Health, Massey University.

Omega-3 fatty acid intake and incidence of type 2 diabetes

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Background
The association of omega-3 fatty acids (n-3PUFA) in the development of type 2 diabetes mellitus (T2DM) remains uncertain.
Objective
To examine the association between n-3PUFA intake and the risk of T2DM in mid age Australian women.
Design
The analysis included 8921 Australian women participating in the Australian Longitudinal Study on Women Health (ALSWH), aged 45–50 years at the time of the initial surveys in 1996. Total n-3PUFA intake was assessed using a validated food-frequency questionnaire (FFQ).
Outcomes
At completion of the 6 years of follow-up, 333 new cases of T2D were identified. Components of n-3PUFA intake were measured separately (ALA, EPA, DHA) as well as by a total measure. Intake was divided into quintiles consumed in grams per day with quintile 1 denoting the lowest intake and quintile 5 the highest. The mean total n-3PUFA intake of the lowest and highest quintiles was 0.58 (95% CI: 0.57-0.59) and 2.17 (95% CI: 2.13-2.21) respectively. There is a statistically significantly greater incidence of T2DM with increasing quintiles of total n-3PUFA (Cochran-Armitage Trend test: Z=5.0, P<0.0001). After adjustment for dietary measures and demographic and lifestyle risk factors (age, physical well-being, alcohol and smoking behaviours, area of residence), n-3PUFA consumption was not statistically significantly associated with the incidence of T2DM (P=0.14).
Conclusion
The examination of the relationship between n-3PUFA intake and incidence of T2DM indicates a complex relationship due to the confounders of other dietary measures. These complexities will need to be addressed in greater detail to delineate the association of n-3PUFA with T2DM.
Source of Funding
AA is supported by a scholarship from the Government of Saudi Arabia. The ALSWH, which was conceived and developed by groups of interdisciplinary research at the University of Newcastle and Queensland, is funded by the Australian Government Department of Health and Ageing.

Assessment of the effects and acceptability of a higher fish diet in women of child-bearing age

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Background
There is good evidence that long chain n-3 polyunsaturated fatty acids (LCn3PUFA) are beneficial for maternal and infant health. Fish is a good source of LCn3PUFA and other nutrients but its consumption within Australian women is overall less than optimal.

Objective
To assess the effects on erythrocyte fatty acids, serum ferritin, haemoglobin and plasma lipids and the acceptability of a diet higher in fish when compared to a typical Australian diet generally lower in fish but higher in meat.

Design
Single-blinded, randomised controlled 8-week trial in healthy women 18 to 50 years who normally consume ≤ one oily fish meal per week. The higher fish diet included four serves per week of a variety of fresh and convenience fish products (both oily and non-oily fish) to provide a daily average of 240 mg of eicosapentaenoic acids (EPA) and 340 mg of docosahexaenoic acids (DHA). The control group maintained their usual lower fish/higher meat diet and were supplied with four serves of beef, chicken or deli-meat per week for eight weeks. Fasting blood samples were collected at baseline, four weeks and eight weeks. On completion, participants rated the acceptability of the diets on a seven-point scale with '1' being extremely unacceptable and '7' extremely acceptable.

Outcomes
After eight weeks, levels of EPA and DHA in erythrocytes were significantly higher in the fish group (n=19) than that of the meat group (n=19) ($P<0.001$) and within those on a higher fish diet, EPA and DHA increased by 47% and 18% respectively. No statistically significant differences were observed for ferritin, haemoglobin or lipid levels between groups or within subjects at four or eight weeks. The median score for the acceptability of both diets was '6' demonstrating good acceptance.

Conclusion
These findings suggest that consuming a variety of fish products four times a week is acceptable and will result in positive changes in LCn3PUFA status. This higher fish diet did not compromise iron status.

Source of Funding
Australian Seafood Cooperative Research Centre.
Fish products supplied by Simplot Australia.

Transcriptional and metabolic responses following flaxseed oil supplementation in two dog breeds

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Background
With reduction in global fish sources, there is a need for an alternate vegetarian source of PUFA.

Objective
To investigate transcriptional and metabolic responses following ALA rich flaxseed oil supplementation in two dog breeds.

Design
Five beagles and five greyhounds were supplemented with Melrose® flaxseed oil for three weeks. Whole blood at fasting state was collected at three time points – Day 0 (pre supplementation), Day 15 and Day 22 (post supplementation). Plasma was analysed to detect the changes in fatty acid constituents (ALA, EPA, DHA, LA and AA). Expressions of three genes – HSP90, HSP70 and IL1B in WBC of the animals were analysed using realtime PCR. For the transcriptional response, GLM was used to identify the changes in gene expression with breed and day effect. For the metabolic response, a nested ANOVA was used to identify the breed and day effect for each fatty acid. The correlation between plasma and gene was also analysed.

Outcomes
Greyhounds showed a significant down-regulation of HSP90 and IL1B ($P<0.05$) with time, while HSP70 remained unchanged. None of the genes changed for beagles. A significant breed difference for HSP90 ($P<0.10$) and IL1B ($P<0.05$) was detected. Plasma ALA, EPA and LA increased significantly ($P<0.05$) with time but no breed effects. Plasma DHA on the other hand, showed a significant breed difference ($P<0.05$), but no day effects. AA showed no day or breed effects. ALA and EPA showed significant negative correlations with the expression of HSP90 ($P<0.05$) and IL1B ($P<0.10$) indicating down-regulation of the genes in greyhounds.

Conclusion
Flaxseed oil could be an alternate PUFA source for ALA and EPA, but not DHA. Genes involved in immune responses (HSP90 and IL1B) have responded to ALA supplementation. Breed differences indicate that two breeds could respond differently to the same feeding regime. This however, needs further investigation.

Source of Funding
Supported by UNE postgraduate fund.

Marginal serum selenium status in Tasmania

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Background
The Tasmanian population is considered at risk of suboptimal selenium status due to low soil levels of selenium, which has previously resulted in selenium deficiency in grazing animals in this state. However, minimal data exists.

Objective
To assess the selenium status of northern Tasmanian adults.

Design
A cross-sectional study of 498 community-dwelling men and women (25-84 yrs) recruited from the electoral roll was conducted in northern Tasmania. Serum selenium and serum glutathione peroxidase levels were measured by graphite furnace atomic absorption spectroscopy and enzymatic kit, respectively, to assess the selenium status of this population and determine the proportion at risk of suboptimal status.

Outcomes
The mean (SD) serum selenium concentration was 1.13 (0.19) µmol/L (range 0.57 – 2.26 µmol/L). There was no significant difference in serum selenium concentration between men and women (P=0.78). In both sexes, the lowest mean concentrations (men 1.06 µmol/L; women 1.01 µmol/L) were observed in the oldest age range (75-84 yrs). Highest mean concentrations occurred in men aged 25-34 yrs (1.24 µmol/L) and women aged 65-74 yrs (1.15 µmol/L). Sixty percent of subjects had serum selenium less than 1.14 µmol/L; a level associated with maximal glutathione peroxidase activity; with a significant positive association between serum selenium and serum glutathione peroxidase (P<0.001). Only 3% of subjects had serum selenium >1.52 µmol/L, a suggested target for maximizing the potential chemopreventative effect of selenium.

Conclusion
Marginal selenium status appears to be prevalent in northern Tasmania. Given the associations between selenium and health, this population could benefit from increasing selenium intakes.

Source of Funding
Supported by a research grant from the Clifford Craig Medical Research Trust, Launceston, Tasmania.

The effect of zinc supplementation on zinc transporter and metallothionein mRNA expression in type 2 diabetes mellitus

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Background
The pathology of type 2 diabetes mellitus (DM) includes impaired zinc utilisation. Zinc ions influence insulin and leptin signalling, potentially linking an imbalance of zinc at the cellular level to insulin resistance and dyslipidaemia. Zinc cellular homeostatic mechanisms include the regulation of the ZnT (SLC30) and Zip (SLC39) zinc transporter families, and the trafficking of zinc through the cell by metallothionein (MT). Little is known about zinc transporter and MT gene expression in type 2 DM.

Objective
To investigate the effect of zinc supplementation on the expression levels of a range of zinc transporter and metallothionein mRNAs in the peripheral blood mononuclear cells (PBMCs) of women with type 2 DM.

Design
Forty-three postmenopausal women with type 2 DM were randomised to receive either 40 mg/d zinc for 12 weeks (n=23) or placebo (n=20). Fasting blood samples were collected on four occasions (week 0, 4, 8, 12). Plasma zinc concentrations and a range of cardiometabolic outcomes were determined. Total RNA from PBMCs was isolated and transcribed into cDNA using reverse transcription. Quantification of the mRNA levels of ZnT1, ZnT5, ZnT6, ZnT7, ZnT8, Zip1, Zip3, Zip7, Zip10, MT-1A, and MT-2A was conducted using Taqman real-time PCR.

Outcomes
The age and BMI of the participants were 64.7 ± 8.1 y (mean ± SD) and 28.8 ± 5.0 kg/m^2, respectively. No changes in plasma zinc, mRNA expression, or cardiometabolic outcomes were observed in the placebo group. The zinc supplement group demonstrated an increase in the plasma zinc concentration (P<0.001) and a decrease (P=0.02) in the mRNA expression of Zip1, the primary transporter responsible for zinc import into the cell. ZnT8 expression was detected in only 21 participants. In the absence of constitutive ZnT8 gene expression, higher levels of ZnT7 and MT-2A (P<0.05) and a trend towards higher ZnT5 expression (P=0.06) were observed.

Conclusion
The transcriptional regulation of Zip1 in response to an increase in plasma zinc is an important mechanism for the maintenance of cellular zinc homeostasis. ZnT8, which is highly expressed in the pancreas, is not constitutively present in PBMCs; modulation of intracellular ZnT5 and ZnT7 gene expression may compensate for its absence.

Source of funding
The Medical Advances Without Animals Trust (MAWA).

Zinc homeostasis and gut function in children with celiac disease

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Background

Celiac Disease (CD) is an immunological enteropathy triggered by the intake of gluten. It is thought that the enteropathy impairs gut function and absorption.

Objective

To assess zinc (Zn) absorption capacity and small bowel integrity in children with Celiac Disease (CD).

Design

Children in whom diagnosis of CD was considered clinically and either confirmed (n=16; Marsh score ≥3) or not (n=22; Marsh score 0) on small bowel biopsy (SBB) were recruited. Fractional absorption of Zn (FAZ) was determined by administering an oral ^{67}Zn dose (2.5 mg) and an IV ^{70}Zn dose (0.2 mg), 2hrs before and during the SBB, respectively. Spot urine samples were collected and Zn isotopic ratios were determined by Ion Couple Plasma Mass Spectrometry. Gut health was assessed by ingesting ^{13}C-sucrose (20 g) after an overnight fast, breath samples collected and analysed by Isotope Ratio Mass Spectrometry.

Outcomes

There was no difference in FAZ in children with Marsh score ≥3 (0.68±0.05%; mean±SEM) compared to Marsh score 0 (0.74±0.05). The exchangeable Zn pool (EZP) was significantly ($p<0.05$) lower in children with Marsh score ³3 (2.6±0.8 mg/kg) compared to Marsh score 0 (3.8±1.4). Gut function in children with Marsh score ≥3 (4.5±0.7% cumulative dose recovered at 90 min) was lower than the lower cut-off of a normal gut function breath test (5.06) but not significantly different compared to Marsh score 0 (4.9±0.4). There was a significant ($p<0.01$) correlation between Zn absorption and gut function in children with CD.

Conclusion

Zn absorption did not appear below usual levels in subjects with CD. Children with CD have impaired gut function which may affect their Zn nutritional status as reflected by a smaller EZP. However, the EZP decrease was not compared to healthy controls and its biological meaning is uncertain.

Source of funding

This study was funded by Channel 7's Children Research Foundation, Women's and Children's Hospital Foundation, Nutricia Research Foundation.

Does daily iodine supplementation improve cognition in mildly iodine deficient young adults?

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Background

Iodine deficiency during periods of brain development can result in detrimental effects on cognitive ability. In school aged children with mild iodine deficiency, improvements in cognitive test scores have been seen with iodine repletion. The brain continues to develop throughout young adulthood and into the fifth decade of life, however, there is little research into the effect of iodine deficiency on cognition in young adults.

Objective

To investigate the effect of daily iodine supplementation on cognition in mildly iodine deficient young adults.

Design

A double-blind, randomised, placebo-controlled trial was conducted from July 2010 to September 2011 in young adults aged 18-30y who usually ate <2 servings of bread per day. Participants were randomised to receive 150 µg potassium iodate daily, or placebo, for 32 weeks. At baseline, seven cognitive tests from the Wechsler Adult Intelligence Scale were administered and participants asked to provide a casual urine sample for the measurement of urinary iodine concentration (UIC). All measurements were repeated at the end of 32 weeks.

Outcomes

At baseline, 205 young adults (mean age = 21.4 years) participated in the study. The median UIC of the subjects was 65 µg/L (25^{th}, 75^{th} percentile: 33, 101), between 50-99 µg/L indicating mild iodine deficiency. There were no significant differences in UIC ($P=0.144$) and cognitive test scores for the block design ($P=0.639$), backward digit span ($P=0.172$), matrix reasoning ($P=0.364$), symbol search ($P=0.465$), visual puzzles ($P=0.641$), coding ($P=0.740$), and letter-number sequencing ($P=0.158$) between the placebo and supplemented group at baseline. The results of the intervention will be presented at the conference.

Conclusion

Despite mandatory fortification of bread, young adults who consumed <2 servings of bread per day were mildly iodine deficient. An improvement in cognitive test scores in the supplemented group will provide evidence for the continuing role of iodine in brain development in young adults.

Source of Funding

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Iron status in female Australian blood donors

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Background
Every week Australia needs 21,000 blood donations to ensure sufficient blood and blood products to help people in need. Regular donations of whole blood over time may result in menstruating women developing iron deficiency which is the most common reason for on-site blood donor deferrals.

Objective
We aimed to assess the prevalence of low iron stores (serum ferritin < 20 ng/mL) in young female blood donors (regular donors, Sydney) and compare this to a control group (University staff and students, non-donors and irregular donors). We also aimed to compare the dietary and supplemental contributions to iron intake in both groups.

Design
Menstruating female (>18 years of age) regular blood donors ("donor group") and non/irregular-donors ("control group") were invited to participate. Participants completed the 'Short Iron Specific Checklist' food frequency questionnaire specifically designed to assess dietary and supplemental iron intake. Blood samples were analysed for serum ferritin.

Outcomes
Mean age of the donor group was 30.2±5.3 years (n = 203) and control group 25.1±5.4 years (n = 49). The donor group had lower mean serum ferritin (21.3±18.7 ng/mL) than the control group (47.2±47.1 ng/mL; P<0.001). Fifty-eight percent of the donor group and 37% of the control group were classified as having low ferritin levels (P= 0.006). Mean dietary iron intake (excluding supplements) was 11.9±4.6 mg/d (donor group) and 15.4±8.1 mg/d (control group) (P=0.002). Twenty-two percent (both groups) reported taking iron supplements. Seventy-nine percent of the donor group and 92% of the control group were consuming less than the reccommended EAR (8 mg/d) for iron (P = 0.040).

Conclusion
The prevalence of low iron stores was high in both groups, but was higher in the menstruating female blood donors. The use of iron supplements was low in both groups. Fewer donors were meeting the dietary recommendations for iron than non/irregular-donors. The findings warrant further research into strategies to improve the incidence of low iron stores in this blood donors as well as non/irregular-donors.

Source of Funding
This project was funded by Deakin University and the Australian Red Cross Blood Service.

Suboptimal iron status and associated dietary patterns in pre-menopausal women living in Auckland, New Zealand

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Background
Most studies investigating associations between iron status and diet focus on individual nutrients and/or foods. However, individuals do not consume nutrients and foods in isolation, but in a variety of combinations that may interact (for example, ascorbic acid enhances non haem iron absorption). Dietary pattern analysis considers how nutrients and foods are consumed in combination.

Objectives
To investigate dietary patterns and their relation to risk of suboptimal iron status in pre-menopausal women living in Auckland, New Zealand.

Design
Pre-menopausal women aged 18-44 years (n=375) participated in this cross sectional study. Women completed a 144-item computerised iron food frequency questionnaire (FeFFQ) developed to assess dietary intake patterns over the previous month. The FeFFQ included iron containing foods and foods known to affect iron bioavailability. The 30 most frequently consumed food items from the FeFFQ were entered into a factor analysis. Suboptimal iron status was defined as a serum ferritin <20 µg/L.

Outcomes
Seven dietary patterns were identified: refined carbohydrate & fat; Asian; healthy; meat & vegetables; tea & coffee; sandwich; and milk & yoghurt. These patterns explained 44.3% of the variance in intake. Women with high scores on the 'meat and vegetable' dietary pattern were at reduced risk of suboptimal iron status [odds ratio (OR) for quintile 5 versus quintile 1: 0.18; 95 % CI: 0.07, 0.52; P=0.001]. High scores on the 'milk & yoghurt' dietary pattern were associated with increased risk of suboptimal iron status (OR 3.04; 95 % CI: 1.29, 7.16; P=0.011).

Conclusion
These results suggest dietary patterns characterised by either a low intake of meat and vegetables, or a high intake of milk and yoghurt, are associated with an increased risk of suboptimal iron status in pre-menopausal women.

Source of Funding
This study was funded by the Massey University Research Fund and New Horizons for Women Trust Research Award.

The effects of non-anaemic iron deficiency on cognition, mental health and fatigue in women of childbearing age: A systematic review

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Background
Iron deficiency may affect cognitive functioning in women of childbearing age.

Objective
The objective of this systematic review is to investigate the effects of non-anaemic iron deficiency on cognition, mental health and fatigue in women of childbearing age (13-45 years).

Design
A literature search for English-language articles from 1970-2010. Eligible studies were those conducted in humans, aged 13-42y, with serum iron status and cognitive functioning data documented. Included studies were assessed for quality using the Joanna Briggs Institute Instrument.

Outcomes
Ten studies met the inclusion criteria: 6 randomised controlled trials (RCTs), 2 non-randomised trials and 2 cohort studies. Studies varied in duration of intervention, measures of iron status and cognitive function. RCTs predominantly investigated changes in iron status on cognitive functioning in females. All except one found a positive association between iron treatment and cognitive function in iron deficient subjects. Of the non-randomised trials, one found no significant correlation between iron deficiency and cognitive function, but reported fewer symptoms of depression and fatigue with iron treatment. Another reported iron deficient subjects demonstrated lower cognitive scores compared with control which significantly improved with iron treatment. One cohort study suggested an inability to sustain attention may signal iron deficiency in dieting women. The other found no correlation between iron deficiency and cognition, but reported reductions in depression and fatigue with treatment.

Conclusion
Evidence suggests that iron treatment can improve cognitive performance and symptoms of depression and fatigue in iron deficient subjects. Limited studies refute this. However, relationships vary across study designs, duration of iron supplementation and reliability of cognitive function assessment method. Further high quality randomised controlled trials are warranted

Source of Funding
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Iron status and dietary intake of Solomon Island women living in New Zealand

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Background
Iron deficiency is a global problem among women of reproductive age, and even more prevalent in women from developing countries. Solomon Island's (SI) recent health and demographic survey reported anaemia (haemoglobin (Hb)<120 g/L) in 44.3% of reproductive aged women. Currently nothing is known about the iron status of women from the SI living in New Zealand (NZ).

Objective
To compare iron status and dietary factors influencing iron status of SI and Caucasian women living in NZ.

Design
A cross-sectional study comparing 39 SI women with 75 age-matched Caucasian women living in Auckland & Hamilton. Serum ferritin (SF), C-reactive protein (CRP) and Hb were analyzed. Iron status was defined as: SF>20 µg/L + Hb>120 g/L (iron replete), SF<20 µg/L + Hb>120 g/L (low iron stores) and SF<20 µg/L + Hb <120 g/L (iron deficiency anaemia (IDA)). Subjects with CRP>10 mg/L were excluded. A computerized iron food frequency questionnaire was used to assess foods affecting iron status. Anthropometric measurements and blood loss, general health and demographic data were collected.

Outcomes
There was no significant difference (P=0.899) in prevalence of low iron stores and IDA combined between groups (16.7% SI and 22.5% Caucasian women). The frequency of beef consumed was lower in SI compared to Caucasian women (median (25^{th}, 75^{th} percentile) 1 (0.5, 2.5) *vs* 2.5 (1, 2.5) times/wk) (P<0.001), whereas SI women consumed more kiwifruit 2.5 (1, 7) *vs* 0.5 (0, 2.5) times/wk (P<0.001). Milk as a drink (P=0.002), tea (P=0.005) and Milo (P<0.001) were more frequently consumed by SI women and milk in food (P=0.047) and cheese (P<0.001) were more consumed by Caucasian women.

Conclusion
The iron status of SI women and Caucasian women did not differ, but the intake of foods influencing iron status varied. Prevalence of IDA was lower in SI women living in NZ (developed country) compared to SI (developing country), possibly due to adopting different dietary habits compared to their native country. A different combination of dietary /other factors may be influencing iron status in various groups.

Source of funding: IFNHH Postgraduate Research Fund Massey University & New Zealand Aid Programme

Can oral supplementation with vitamin B12 reduce vitamin B12 deficiency in South-Asian women of child-bearing age?

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Background
Maternal vitamin B12 (B12) deficiency is associated with an increase in the life-course risk of non-communicable disease for offspring. South-Asian women are particularly susceptible to B12 deficiency due to low or non-meat dietary patterns.

Objective
To investigate whether low dose B12 supplementation or individualised B12 dietary advice are effective, appropriate and sustainable in reversing B12 deficiency in South-Asian women of child bearing age.

Design
A double blind intervention trial recruiting 63 South-Asian women of child bearing age, stratified by dietary pattern, then randomly allocated to one of three treatment groups (B12 dietary advice, 6mcg B12 supplement or placebo capsule). Participants were tested at baseline, two months and six months for B12 biomarkers (serum B12 and holotranscobalamin [holoTC]), serum folate, glucose, insulin, lipids and full blood count.

Outcomes
At baseline, 49.2% of the study participants met the criteria for borderline serum B12 deficiency (B12<222 pmol/L) and 40.7% met the criteria for a low holoTC (<35 pmol/L). None of the participants were very low in serum B12 (B12<110 pmol/L). After six months of treatment the increase in B12 biomarkers was significant for the B12 supplement treatment (P<0.05) but not for the placebo or B12 dietary advice treatments. Serum B12 increased by 30% and holoTC by 44% for the supplement group, but decreased by 8.1% (serum B12) and 9.8% (holoTC) respectively for the placebo group. Dietary advice group serum B12 decreased by 2.5%, while holoTC increased by 1.1%.

Conclusion
Borderline vitamin B12 deficiency is common in South-Asian women of child-bearing age. A B12 6mcg supplement treatment had a small, but significant effect on increasing B12 biomarkers while placebo and B12 dietary advice treatments had a non-significant effect. Low dose oral B12 supplementation may be an important strategy for preventing B12 deficiency before pregnancy, therefore reducing the non-communicable disease risk from this deficiency for offspring.

Source of Funding
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Skin type and knowledge of vitamin D and sun exposure in New Zealand mothers

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Background
Skin colour is a risk factor for vitamin D deficiency. Darker skin requires longer sun exposure to generate comparable amounts of vitamin D to fair skin.

Objective
The objective of this study was to determine whether darker skinned mothers were aware of the relationship between skin colour and risk of low vitamin D.

Design
An anonymous, online survey about vitamin D and sun exposure was completed by mothers (n=8004) who had a child 5 yrs or less and living in New Zealand. Questions included knowledge about vitamin D, skin type and sun exposure. Mothers self-identified their own and their child's sun sensitivity type according the Fitzpatrick skin type scale.

Outcomes
A sub group of mothers (n=2689) with self-rated Fitzpatrick skin types 3 to 5 (minimally sensitive to sun or sun insensitive) were identified. The majority of these mothers were Caucasian (n=1905) followed by Maori (n=548), Pacific (n=431), Asian (n=158) and Indian (n=121). Most of these mothers (71%) reported that their child also had a Fitzpatrick skin type 3 to 5. When asked whether having darker skin was a risk factor for low vitamin D status 1315 (48.9%) said no and 702 (26.1%) didn't know. The majority of mothers (n=1224, 45.5%) reported that people with darker skin tones did not need to spend longer in the sun to make enough vitamin D and a further 883 (32.8%) were unsure. When asked about their child sunbathing 2193 (81.6%) agreed that it was harmful.

Conclusion
These results show that the majority of mothers surveyed, who identified themselves as having darker skin tones, were unaware or unsure of the relationship between skin colour and risk of low vitamin D. This could potentially put mothers and young children with dark skin tones living in New Zealand at risk of vitamin D deficiency and further studies are warranted.

Source of Funding
Institute of Food, Nutrition & Human Health, Massey University

The relationship between serum vitamin D and sun exposure in boys with Duchenne muscular dystrophy treated with corticosteroids compared with their healthy siblings

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Background

There has been little investigation into the micronutrient status and requirements of boys with Duchenne muscular dystrophy (DMD). With initiation of regular corticosteroid therapy, the micronutrients that require immediate attention are vitamin D and calcium. Vitamin D is being increasingly recognised for its role in muscle strength.

Objective

This study investigated the role of the environment and sun exposure on vitamin D levels in steroid-treated, ambulant boys with DMD, compared to their healthy siblings.

Design

Serum 25-hydroxy vitamin D (25(OH)D) was measured simultaneously along with sun exposure over a 1 month period during spring, 2009, in Melbourne, Australia. Sun exposure was assessed with a validated questionnaire in boys and their healthy siblings inhabiting the same home environment.

Outcomes

Six boys with DMD, each with at least one healthy sibling (n=7), were recruited. Serum 25(OH)D levels were significantly lower in boys with DMD compared to their siblings (52.2 ± 14.2 nmol/l vs. 77.9 ± 11.4 nmol/l respectively; P=0.02) despite no difference in mean time spent in sun exposure per day (251 ± 85 minutes/day vs. 314 ± 78 minutes/day; P=0.138). Although not significant, the relationship between mean daily sun exposure and serum 25(OH)D was considerably stronger in healthy siblings (r=0.642, P=0.12) than in boys with DMD (r=0.146, P=0.78).

Conclusion

This study demonstrates that boys with DMD treated with corticosteroids have low serum 25(OH)D levels which are unlikely to be attributed to less sun exposure in their home environment. Possible explanations include a primary defect in vitamin D metabolism in DMD, increased requirements or biochemical interactions due to corticosteroid use.

Source of Funding

This study was supported by a donation from the Duchenne Foundation, Australia.

The relationship of vitamin D receptor gene polymorphisms with insulin resistance in vitamin D deficient women

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Background

The actions of vitamin D are mediated by the vitamin D receptor (VDR). A number of single nucleotide polymorphisms (SNPs) have been identified on the VDR gene. Genotype may predict risk in diseases related to vitamin D status such as insulin resistance, and response to subsequent supplementation.

Objective

To discover any relationships between 5 identified SNPs in the VDR gene and insulin resistance (IR) in women with low vitamin D concentrations; to determine if allelic variants affect the response in IR to vitamin D supplementation.

Design

Genotyping of the Cdx-2, *Fok*I, *Bsm*I, *Apa*I and *Taq*I SNPs was carried out on 239 South Asian women in Auckland, New Zealand using polymerase chain reaction-based techniques. Associations of these genotypes and 3' end haplotypes with IR were determined using multiple regression analysis. Associations between SNP genotypes and responses in insulin sensitivity to vitamin D supplementation (4000 IU vitamin D_3 per day) were also determined for a subset (81) of these women who participated in a randomised controlled trial.

Outcomes

*Bsm*I BB, *Apa*I AA and *Taq*I tt genotypes were significantly associated with lower insulin resistance compared to *Bsm*I bb, *Apa*I aa and *Taq*I TT, and homozygosity of the haplotypes baT and BAt was associated with higher and lower insulin resistance, respectively, compared to no copies of their respective alleles. Of the subjects supplemented with vitamin D, those with the *Fok*I Ff genotype showed a significantly greater improvement in insulin sensitivity (increase of 29.4 (2.9, 38.1)) compared to women with the *Fok*I FF genotype (increase of 2.3 (-11.5, 10.1)).

Conclusion

This study has highlighted the association of vitamin D responsiveness and insulin resistance with *VDR* gene polymorphisms. This is the first study to determine associations between all three. Genotyping of the *VDR* gene may provide a predictive measure for insulin resistance in response to vitamin D intervention.

Source of Funding

Lottery Health, Massey University, AUT University.

Sarcopenia and vitamin D deficiency are risk factors for falls but remain undetected in aged care residents

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Background

Institutionalised elderly, in whom sarcopenia and vitamin D deficiency are common, are at high risk for falls.

Objective

To determine the contribution of sarcopenia and vitamin D deficiency to falls risk and to identify ways of assessing the risk of falling in elderly aged-care residents.

Design

Eighty ambulatory female residents age 86 years (range 67-99 years) from 18 low-level aged care facilities participated. Body composition was determined using DXA, ankle, knee and hip strength measured using the Nicholas manual muscle tester, balance assessed using the Lord's Balance test, and physical function reported using TUG and walking speed over 6 metres. Serum 25(OH)D was measured from morning blood samples. Basic anthropometry was performed. Falls were recorded prospectively during 12-months. Medical records were reviewed for medical conditions and medication use. Relative sarcopenia was determined using the Janssen method. Chi square distributions and logistic regression analysis were performed.

Outcomes

Sarcopenia was associated with an increased risk for falls (OR 10.7; 95% CI 1.1–99.9, P<0.05). Higher serum 25(OH)D levels had a small but protective effect against risk for falls (OR 0.97; 95% CI 0.94–0.99, P<0.05). Age, physical function, medications or medical conditions were not predictors for falls. Sarcopenic women were heavier (but not taller), had higher BMI (27.8±4.3 v 22.1±2.4, P<0.001) and had greater % body fat (40.8±5.4 v 26.2±5.1, P<0.001) than non-sarcopenic women, but groups did not differ in lean mass. Sarcopenic women were not distinguishable using limb circumferences or functional measures, and despite being sarcopenic most were classified overweight or obese.

Conclusion

Sarcopenia is a risk factor for falls but is not readily identified from basic anthropometry and therefore goes undetected. Routine screening of serum 25(OH)D levels and correction of deficiencies may also contribute to falls risk reduction in elderly aged care residents.

Source of Funding

Supported by a grant from Dairy Australia.

Folic acid deficiency causes rapid, deleterious effects on telomere function and chromosome stability in human WIL2-NS cells *in vitro*

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Background

Folate acts via two distinct but interconnected biochemical pathways, both of which are critical for maintaining chromosomal stability: methylation of cytosines in DNA, and conversion of dUMP to dTTP. Telomeres are nucleoprotein structures 'capping' the ends of chromosomes which, when compromised, cause chromosomal instability (CIN) and potential to initiate disease. It is plausible that insufficient folate could affect telomere length and integrity by hypomethylation of subtelomeric sequences, and incorporation of uracil into the TTTAGG hexamer repeat. However, this hypothesis had not been tested.

Objectives

To determine whether folic acid (FA) deficiency affects telomere length (TL) and chromosomal stability in human cells *in vitro*.

Design

Human WIL2-NS cells were grown in culture medium containing 30, 300 or 3000 nM FA for 42 days. Weekly samples were tested for cell viability and nuclear division index (NDI), telomere length (by flow cytometry), biomarkers of CIN (CBMN Cytome assay) and LINE1 DNA methylation status (qPCR).

Outcomes

FA deficiency impacted significantly and negatively on cell viability (P<0.0001) and NDI (P<0.0001), while LINE1 (global) hypomethylation (P=0.0007) and biomarkers of CIN (micronuclei (MN) and nucleoplasmic bridges (NPB)) increased under low FA conditions (P<0.0001). TL increased significantly in the lowest FA concentration in the short term (up to 14 days) (P<0.0001), followed by a steady reduction (P trend <0.0001) in TL through to day 42.

Conclusion

FA-deficiency causes an increase in TL in the short term, followed by rapid telomere attrition over the longer term, in parallel with increased CIN. FA-deficiency has a significant, deleterious impact on multiple parameters of genomic stability in WIL2-NS cells *in vitro* including loss of TL control. Further research is required to fully elucidate the mechanisms.

Source of Funding

Not applicable.

Mandatory folic acid fortification – who stands to benefit? Results from a New Zealand postpartum survey

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Background
Internationally, poor maternal periconceptional folic acid uptake has been associated with lower socioeconomic status, minority ethnicity status and unintentional pregnancy.

Objective
To investigate the effect of proposed mandatory folic acid fortification of bread on associations between maternal factors and recommended folic acid use.

Design
Retrospective survey of postpartum women in hospitals and birthing centres across New Zealand using a self-administered questionnaire on supplement use and bread intake in the periconceptional period.

Outcomes
Of the 968 women approached, 758 (78%) agreed to participate. Thirty-three per cent (33%) of women reported having used folic acid supplements as recommended during the periconceptional period. When the mandatory fortification of bread was modelled, socio-demographic predictors of poor folic acid use, including younger maternal age, increasing parity, non-New Zealand European ethnicity, lower education and less income, were rendered either non-significant or appreciably attenuated. Notably, after controlling for all other significant factors, the odds ratio of pregnancy planning was reduced from 17.23 (95% confidence interval (CI): 8.12–36.55) to 2.60 (95% CI: 1.72–3.92; both P<0.001). Overall, the proportion of women who would achieve adequate folic acid intake increased to 59% with mandatory fortification.

Conclusion
Few women comply with periconceptional folic acid recommendations and thus the maximal prevention of neural tube defects is still far from being attained. Health education campaigns to increase awareness of folic acid recommendations will likely widen socio-demographic inequalities in periconceptional folic acid intake, while the data from this study demonstrate that mandatory fortification narrows these inequities.

Source of Funding
Funding provided by the Department of Human Nutrition, University of Otago, Dunedin, New Zealand.

Bias within the folate microbiologic assay: implications for monitoring folate status

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Background
The microbiologic assay for folate is a "gold standard" assay and is relied upon as an accurate measure of folate status. The microbiologic assay is often used to assess population folate status in national nutrition surveys.

Objective
To assess the effect of varying dilution factors on calculated folate concentrations using the microbiologic assay, and to determine the level of agreement between the microbiologic assay and liquid-chromatography tandem mass spectrometry (LC-MS/MS).

Design
Plasma and whole blood (WB) folate were measured in samples from 73 participants using the microbiologic assay method of Molloy and Scott (1997). The calibrator used was 5-methyltetrahydrofolate and dilution factors of 1/40 and 1/80 for plasma and 1/800 and 1/1600 for WB were used. WB samples were also measured by a LC-MS/MS method adapted from Fazili *et al*. (2005). Pearson correlation coefficients, Deming regression, and Bland-Altman plots were used to compare the effect of the higher and lower dilution factors used in the microbiologic assay, and to compare LC-MS/MS with the microbiologic assay.

Outcomes
Deming regression showed a proportional bias with a slope of 1.79 (95% CI 1.49 – 2.10) and 1.48 (1.33 – 1.64) comparing the lower vs. higher dilution factor for plasma and WB folate respectively. The Bland-Altman relative bias was 31% (limit of agreement -20 – 83%) and 21% (-7 – 48%) for plasma and WB folate respectively. The best agreement was seen at low concentrations, with an increasing difference in calculated folate concentration between dilutions toward higher concentrations. Deming regression comparing the microbiologic assay using a higher dilution factor with LC-MS/MS showed no significant proportional (slope 0.94, 0.77 – 1.11) or constant bias (intercept 23, -17 – 62). The Bland-Altman relative bias was 4% (-25 – 32%) and the Pearson correlation coefficient between these two methods was 0.92.

Conclusion
Our data show a discrepancy in the results of the two dilutions whereby the lower dilution (i.e. higher folate concentration) may lead to an overestimation of population blood folate status when using the microbiologic assay.

Source of Funding
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Impact of dairy consumption on the risk of cardiovascular disease

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Dietary guidelines for the reduction of cardiovascular disease (CVD) risk recommend restricting the intake of saturated fatty acids (SFA). In practical terms, this requires either the restriction or alteration of the fat composition of major food sources of SFA, including dairy. The scientific foundation for this advice rests on the ability of certain SFA to raise serum LDL cholesterol, a well established risk factor for CVD. However, this cholesterol paradigm is based on an indirect relationship between SFA and CVD, which are linked by a single biomarker of risk for a multi-factorial disease. Since foods are a complex matrix of nutrients that can exert effects on CVD through numerous pathways, it is understandable that the effect of dairy foods on CVD risk cannot be predicted, purely on the basis of their content of SFA.

There are, as yet, no definitive, randomly controlled trials on the effects of dairy foods on CVD, only intervention studies with intermediate rather than final endpoint data on total or CVD death. Nonetheless, the totality of evidence from prospective cohort studies is convincing in showing that dairy foods do not increase risk of CVD, and may even exert long term benefits to cardiovascular health. While the quality and quantity of this evidence is highly variable and prone to confounding, it is still impressively consistent, especially for milk, with benefit being conferred upon the highest milk consumers (defined as between 190-568ml/day).

This apparent paradox with respect to effects of SFA in dairy fat on serum cholesterol may be explained, in part, by the impact of other nutrients within dairy on lipid and non-lipid mediated CVD risk factors. The most consistent and outstanding finding in observational and intervention studies has been an association between milk and lower, and reduced blood pressure, respectively. This effect has been ascribed to the calcium and potassium in milk, and to bioactive peptides released from whey and casein milk proteins that exert anti-hypertensive effects via inhibition of angiotensin-1- converting enzyme. Calcium in dairy has also been implicated in counterbalancing the cholesterol-raising effect of SFA by promoting the excretion of SFA, bile acids and cholesterol from the gut. A loss of energy in fat via this same route may underlie the effect of dairy in promoting weight loss and decreasing BMI. These effects of calcium may be more pronounced in dairy foods with a higher content of calcium, such as cheese.

In summary, although dairy foods represent a major source of dietary SFA, the effect of these foods on a single biomarker of CVD risk, such as cholesterol, clearly provides an inadequate means for explaining the relationship between dairy and CVD. Future dietary guidelines should take into account the weight of emerging evidence in favour of the beneficial rather than detrimental effects of dairy on CVD risk. They should also attempt to translate nutrient-based advice into food-based recommendations.

Source of Funding
Not applicable.

Role of nutrition knowledge in the association between socioeconomic position and takeaway food consumption

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Background
Lower socioeconomic groups consume takeaway food more regularly and it is thought that lower levels of nutrition knowledge may partly contribute to the poorer dietary intakes of lower socioeconomic groups.

Objective
To examine whether nutrition knowledge partly explains the association between SEP and takeaway food consumption, and the types of takeaway food consumed.

Design
A cross-sectional postal survey was conducted among 1500 randomly selected adults aged 25–64 years in Brisbane, Australia (response rate 63.7%). Participants reported their usual consumption of overall takeaway food and consumption of 22 specific takeaway food items (times/week). These latter items were grouped into "healthy" and "less healthy" choices and indices were created. A nutrition knowledge index was constructed using a 20-item scale. SEP was ascertained by education.

Outcomes
Lower educated groups were more likely to have low nutrition knowledge compared with the most educated (all $P<0.05$). Compared with the most educated, those in the second highest educated group consumed a higher levels of "healthy" takeaway food ($P=0.02$) whereas the least educated consumed higher levels of "less healthy" takeaway food ($P<0.01$). Once the nutrition knowledge variable was included in the models, the associations between education and "healthy" and "less healthy" takeaway food were attenuated; however, they remained significant. Nutrition knowledge partly explained the education differences in "healthy" and "less healthy" takeaway food consumption but not overall takeaway food consumption.

Conclusion
Nutrition knowledge may have an important role in the choice of takeaway food. Nutrition education programs aimed at improving their nutrition knowledge may be important for reducing the socioeconomic differences in takeaway food consumption, especially with regard to "less healthy" choices.

Source of Funding
Not applicable.

Food expenditure of food insecure families: a reality check

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Background
The food environment has been proposed as an important factor in terms of influencing diet. A high use and density of fast food outlets in lower socio-economic areas has been proposed as a possible cause of obesity. There is however limited data on actual use of these foods in New Zealand. Information on food purchasing practices can provide some insight into this.

Objective
To describe where food insecure households with children are purchasing food and how much they are spending on food.

Design
This descriptive analysis uses baseline data from a randomised control trial (Spend Study) conducted in Dunedin between June 2009 and May 2010. Low income ($45,000/year), food insecure households with children collected food-shopping receipts from all possible sources for four weeks (n=159). When receipts were not obtained households recorded the date the food was purchased, the retail outlet, and an itemised list of the food and associated prices. Food items were classified into groups based on where they were purchased. Many households did not report any expenditure for some food outlets therefore medians and interquartile ranges have been reported.

Outcomes
One quarter of this group reported 'low food security' meaning they were reliant on others for their regular food supply. Nearly half received a government benefit as their main source of income and half were single parent families. Weekly median expenditure on food from all food shops was $40.20 per person (standardised to one adult female). Eighty-five percent of this was attributed to supermarkets, 4% at local food shops and 3% at fast food/takeaway outlets. Median expenditure at restaurants and cafes was zero.

Conclusion
Most food purchased by food insecure households with children in Dunedin was from supermarkets with negligible purchases from fast food or takeaway outlets and restaurants and cafes. Further research relevant to the NZ environment into actual consumption of these foods is warranted.

Source of Funding
Department of Human Nutrition, University of Otago

Describing socioeconomic gradients in children's diets – does the socioeconomic indicator used make a difference?

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Background
Children of low socioeconomic status (SES) may have poorer diets than children of high SES, however there is no consensus on which SES variable is most indicative of differences in dietary intake between children of different SES groups.
Objective
To explore how SES differences in dietary behaviours may change according to the SES indicator used.
Design
Families (N=629) were recruited from grades five to seven in 27 Adelaide primary schools, stratified by SEP. Children completed food questionnaires providing intake scores for fruit, vegetable, non-core food and sweet drink intake, and a healthy eating behaviour (HEB) score. Parents reported demographic information by telephone interview. Differences in dietary intake scores between SES groups were compared using education, income and postcode. ANOVAs (P<0.05) were used to compare scores between groups. Analyses were conducted separately for boys and girls.
Outcomes
Most consistency was seen between results for education and income (76.2%) and least consistency was seen for education and income with postcode (52.4% and 66.7% respectively). Significant differences were observed for boys' fruit and vegetable intake with all SES indicators, and HEB score with education and income. For girls, significant differences were observed for sweet drink intake with all SES indicators, HEB score with education only and vegetable intake with postcode only.
Conclusion
Socioeconomic gradients observed in children's dietary intake (lower SES being associated with poorer diet) varied according to the SES indicator used. SES indicators may function by different pathways to influence dietary intake, whereby education may be an indicator of nutrition knowledge and attitudes, while income may reflect access to resources. In designing studies, researchers need to consider the most appropriate SES indicator to use, according to the variables under investigation.
Source of Funding
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Effects of a free school breakfast programme on children's attendance, academic achievement, and short-term hunger: a stepped-wedge, cluster randomised controlled trial

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Background
Free school breakfast programmes exist in a number of high income countries, but their effects on educational outcomes have rarely been evaluated in randomised controlled trials.
Objective
To evaluate the effect of a free school breakfast programme on children's school attendance, academic achievement and short-term hunger.
Design
A stepped-wedge, cluster randomised controlled trial was conducted. Schools were randomised to cross over from control to intervention phase (i.e. one-way switch over) in different terms during a full school year.
Setting: 14 New Zealand schools (decile 1-4).
Participants: 424 children, mean age 9.4 ± 2 years, 53% female, 34% Māori, 42% Pacific, 23% New Zealand European/Other ethnicities.
Intervention: A free daily school breakfast programme.
Outcome measures: The primary outcome was children's school attendance. Secondary outcomes were academic achievement; self-reported grades; sense of belonging at school; behaviour; short-term hunger; breakfast habits; and food security.
Results
There was no statistically significant effect of the breakfast programme on children's school attendance. The odds of children achieving an attendance rate <95% was 0.76 (95% confidence interval [CI] 0.56, 1.02) during the intervention phase, and 0.93 (95% CI 0.67, 1.31) during the control phase, giving an odds ratio of 0.81 (95% CI 0.59, 1.11); p = 0.19. There was a significant decrease in children's self-reported short-term hunger during the intervention phase compared with the control phase, demonstrated by an increase of 8.6 units on the Freddy satiety scale (95% CI 3.4 – 13.7, p = 0.001). There were no effects of the intervention on any other outcome.
Conclusion
A free school breakfast programme did not have a significant effect on children's school attendance or academic achievement, but had significant positive effects on children's short-term satiety ratings. More frequent programme attendance may be required to influence other outcomes.
Source of Funding
Health Research Council of New Zealand (09/337). Cliona Ni Mhurchu holds the National Heart Foundation Senior Fellowship (Grant 1380).

Patterns of stress, mood and eating behaviour in a student population

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Background
Daily stress and mood may influence eating behaviour, which may affect health outcomes in the long term.

Objective
To investigate the role of daily stress and mood on eating behaviour in a student population and to examine how trait characteristics may moderate these associations.

Design
A daily diary survey was carried out over 21 days in 288 undergraduate students at the University of Otago. Students accessed a secure webpage each day and reported the type and intensity of their daily stress, mood, and daily eating behaviours. The moderating effect of Intuitive Eating, Mindfulness, Emotional Eating, BMI, gender, and dietary restriction to lose or maintain weight was measured separately. Hierarchical linear modelling was used to examine associations between daily stressors, mood, and eating behaviour.

Outcomes
On days when participants reported greater positive moods, they reported consuming more servings of fruit ($P<0.01$) and vegetables ($P<0.001$), yet they also perceived consuming more food than usual ($P<0.001$). By contrast, the experience of daily stress and negative mood were associated with less healthy eating patterns. Greater total daily stress was associated with a lower number of servings of vegetables per day ($P<0.01$). Total daily stress was also associated with the self-perception that the amount of food consumed that day was less than usual ($P<0.001$). On days when participants reported higher negative moods, they also reported consuming more servings of crisps, corn snacks and corn chips ($P<0.05$), and less fruit ($P<0.05$). Body Mass Index was positively associated with consuming more unhealthy foods on days when more stress and negative mood was experienced. No other moderators substantively altered the stress, mood, and eating associations.

Conclusion
The adverse influence of stress and negative mood is consistent with previous research. A unique finding is the link between positive mood and higher fruit and vegetable consumption. Individuals with a high BMI may be at risk of unhealthy eating behaviours under stress and negative mood.

Source of Funding
University of Otago Research Grant.

Fish intake and barriers towards its consumption in older adult Australians

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Background
Current fish intake data are scarce. Given the health benefits of fish there is little information available on adults' predictors towards fish consumption.

Objectives
To determine current intakes of fish in a nationally representative sample of Australian adults >51 years; and to identify barriers influencing lower fish consumption (i.e. less than once per week).

Design
Cross-sectional survey. Your Source Market Research agency conducted online (n=485) and computer assisted telephone interviews (n=369) using a quantitative fish frequency questionnaire and additional open and closed ended survey questions.

Outcomes
Current average consumption of finfish *and* seafood was once a week. Cost was the most frequently reported barrier for lower intake of fresh (37% of respondents) and canned fish (15%); poor availability of good quality/preferred seafood was second most reported barrier (16%) for fresh fish consumption. Twenty percent and 39% reported "no particular barrier" regarding their lower intake of fresh and canned fish. More reported barriers ($\beta=-.256$, $P=0.001$) predicted lower frequency of fish consumption; younger age ($\beta=.617$, $P<0.001$) predicted higher frequency of consumption. State of residence or income were not significant predictors.

Conclusion
Average fish/seafood consumption remains low in older Australian adults. In less frequent consumers, cost was the most frequently reported barrier; with more reported barriers predicting lower consumption. Strategies to reduce cost need to be identified in an attempt to increase consumption. Understanding why a group of lower fish consumers reported "no barriers" towards fish consumption needs to be determined.

Source of Funding
Australian Seafood Cooperative Research Centre (CRC) Company Limited (Simplot Australia and Flinders University as core partners).

Glycaemic response and glycaemic index for rice in people of European and Chinese ethnicity

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Background
Glycaemic Index (GI) maybe used to guide choice of carbohydrate containing foods. GI is normally determined in small groups of European volunteers and the value thus obtained is assumed to apply to all populations.

Objective
Our study aim was to determine whether there are ethnic differences in glycaemic responses and GI to various varieties of rice in people of European and Chinese ethnicity.

Design
Sixty-two healthy volunteers, 31 Chinese and 31 Europeans (18-50 yr) consumed 50 g of available carbohydrate portions on separate mornings after a 10 hr overnight fast. Capillary blood glucose was measured at baseline and over a 2 hr period following ingestion of foods (2 x glucose beverage and 1 x five rice varieties: Jasmine, Basmati, Brown, Doongara® and Parboiled).

Outcomes
Age, height, and sex distribution was not different between the two groups, but body weight and BMI were significantly lower in the Chinese than the European group ($P<0.05$). Incremental blood glucose areas under the curve (iAUC) of all tested foods were greater in Chinese than in Europeans ($P<0.05$). The largest difference was for Parboiled rice for which the Chinese iAUC was 77% (95%CI: 38, 226, $P<0.001$) higher than the European iAUC. In the Chinese and European groups, respectively, the GI of Doongara® (67, 55), Jasmine (81, 68), and Parboiled rice (72, 57) were statistically significantly higher in the Chinese.

Conclusion
Chinese have a greater glycaemic response to the rice varieties than Europeans. Further study is required to investigate long-term consequences of rice intake in Chinese.

Source of Funding
Riddet Institute (Palmerston North, New Zealand), and Performance Based Research Fund (PBRF).

Food Intolerances: restriction of dietary FODMAPs reduces gastrointestinal symptoms in patients with irritable bowel syndrome

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Background
Fermentable Oligosaccharides, Disaccharides, Monosaccharides And Polyols (FODMAPs) are poorly absorbed sugars known to cause luminal distention in the colon through increased gas production and water delivery. FODMAPs include fructose (in excess of glucose), lactose, fructans, galacto-oligosaccharides and polyols. Challenge trials using fructose and fructan solutions have induced symptoms in patients with irritable bowel syndrome (IBS), however the influence of dietary FODMAPs in IBS has not been investigated for greater than two days.

Objective
To compare gastrointestinal symptoms in IBS patients receiving both high and low FODMAP diets for three weeks each.

Design
Twenty-two IBS patients undertook a single-blinded, cross-over, interventional trial which involved consuming two nutritionally-matched diets, varying only in mean daily FODMAP content (low: 1.5 g/day vs. high: 21.5 g/day, both diets were lactose-free) for 21 days each. All food was provided. Daily symptoms were measured using a 100 mm visual analogue scale, 100 mm representing symptoms worst ever experienced.

Outcomes
Overall gastrointestinal symptoms were reduced on the low FODMAP diet (median VAS [IQR] 20.4[14.3-28.7] mm) compared to the high FODMAP diet (41.3[27.0-52.3] mm; $P<0.001$). The greatest symptom control was achieved after 7 days on the low FODMAP diet and thereafter maintained (14.1[10.5-25.9] mm vs high FODMAP: 41.7[26.5-86.9] mm; $P<0.001$). Similar results were seen for individual symptoms of abdominal pain ($P<0.001$) and bloating ($P=0.001$).

Conclusion
Restriction of dietary FODMAPs effectively reduces gastrointestinal symptoms including abdominal pain and bloating in IBS patients, hence, should be recommended as first-line therapy for IBS.

Source of Funding
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Breaking prolonged sitting reduces postprandial glycemia & insulinemia in healthy adults

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Background

Observational research suggests that breaking sitting time is associated with improved cardiometabolic risk. However, intervention studies are needed to substantiate these findings.

Objective

To compare the effects of prolonged sitting on postprandial lipidemia glycemia and insulinemia to a similar duration of sitting combined with either 30 min of continuous physical activity or intermittent short bouts of activity in healthy adults.

Design

Seventy (28 males: VO_{2max} 50.8±3.6 ml/kg/min and 42 females: VO_{2max} 37.7±6.6 ml/kg/min) participants completed three, 9 h trials in a randomised order: *1) Physical Activity (PA):* participants walked on the treadmill at 60 % VO_{2max} for 30 min prior to consuming the first meal replacement beverage (MRB) then remained seated for the remainder of the trial; *2) Breaking sitting time (BS):* participants walked on the treadmill at the same speed and incline as PA, for 1 min and 40 s every 30 min throughout the trial; and *3) Prolonged sitting (PS):* participants remained seated for the duration. In each trial participants were fed three MRBs, each providing 0.46 g fat, 0.54 g protein and 1.12 g carbohydrate per kg of body mass at 60, 240 and 420 min. Venous blood samples were obtained at baseline, and hourly for 9 h, with additional samples taken 30 and 45 min after each feeding.

Outcomes

After adjusting for age, sex and BMI, the 9 h triglyceride iAUC was 24% lower in PA, compared to BS ($p=0.008$). The 9 h glucose iAUC was 32.5% and 29.3% lower in BS when compared to both PA ($p<0.001$) and SE ($p=0.002$). The 9 h insulin iAUC was 24.4% and 31.9% lower in BS compared to both PA ($p<0.001$) and PS ($p<0.001$).

Conclusion

Regularly breaking sitting time with intermittent short bouts of moderate intensity activity lowers acute postprandial glucose and insulin concentrations in healthy adults. Limiting sitting time by incorporating regular very short bouts of activity may be an important public health intervention

Source of Funding

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The influence of caffeine on consumption of sugar-sweetened beverages

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Background

Trends in sugar-sweetened beverage (SSB) consumption and rates of obesity have risen significantly in the past 30 years. This simultaneous rise indicates there may be an association between SSB and obesity. Caffeine is a controversial additive to SSB, and its addition to SSB, which is hedonically pleasant to drink, may be driving the consumption of SSB.

Objective

To determine whether the concentration of caffeine influences consumption of SSB at a standardised meal and to investigate the relationship of taste sensitivity with volume of SSB consumed at different caffeine concentrations.

Design

Participants (n=23, 27 ± 5 years old, BMI 18.8 ± 2.3 kg/m^2, 57% female) were recruited from Deakin University. In a crossover study design, participants were provided with a standardised meal on four days and simultaneously consumed SSB with varied levels of caffeine (0 mM, 0.67 mM, 1.16 mM & 1.65 mM). Caffeine taste thresholds were assessed using the International Standards Organisation method for assessing taste sensitivity.

Outcomes

A one way between groups ANOVA revealed no significant main effect of caffeine concentration on consumption of SSB [$F(3,89)=0.113$, $P=0.95$]. Pearson correlation analysis identified significant correlations between amount consumed in each session, meaning if you consumed a higher amount at one session you were likely to consume similar amounts at all sessions ($R=0.75$-0.65, $P<0.05$). An individual's oral sensitivity to caffeine was not associated with SSB consumption ($R=0.4$-0.3, $P=0.08$-0.2).

Conclusion

The concentration of caffeine in SSB did not influence the amount of SSB consumed. Further research is required within a larger sample and in a free living enviroment to further understand the role caffeine plays in SSB consumption.

Source of Funding

Centre for Physical Activity and Nutrition Research (CPAN), Deakin University.

Kernel intactness, carbohydrate digestibility and the relative glycaemic impact of white, wholemeal, multigrain and mixed grain breads

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Background

Breads described in New Zealand (NZ) as wholegrain, multigrain and mixed grain, and promoted for their health benefits, usually contain a proportion of intact or partially intact (cracked) kernels, but whether kernel intactness and the bread descriptor used reliably indicate a low glycaemic impact of the breads is uncertain.

Objective

To determine whether or not the terminology used to promote NZ supermarket breads, and the appearance of semi-intact grain kernels in them, is useful to consumers as a guide to breads of low glycaemic impact.

Design

Eight NZ breads described as white, wholemeal, multigrain mixed grain and low GI were digested in vitro either intact (I) or after homogenising (H) to remove grain structure, and determine their relative glycaemic impact (RGI) determined as grams of glucose equivalents (GGE) per serving and per 100g. The breads were also digested under gastric conditions to remove and measure intact kernels and kernel fragments from the breads.

Outcomes

Digestion profiles of I and H versions of white, wholemeal, wholegrain and low GI white bread were similar, although the breads differed in relative glycemic impact (RGI; g glucose equivalents/100 g bread) because they differed in digestible carbohydrate content. Intact kernels or kernel fragments made little difference to the digestion profiles of some grainy breads, but made a small difference in others. Based on rapidly available (20 min) carbohydrate, the RGI of I and H samples ranged from I = 34.3 ± 0.5 GGE/100 g and H = 34.0 ± 1.6 GGE/100 g for a white bread to I = 18.1 ± 0.3 GGE/100 g and H = 23.0 ± 1.1 GGE/100 g for a Wholemeal and Grain bread. The main factors determining glycaemic impact per serving were available carbohydrate content, and conversely, water content of the breads.

Conclusion

Description as wholegrain and wholemeal, and appearance of intact kernels in breads available in NZ supermarkets, is not a reliably effective guide to breads of low glycaemic impact, because the proportion of intact kernels in the breads available is too low to sufficiently retard carbohydrate digestion.

Effects of resistance training and detraining and muscle fibre type on insulin responses to a glucose load

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Background

Resistance training can enhance insulin sensitivity. Literature is limited in type 2 diabetic (T2DM) populations and in those with a familial link. Muscle fibre types vary in their glucose handling and training and detraining can influence muscle fibre composition.

Objective

This study was designed to investigate glucose and insulin responses to an oral glucose load, muscle fibre type and muscular performance, in offspring of T2DM and control subjects, with resistance training and detraining.

Design

Six familial insulin resistant (FIR) and 10 control (C) subjects did 9 wk resistance training, then 9 wk detraining. At baseline (T1), after training (T2) and after detraining (T3), performance measures, an oral glucose tolerance test and myosin heavy chain (MHC) fibre composition were taken.

Outcomes

3RM increased similarly in both groups in leg press, leg curl and squat (all P≤0.001). Wingate peak power also increased (P≤0.005). Only strength decreased with detraining (P ≤ 0.001). Training reduced insulin area under the curve (AUC) to a greater extent (P = 0.050) in FIR (T1, T2: 1219±734 , 837±284 pmol/L, resp.) than C (T1, T2: 647±268, 635±258 pmol/L, resp.). Detraining increased insulin AUC, with a larger (P = 0.018) insulin AUC in FIR (T2, T3: 837±285, 1040±194 pmol/L, resp.) than C (T2, T3: 635±258, 625±213 pmol/L, resp.) No differences in MHC isoform distribution between groups or with training were observed. MHCIIX fibres increased with detraining (P=0.026). A positive correlation between fasting insulin concentration and MHCIIA content was observed after training (P=0.046) and an inverse correlation between fasting glucose concentration and MHCIIX after detraining (P=0.027).

Conclusion

Familial insulin resistant individuals exhibit a greater training effect to reduce insulin AUC and, in contrast to controls, an increase with detraining. Fibre type plays a role in insulin and glucose responses, but cannot fully explain differences with training or between groups.

Source of Funding

Funding was received from the Sports Nutrition and Exercise Metabolism Research Group, Otago University.

Salt loading in canola oil fed SHRSP rats induces endothelial dysfunction

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Background
Canola oil (CO) intake as the only dietary fat source shortens the life-span of stroke-prone spontaneously hypertensive (SHRSP) rats. SHRSP rats fed CO have a 15-20% reduced life span following NaCl loading when compared to SHRSP rats fed soybean oil (SO) with NaCl loading.

Objective
This study aimed to: (1) determine if 50 days of CO intake causes endothelial dysfunction in SHRSP rats, and; (2) determine if NaCl loading with CO leads to endothelial dysfunction.

Design
Male SHRSP rats were fed the following diets for 50 days: 10 wt/wt% SO, or 10 wt/wt% CO, each given tap water; 10 wt/wt% SO, or 10 wt/wt% CO, each given water with 1% NaCl. Male Wistar Kyoto (WKY) rats were used as a normotensive control and were fed 10 wt/wt% SO for 50 days.

Outcomes
Contractile responses to norepinephrine, and endothelium-dependent and -independent vasodilating responses to acetylcholine (ACh) and sodium nitroprusside (SNP), respectively, were measured in thoracic aortic rings. The ACh dilating responses were not significantly different ($P > 0.05$) between the SHRSP rats fed CO and SO alone. CO fed SHRSP rats with NaCl loading showed a significantly impaired ($P < 0.05$) endothelium-dependent relaxation response of the thoracic aorta compared to the CO only group and WKY rats. Relaxation responses to SNP were not significantly different between groups ($P > 0.05$). CO fed SHRSP rats with NaCl loading showed significantly reduced ($P < 0.05$) contractile responses to norepinephrine compared to SHRSP rats fed only CO. Contractile responses to norepinephrine were significantly greater ($P < 0.05$) in the WKY rats compared to all SHRSP groups.

Conclusion
CO intake did not induce endothelial dysfunction in SHRSP rats. However, CO intake with 1% NaCl loading significantly impaired endothelial dysfunction in SHRSP rats when compared to CO intake alone.

Source of Funding
Deakin University

The effect of seasonal heat acclimatisation on fluid and electrolyte losses in endurance trained athletes

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Background
Heat acclimatisation results in several thermoregulatory adaptations that serve to reduce the physiological strain associated with exercise in the heat. These include an increase in sweat rate and aldosterone mediated conservation of sweat sodium. Few studies have investigated the effect on sweat potassium losses.

Objective
To document the effect of seasonal heat acclimatisation on sweat rate and sweat electrolyte losses (sodium and potassium) in a group of highly trained endurance athletes.

Design
Twenty-six athletes completed two exercise sessions on separate days in an environmental chamber. Trials were completed at the end of both the summer and winter months. Sweat rate was calculated from loss of body mass over time. Sweat collecting devices were attached to the upper arms and legs.

Outcomes
Sweat rates were higher and sodium concentrations were lower at the end of the summer period. Sweat potassium loss was significantly greater ($P<0.05$) in the legs at the end of the summer period (winter: 7.1mmol/L, summer 8.3mmol/L). There was a significant reduction in sweat sodium concentration at the end of summer in both the arms and legs (winter: 53.4mmol/L, summer 46.0mmol/L).

Conclusion
The data from this study predicts that endurance athletes with high sweat rates are at risk of both sodium and potassium deficiency if dietary intake is not sufficient to replace losses. Emphasis on the replacement of both fluid and electrolyte losses accompanying prolonged exercise in the heat is important in order to avert potential heat related illness and maintain performance.

Source of funding
Not applicable

Salt intake assessed by 24-hr urine collection in Australian school children aged 5-13 years

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Background
Data from the 2007 Australian Children's Nutrition and Physical Activity Survey indicates dietary salt intake exceeds recommendations. However, these findings need to be confirmed using urinary sodium as a marker for salt intake.

Objective
To measure total daily salt intake using 24-hr urinary sodium excretion within a sample of Victorian school children aged 5–13 years.

Design
A cross-sectional study was completed with a convenience sample of independent Victorian primary schools (n=9). Two hundred and fifty four children completed a 24-hr urine collection over a school (33%) or weekend day (67%). 24-hr urinary sodium excretion was used to estimate total sodium intake and the salt equivalent. Total volume, urinary creatinine and questioning of participants were used to assess the completeness of the 24-hr urine samples. Thirty three (13%) urine samples were considered incomplete and excluded from the analysis.

Outcomes
One-hundred and ten males and 111 females were included with a mean age of 9.3±1.6 years. The average 24-hr urinary sodium excretion (n=221) was 103±43 mmol/24 hr, range 13-310 mmol/24-hr (salt 6.0±2.5 g/d, range 0.8-18.2 g/d). Daily sodium excretion did not differ by gender, male 106±46 mmol/24-hr (salt 6.2±2.7 g/d) vs. female 101±40 mmol/24-hr (salt 5.9±2.3 g/d), P=0.395. Seventy one percent of children exceeded the recommended daily Upper Limit for sodium (UL: 4-8 yr=60 mmol/d; 9-13 yr=86 mmol/d) and 99% of children exceeded the daily Adequate Intake (AI: 4-8 yr=13-26 mmol/d; 9-13 yr=17-34 mmol/d).

Conclusion
These data provide evidence that many children exceed dietary recommendations for salt. Action should be taken on raising awareness of high salt consumption within children and lowering the amount of salt added to food products, through adopting salt content targets. Such rigorous targets should include those foods which contribute the most salt in children's diets.

Source of Funding
Helen McPherson Smith Trust and the Heart Foundation (Australia).

Long-term effects of modest salt reduction on vascular function in overweight and obese subjects

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Background
The effect of a modest reduction in dietary salt intake to recommended levels on vascular endothelial function in overweight and obese persons is unknown.

Objective
Our aim was to determine the effects of a reduction in dietary sodium to 100mmol/day on measures of vascular function in overweight and obese subjects.

Design
In this pilot study, we conducted a randomised cross-over trial of sodium reduction to 100 mmol/day with or without sodium supplementation to 150mmol/day each for 6 weeks in 14 overweight and obese subjects with normal blood pressure (BP). Flow-mediated dilatation (FMD), BP, augmentation index (AIx), pulse wave velocity (PWV) and plasma and urinary nitrates/nitrites were measured at the end of each intervention.

Outcomes
Eight overweight and obese subjects aged 58±8 years (BMI 30.7±5.18kg/m^2; SBP 118±7mmHg; DBP 76±4mmHg) complied with the sodium reduction intervention. Urinary sodium was reduced from 158.6±54.6mmol/24hr to 90.9±34.6mmol/24hr (P=0.006). Following sodium reduction there was a significant improvement in FMD from 1.89±1.68% to 4.37±1.76% (P=0.003), AIx improved from 30.1±6.5% to 28.0±6.6% (P=0.03) and plasma nitrate/nitrite increased significantly from 15.30±7.67mM to 28.56±6.49mM (P=0.005). Daytime DBP and MAP both decreased (DBP 76.75±4.56mmHg to 72.63±6.32mmHg (P=0.049); MAP 93.63±5.95mmHg to 89.75±6.45mmHg (P=0.046)) with sodium reduction. Endothelium-independent vasodilatation, PWV and systolic BP variables were not different between treatments.

Conclusion
Modest sodium reduction equivalent to the recommended intake of 100 mmol/day has beneficial effects on vascular function in overweight and obese subjects with normal blood pressure. Further work is needed to explore the precise mechanisms.

Source of Funding
CSIRO Food and Nutritional Science

Salt intake in a rural Australian population

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Background
There is a large body of evidence that clearly demonstrates the adverse effects of salt on human health. It is believed Australians consume much more salt than they need although just how much is uncertain, with no recent definitive measures of salt intake available. *Drop the Salt Lithgow* is a population-based study designed to provide precise and reliable data about salt consumption levels in regional Australia.

Objective
To investigate average sodium excretion in 24h urine as a marker for salt intake.

Design
A random population sample was selected from the 2009 Federal electoral roll. From each individual we sought a 24 hour urine sample. 319 collections were obtained with 14 subsequently excluded on the basis of implausible urine volumes or creatinine excretion levels.

Outcomes
Mean age was 58 (range 20-88) years and 54% were women. Overall mean (SD) sodium excretion was 147 (61) mmol/day. Excretion was 172 (64) mmol/day in men compared to 125 (50) mmol/day in women (P<0.001). It was also greater in those aged <50 years compared to those aged >50 years (160 vs.142mmol/day; P=0.03).

Conclusion
These Australian adults have an average daily sodium intake well above the maximum level recommended by the National Health and Medical Research Council (102mmol Na/day = 6g salt/day). Men and younger adults warrant particular attention.

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The influence of body composition and inflammation on lung function in asthma

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Background
Obesity and asthma are associated conditions, however the obese-asthma phenotype is not well defined.

Objective
To investigate both the mechanical and inflammatory influences on the obese-asthma phenotype, by comparing lung function with body composition and airway inflammation, in overweight and obese subjects with asthma.

Design
Overweight and obese (BMI 28-40kg/m^2) adults with asthma (n=44) completed lung function assessment and underwent full-body dual energy x-ray absorptiometry. Blood and sputum samples were analysed for inflammatory markers.

Outcomes
In females, android and thoracic fat tissue and total body lean tissue were inversely correlated with expiratory reserve volume (ERV) (r=-0.505, P=0.020; r=-0.564, P=0.008; r=-0.463, P=0.035, respectively). Conversely in males, fat tissue was not correlated with lung function, however there was a positive association between ERV and android and thoracic lean tissue (r=0.666, P=0.005; r=0.540, P=0.031, respectively). Lower body (gynoid and leg) lean tissue was positively correlated with sputum neutrophils in females (r=0.544, P=0.020 and r=0.709, P=0.001, respectively), while leptin was positively correlated with android and thoracic fat tissue in males (r=0.726, P=0.002 and r=0.675, P=0.006, respectively).

Conclusion
This study suggests that both body composition and inflammation independently affect lung function, with distinct differences between males and females. In females, the negative relationship between lean mass and lung function may be a result of the positive association between lean mass and airway neutrophils. This suggests that in females, intramyocellular lipid may be driving the inflammatory component of the obese-asthma phenotype.

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The politics of nutrition

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Background
Nutrition has been, is and always will be, a highly political issue.

Objective
To present an overview from inside the realms of Government of the many political facets of nutrition.

Design
What may seem a simple scientific issue is caught in the midst of political dimensions of Governments that support personal choice and Governments that provide for supportive environments. Capturing the opportunities for trade while maintaining politically responsible choices is the challenge. A review of the political environment over the last 20 years in New Zealand and trans-Tasman will capture the multi faceted nature of nutrition – the science and the politics. Highly politicised area within Codex Alimentarius and topical areas within New Zealand such as folic acid, food security and obesity will be used to support the discussions of the politics of nutrition.

Outcomes
While we aspire for a healthier nation the road to achievement remains a challenge with varying calls as to the best ways to achieve nutritional well being.

Conclusion
Nutrition will be caught in the political cycles - and in and out of favour. The challenge lies in the progress that is made during the positive cycles and the ability to move in the political spheres in between the other cycles.

Source of Funding
Not applicable.