Concurrent Session 12: Nutrition for the elderly

Nutritional intake of Australian elderly requiring low level care

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**Background** – Many elderly are at increased risk of poor nutritional intake following increased sedentary behaviour and low food consumption impacted on by other complex social and psychological factors. Most studies investigating the nutritional status of the elderly focus on those in nursing homes (high level care) or free-living elderly in the community. Few studies have examined those living in hostels (low level care).

**Objective** – To determine the nutritional status of elderly residents in low level care.

**Design** – Cross sectional study of 77 residents (59 women, 18 men) from 10 low level care facilities in metropolitan Melbourne. Nutrient intake was assessed by three day weighed food records; body composition by DXA and height and weight via usual methods. Blood samples were drawn and analysed for serum albumin.

**Outcomes** – Residents were aged 83 ± 18.1 years (mean ± SD) with a mean BMI of 27.1 ± 4.7 kg/m\(^2\) in women and 25.7 ± 3.5 kg/m\(^2\) in men. Few women (9.4%) or men (6%) were underweight (BMI<22 kg/m\(^2\)) while almost half were overweight or obese (47% women, 44% men with BMI> 27 kg/m\(^2\)). A significant proportion of residents were sarcopenic as determined by appendicular skeletal muscle mass/ht\(^2\), (24.5% of women <5.4, 43.7% of men <7.26). Moreover, 17% of women with a BMI > 22 kg/m\(^2\) were sarcopenic, as were 31.2% of men. Only five women (9.2%) and no men had low serum albumin. Average energy intakes were 6.5 ± 1.9 MJ/day for women and 8.1 ± 1.6 MJ/day for men.

Average intakes of protein, fibre, calcium, zinc, magnesium and folate were low (56.3 ± 17.1g/day, 16.5 ± 4.8 g/day, 668 ± 284 mg/day, 7 ± 2mg/day, 215 ± 69mg/day, 207 ± 69g/day, respectively), with many not meeting the EAR or RDI. There were no gender differences in nutrient intake after correction for energy intake.

**Conclusions** – Elderly people living in low level residential care demonstrate a degree of poor nutritional intake. They may be sarcopenic even when apparently within a healthy weight range. Periodic monitoring of residents may help ensure that nutritional deficiencies are addressed and poor nutritional status does not become chronic in this group.

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A 5-year randomised controlled trial of the effects of calcium and vitamin D supplementation on hip bone mineral density in elderly ambulant Australian women

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**Background** – Postmenopausal women are at increased risk of secondary hyperparathyroidism resulting in reduction in bone mass because of loss of the beneficial effects of estrogen on stimulation of intestinal calcium absorption and reduction of renal calcium excretion.

**Objective** – To evaluate the relative benefits of vitamin D and calcium supplementation compared to calcium alone on hip bone mineral density (BMD) in ambulant elderly Western Australian women aged 70-80 years at baseline.

**Design** – A 5-year randomised controlled double-blind study of 40 women per group assigned to received either 1000 IU vitamin D and 1200 mg calcium carbonate (CaD group), 1200 mg Ca and placebo vitamin D (Ca group) or placebo Ca and placebo vitamin D (placebo group) per day over the 5 years. Hip BMD was measured by DXA at baseline and years 1, 2, 3 and 5 using an identical protocol. Vitamin D status was measured at baseline.

**Outcomes** – The mean baseline age of subjects was 74.5 ± 2.4 years, mean total hip DXA 817 ± 99 mg/cm\(^2\) and mean total 25(OH)D 68.0 ± 28.7 nmol/L, 43% had vitamin D insufficiency (25(OH)D < 60 nmol/L), there were no baseline differences between the groups. Adjusted for baseline values, both Ca and CaD groups had significantly better maintenance of hip structure than the placebo group at 1 year, the effects were maintained in the CaD group at 3 and 5 years.

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<td>CaD – Placebo</td>
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<td>Ca – Placebo</td>
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**Conclusions** – Addition of vitamin D to calcium may have long term beneficial effects on bone structure in elderly postmenopausal Australian populations on the 35th parallel South.
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High incidence of vitamin B12 and vitamin D deficiencies in the elderly
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Background – Malnutrition is common in the elderly. Vitamin B12 is of particular interest as deficiency is linked to chronic diseases including dementia, osteoporosis, stroke and macular degeneration.

Objective – To examine the extent and determinants of malnutrition, including micronutrient deficiencies in an aged care rehabilitation unit.

Design – Patients (n=67, age >60 y) admitted to Calvary Health Care Sydney, underwent screening using the Mini Nutritional Assessment (MNA) and a modified MNA (mMNA) incorporating Australian protein and anthropometric indices. Biochemical screening assessed protein and micronutrient status. A sub-group of patients (n=22) underwent additional investigations to determine vitamin B12 status, as assessed by methylmalonic acid (MMA) and homocysteine concentrations, and dietary intake using a semi-quantitative food frequency questionnaire (FFQ).

Outcomes – Eighteen and 27% of patients were malnourished as determined by the MNA and mMNA, respectively, with both tools indicating 61% of patients were at risk of malnutrition. Twenty-six subjects (38%) were deficient in vitamin B12 (based on values <220 pmol/L) and 53 subjects (79%) were deficient in vitamin D (<50 nmol/L). A positive correlation was found between serum folate concentrations and the mMNA score (r= +0.28, P<0.05). Hyperhomocysteinemia (>12 µmol/L) was found in 73% of subjects (n=16), and was significantly associated with lower serum- and erythrocyte-folate concentrations. Thirty-six percent (n=8) of subjects had elevated MMA indicating cellular vitamin B12 deficiency, but all had serum vitamin B12 in the normal range. All subjects had adequate intakes (>77% 1991RDI) of vitamin B6, B12 and folate.

Conclusions – The present study highlights malnutrition, vitamin D and vitamin B12 deficiencies in subjects with normal serum vitamin B12 levels. This study supports routine screening and appropriate supplementation of micronutrients.

Risk factors for falls and fractures in aged care residents: can improving nutrition better the odds?
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Background – Falls and fractures are common in aged-care residents and are a costly health burden. Sub-optimal nutritional intake, especially that of calcium, protein and vitamin D may contribute to fragility fractures and falls risk either by directly affecting metabolic process or functions, or by affecting body composition.

Objectives – To determine the risk factors for falls and fractures in ambulatory aged care residents.

Design – Cross sectional analysis of 82 aged care residents (mean age 86.2 yrs) from 18 hostels in Melbourne. Nutrient intake was determined from 3 day weighed food intake. Bone mineral density (BMD) was ascertained using DXA. Balance, leg strength and functional capacity were measured using established methods. Blood samples were drawn and analysed for 25(OH) vitamin D, PTH, creatinine, albumin, and bone metabolism. Medical records were reviewed to determine medication use, medical conditions and fracture history. Prospective falls data was collected over a 12-month period.

Outcomes – Over the 12 months, falls were reported in half of residents, with 100 falls recorded. One third of residents had a history of fractures. Mean calcium (668 mg/day) and protein (0.82 g/kg BW) intakes were below recommended levels. 34% had vitamin D levels below 30 nmol/L. Residents with a history of fractures consumed less calcium and had less lean mass, after adjusting for size (P<0.05). Fracture sufferers had reduced leg strength, lower femoral neck BMD (P<0.05) and tended to have reduced functional capacity (P< 0.1). Failers were heavier and had a higher BMI than non-failers (P<0.05), and tended to demonstrate more body sway (P< 0.1). Those with vitamin D levels below 30 nmol/L tended to have lower functional capacity and more body sway (P<0.1).

Conclusion – Risk factors for falls or fractures appear to differ. The potential for vitamin D to improve balance and functional capacity and calcium to reduce fracture risk in this group, warrants further investigation. Protein intake was not related to falls or fractures in this group. However, frank protein deficiency may contribute to risk factors.
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**Energy and nutrient intake within residential aged-care facilities: results from a selection of Melbourne facilities**

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**Background** – The elderly living in residential aged-care facilities are particularly at risk of nutritional inadequacies due to their overall health status, state of dependency and general lack of control over food provision.

**Objective** – To measure energy and nutrient intakes in aged-care facilities and evaluate against dietary recommendations.

**Design** – A three-day weighed food record, incorporating all main meals and snacks, was performed on 83 participants ranging in age from 65 to 94 years in five Melbourne residential aged-care facilities. Dietary intake data were analysed using FoodWorks 3.01. Mean energy and nutrient intakes were compared to nutrient reference values (NRV).

**Outcomes** – Estimated energy requirements (EER) were met (M126% EER ± 41% [all data is ± SD]); F122% EER ± 27%). Estimated average requirements (EAR) for protein were also met (M109% ± 56%; F140% ± 36%). Carbohydrate intake for males was 50% of energy ± 7% and 48% for females ± 5%. Sugars made up a larger proportion of carbohydrate intake (M28% ± 9%; F25% ± 6%). Intake of fat for males was 34% of energy ± 7% and 36% for females ± 5%. Saturated fat intake was high (M17% ± 5%; F16% ± 2%). Fibre intake was low (M56% adequate intake (AI) ± 28%; F66% AI ± 24%). Participants failed to meet the EAR for calcium (M94% ± 50%; F88% ± 41%) and magnesium (M77% ± 26%; F94% ± 27%). Intake of potassium was below the AI (M79% ± 29%; F96% ± 24%). Males failed to meet the EAR for zinc (77% ± 27%). Sodium intake for males and females was exceptionally high (M308% AI ± 92%; F247% AI ± 77%).

**Conclusion** – Results of this study can be used to guide education programs for food service staff to ensure the nutritional requirements of residents are met in the future.
**Concurrent Session 13: Trace elements II**

**Efficacy and side effects of iron supplements for the correction of anaemia in pregnant women: a comparison of high dose vs. low dose iron**

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**Background** – Anaemia is relatively common in pregnancy and the most common cause is iron deficiency. Despite lack of evidence on the most effective way to treat anaemia in pregnancy, it is often treated with high doses iron that may cause gastrointestinal side effects, interfere with mineral absorption and cause haemoconcentration. Both severe anaemia and haemoconcentration have been linked with adverse pregnancy outcomes.

**Objective** - To compare the efficacy and side effects of low dose vs. high dose iron supplements in treating anaemia in pregnant women.

**Design** – Double blinded randomised dose response trial. Eligible pregnant women with anaemia (haemoglobin <110g/l) at the mid-pregnancy routine blood test were randomly allocated to receive either 20mg, 40mg or 80mg of iron daily for 8 weeks. Iron status of the women was assessed at the end of treatment. Gastrointestinal side effects were assessed every 2 weeks. Information on pregnancy outcomes and pregnancy complications were collected from medical records.

**Outcomes** – A total of 180 women were enrolled and 179 completed the study. At the end of treatment there was a clear dose response of increasing Hb concentration with iron dose (111 ± 13g/L at 20mg/day, 114 ± 11g/L at 40 mg/day, 118 ± 13g/L at 80mg/day, P=0.015). However, the incidence of moderate anaemia (Hb<100g/L) or outcome of pregnancy did not differ between groups. Gastrointestinal side effects (including nausea, stomach pain and vomiting) also increased with iron dose (P<0.05). Similarly, there was a tendency for more women to have haemoconcentration, defined as Hb>130g/L, with increasing iron dose (4%, 7%, 13%, P=0.175).

**Conclusions** – Although high dose iron supplements are more effective in increasing Hb levels in pregnancy, they are associated with more gastrointestinal side effects and may also be associated with a higher risk of haemoconcentration. Further research is needed to determine the optimal levels of Hb in pregnancy and the most effective and safe dose of iron to treat anaemia in pregnancy.

**Iron stores diminish over time in 12-20 month old New Zealand children**

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**Background** – Recent cross-sectional research suggests that iron stores diminish with age in the first two years of life.

**Objectives** – To determine the dynamics of serum ferritin (SF) concentration over a five month period in a sample of healthy 12-20 month old New Zealand (NZ) children.

**Design** – In a 20-week randomised placebo-controlled trial 225 toddlers were assigned to one of three groups including a placebo group (n=90) in which the toddlers’ regular milk was replaced with unfortified (<0.1 mg Fe/100 mL) cow’s milk. Three-day weighed dietary intakes were recorded. Non-fasting venipuncture blood samples and anthropometric measures were collected at baseline and 20 weeks. Suboptimal iron status was: “depleted iron stores”, SF ≤10 µg/L; “iron deficiency” (ID), haemoglobin (Hb) ≥110 g/L and two or more abnormal values for SF, mean corpuscular volume (≤73 fL) and zinc protoporphyrin (≥70 µmol/mol haem); or “iron deficiency anaemia” (IDA), Hb <110 g/L and ID.

**Outcomes** – At baseline the children (n=71) were predominantly boys (58%), and had a mean (SD) age of 16.6 (2.7) months. The mean (SD) intake of dietary iron was 5.6 (2.7) mg/d and 28.8% (95% CI 18.3 to 39.4) had iron intakes below the Australian & NZ EAR for iron (4 mg/d). The prevalence (95%CI) of suboptimal iron status increased from 13.2% (6.2 to 23.6) at baseline to 17.6% (9.5 to 28.8) at 20 weeks. Mean SF concentration (95%CI) declined from 22.8 (19.9 to 26.0) µg/L to 18.6 (16.1 to 21.4) µg/L over 20-weeks (P=0.0359). There was no change in Hb concentration (P=0.1968). Faster growth in length was associated with lower SF concentration (P=0.0004) but not Hb concentration (P=0.3779). Younger girls had lower Hb concentration than boys, and older girls had higher Hb than boys (P=0.0177).

**Conclusions** – Iron stores decreased over 20 weeks among healthy 12-20 month old NZ children who followed typical NZ toddler diets. Faster growth in length appeared to have contributed to diminishing iron stores. Dietary intervention strategies aiming to improve iron status of NZ toddlers should be assessed.
Concurrent Session 13: Trace elements II

Study of dietary intake of trace elements from the Australian diet
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Background – The Australian Total Diet Study is a significant national survey that examines levels of nutrients and other food chemicals in food and estimates exposure of the population to those chemicals through the food supply. In Australia, data on some of the trace elements are limited or not available at all. The intakes of some trace elements may have public health significance for Australia, particularly iodine and selenium where the Australian population is suspected of not meeting recommended intakes. Early in 2006, the National Health and Medical Research Council revised the recommendations for a number of nutrients and included several new nutrients in the new Nutrient Reference Values.

Objective – To obtain data on trace element levels in Australian foods, estimating dietary intake for various population groups.

Design – Ninety-four types of foods, sampled during July and November/December 2004, were analysed for the nutrients: iodine, selenium, chromium, molybdenum, and nickel. Foods were sampled from all States and Territories, prepared and analysed in a ‘table ready’ state. Nutrient intakes were estimated using analytical levels applied to 1995 NNS data for various age groups.

Outcomes – Collection and reporting of new trace element data in Australian foods and dietary intake estimates for key trace elements.

Conclusion – Generally Australian intakes appear to be within appropriate ranges for the five trace elements, recognising the limitations of the study. Regional variations and differences in levels of trace elements in foods were observed but are minimal; national distribution of foods appears to include both packaged and fresh produce.
Concurrent Session 14: Folate

Preventing neural tube defects in Australia and New Zealand with folic acid: predicted effectiveness of mandatory fortification compared with supplementation

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Background – Folic acid taken before conception and through early pregnancy reduces the risk of neural tube defects. The amount of folic acid (400 µg/d) proven in randomised control trials to prevent neural tube defects far exceeds that readily obtained by eating foods naturally rich in folate. Therefore, population strategies to reduce rates of neural tube defects require either the addition of folic acid to foods that are consumed regularly by women of child-bearing age or increasing the proportion of women who take folic acid supplements during the critical period. Food Standards Australia New Zealand has recently proposed (P295) to mandate the addition of folic acid (230-280 µg/100 g) to bread-making flour and estimate this will increase mean intake of folic acid in the target population by 100 µg/d in Australia and 131 µg/d in New Zealand.

Review – Mandatory fortification has the advantage that it reaches most women regardless of education or socio-economic backgrounds, it suffers because the need to minimise high folic acid intakes in young or old people limits the level of fortificant (µg folic acid/100 g food) to an amount where only a small percentage of women receive 400 µg/d. Supplementation, on the other hand, has the advantage that it provides folic acid at the correct dose and time directly to – and only to – the target population. The disadvantage is that almost half of pregnancies are unplanned. Overseas experience shows that in regions with high rates of neural tube defects and low folate status, increased population intakes of folic acid reduce neural tube defect rates dramatically. However, in regions where neural tube defect rates are low and folate status is high the effect of increasing population intakes of folic acid is uncertain. The rates of neural tube defects in Australia and New Zealand rank low by international comparison. Furthermore, a population-based sample of Dunedin woman (18-45 y) suggests high folate status in New Zealand. These conditions are likely to influence the effectiveness of mandatory folic acid fortification or supplementation programmes.
Concurrent Session 14: Folate

Folate: Analytical methods for foods
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Background – Analytical methods have been a limitation in the study of folates due to their inability to distinguish accurately between the added form (folic acid) and naturally occurring forms in foods. This is critical in view of the need for accurate data in establishing folate composition, requirements and assessing the bioavailability of the vitamin. The complexity, diversity and instability of folates are substantial obstacles encountered in the development and selection of analytical methods. The analysis of folates is further complicated due to the difficulties in sample preparation which include extraction, deconjugation and extract purification. Currently, there are three main analytical methods: Microbiological assay (MA), High pressure liquid chromatography (HPLC) and biospecific procedures including enzyme protein binding assays (EPBA), enzyme linked immunosorbent assays (ELISA) and radioassays (RBPA). Folate in foods is commonly measured by microbiological assay which is based on the assumption that *L. rhamnosus* (most commonly used folate dependant microorganism) has identical growth responses to the mono-, di- and triglutamyl folate structures present in foods. However there is much debate over this assumption as some investigators report that *L. rhamnosus* response is similar to all forms (O’Broin et al., 1975; Shane, Tamura and Stokstad, 1980) while others do not (Phillips and Wright 1982; Goli and Vanderslice, 1992). High pressure liquid chromatography separation techniques with ultraviolet and/or fluorescent detection have been documented to detect the different forms of folate. In many instances these methods lack specificity and have failed to reach the required detection limits due to matrix interference by the presence of breakdown products that arise during extraction (Shane, 1986). Recently, LC-MS methods have been reported as an acceptable and accurate approach to the analysis of folates in foods and biological materials which are based on the separation power of reversed phase chromatography coupled with the superior detection capability of mass spectrometry (Rychilik et al., 2003).

Objectives –The main objective is to critically review the current status of folate analysis methods. This session will provide a discussion on 1. Strengths and limitations of the various methods of analysis, 2. Considerations in the selection of existing analytical methods and 3. Further research needs concerning folate analysis and an added review on the liquid chromatography mass spectrometry methods available today. Quantification of folates is performed using C^{13} isotopically labelled internal standards.

Review –Though the microbiological assay is most commonly used, it is time consuming, needs great care and skill. It cannot however quantify the different forms of food folates. In addition, whether microorganisms respond to the different forms differently is still under question. Immunoassay techniques are quick, easy and cheaper but are not suitable for food folate determination. HPLC has proven to be a better analytical technique and more recently liquid chromatography mass spectrometry (LC-MS) techniques offer better sensitivity and specificity to accurately quantify folates in foods and biological samples. It appears that the method of choice would depend on the purpose.

Conclusions – The LC-MS/MS techniques offer an accurate, reproducible and reliable method for profiling and quantifying the folate forms present in foods. This new method provides enhanced sample throughput of 36 samples/12 hours.

References
Concurrent Session 14: Folate

Enhancing folate levels in cereal products
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Background – Folate is a B vitamin, which acts as a coenzyme in single carbon transfer reactions to synthesize components of DNA, RNA and proteins. Folate deficiency causes megaloblastic anemia and neural tube defects. In addition, association of folate with cardiovascular diseases, certain cancers and cognitive disorders is under active research. In many countries folate intake has been shown to fall below recommendations. Therefore, mandatory or voluntary fortification is widely accomplished. In countries, which do not practice fortification, enhancing folate levels by other means is important. In Finland, cereal products provide ca. 40% of the daily folate intake. Therefore, increasing folate levels in cereal products further would significantly effect folate status of the population.

Review – We have studied possibilities to increase folate levels in cereal product by selecting optimal cereal raw materials and by utilization of in situ folate synthesis. We have mainly focused on rye and wheat fractionation and bioprocesses, such as fermentation, malting and germination. Variation of folate levels between varieties has also been investigated. A microbiological assay on microtiter plates after tri-enzyme extraction was used to measure total folate contents and HPLC after purification with affinity chromatography to determine folate vitamer composition of selected samples.

Genetic and environmental factors affect folate levels in cereal raw materials. However, fractionating the grains and utilizing the folate-rich fractions was shown to be a more efficient mean to enhance folate levels in cereals raw materials and thus those of the final products. Fractionation of rye grains by a roller mill at laboratory scale to bran, short, and two flours led to products with folate contents ranging from ca. 10 µg/100 g (flour) to ca. 110 µg/100 g (bran). In wheat fractions, taken from a commercial scale mill, the folate contents increased linearly with the ash content up to 4% ash. In rye milling fractions the correlation was not that unambiguous. However, when the ash content exceeded 3% (approximating to 25% fibre content) the folate levels were relatively high, ca. 110–130 µg/100 g.

Both germination/malting and fermentation enhanced folate contents. As an example, germination of rye grains for six days at 25 °C led to 3.5-fold higher levels as compared with the grains. Fermentation with yeast in rye and wheat baking processes was shown to significantly enhance folate levels. For instance, a total folate content 62 µg/100 g in the flour led to a folate content 162 µg/100 g after the fermentation step in rye bread baking. Some bacteria also produce folate.

Conclusions – Utilization of folate-rich cereal fractions would significantly increase folate levels and simultaneously contents of many other bioactive compounds in cereal-based foods. Developing further bioprocesses, especially fermentation, offers a useful means to enhance folate contents in foods available for the entire population.

References
Concurrent Session 14: Folate

**The association of dietary folate with serum and red cell folate is modulated by the G80A reduced folate carrier single nucleotide polymorphism in an elderly population sample**

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**Background** – There are various polymorphisms in the genes coding for enzymes and carriers involved in folate metabolism which are known to affect folate distribution and disposition. Recently, a single nucleotide polymorphism (SNP) in the reduced folate carrier (RFC) has been found to modulate the uptake of folate by cells. The SNP, a change from guanine to adenine at position 80 of exon 2 of the gene (G80A RFC) leads to an arginine replacing a histidine in the expressed RFC protein.

**Objectives** – As the G80A RFC SNP may affect the absorption of dietary folate and its uptake by cells, the aim was to determine whether it impacted on the associations between dietary folate and serum and red cell folate.

**Design** – Subjects (119, 52 males, 67 females) were recruited from a retirement village. Dietary folate intake was assessed by food frequency questionnaire, serum and red cell folates were measured by immunoassay and Pearson correlation coefficients \(r\) and their significance \(P < 0.05\) were determined using SPSS.

**Outcomes** – Dietary folate intake was significantly associated with serum folate in the elderly having the GG \((r = 0.524; P = 0.002)\) and GA \((r = 0.408; P = 0.002)\) genotypes but not in those with the AA \((r = 0.347; P = 0.060)\) genotype. Similarly, dietary folate was significantly associated with red cell folate in the GG \((r = 0.399; P = 0.022)\) and GA \((r = 0.564; P < 0.0001)\) but not in the AA genotypes \((r = 0.223; P = 0.236)\).

**Conclusions** – The G80A RFC SNP modulated the association of dietary folate intake with serum and red cell folate in this elderly population with the GG and GA genotypes but not the AA genotype showing significant associations.
Concurrent Session 15: Diet and health

The effect of a low glycemic index diet during pregnancy on obstetric outcomes

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Background – Pregnancy is a condition where the GI concept may be of particular relevance because maternal glucose is the main energy substrate for intrauterine growth (1-2).

Objectives – The aim was to compare the effects of a low GI and conventional dietary strategy on pregnancy outcomes in healthy women. Compliance and acceptability were also investigated.

Design – Volunteers were assigned alternately to receive dietary counselling that encouraged either low GI carbohydrate foods (LGI) or high fibre, moderate-to-high GI foods (HGI) and studied five times between <16 weeks gestation and delivery. Of the 70 women who met the inclusion criteria, 62 completed the study (32 in LGI and 30 in HGI). Primary outcomes were measures of foetal size.

Outcomes – Mean diet GI fell significantly in the LGI group but not the HGI group. Compared with the LGI group, women in the HGI group gave birth to infants who were heavier (3408 ± 78 vs 3644 ± 90 g respectively, P = 0.051) with higher birth centiles (48 ± 5 vs 69 ± 5, P = 0.005), higher ponderal index (2.62 ± 0.04 vs 2.74 ± 0.04, P = 0.03) and higher prevalence of large-for-gestational age (3% vs 33%, P = 0.01). There was no effect of diet composition on maternal weight gain, method of delivery or indirect measures of insulin sensitivity. Compared with baseline, only the LGI group reduced intake of saturated fat. Women in the LGI group found the diet easier to follow.

Conclusion – Since birth weight and ponderal index may predict chronic disease in later life, a low GI diet may favourably influence long-term outcomes.


The effect of dietary modifications on cortisol secretion

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Background – Cortisol is a key hormone in the response to stress, and depression, anxiety and stress are associated with increased daily cortisol secretion. Dietary factors may influence daily cortisol secretion.

Objective – To assess the effect on cortisol secretion of two diets: a high-calcium diet, rich in low-fat dairy foods (HC) and a low-sodium, high-potassium diet, rich in fruits and vegetables (LNAHK) with a moderate-sodium, high-potassium, high-calcium “DASH” type diet, high in fruits, vegetables and low-fat dairy foods (OD).

Design - In a crossover design, subjects were randomised to two test diets for 4- wk, the OD and either HC or LNAHK, each preceded by a 2 wk control diet (CD). Saliva samples were collected in the morning and at 1200 h, 1600 h, 2000 h for 1 d at the end of each diet.

Outcomes – Seventy-four subjects completed the study (29 men, 45 women) with a mean (SD) age of 56.3(9.8) yr and a mean BMI of 29.2(3.8) kg/m2. Cortisol variability was high for morning samples (176% CV); however, afternoon/evening samples (area under the curve (AUC) (nmol.l-1.8hr-1)) had less variation (30% CV). CD cortisol concentrations predicted the change in AUC: for the OD ß=-0.8(0.1) (SEM), LNAHK ß=-0.7(0.1) and HC ß=-0.7(0.1) (R2: 0.4-0.6). The % change in AUC was lower in the HC diet when compared to the OD diet (P=0.058), and significantly lower when compared to the LNAHK diet (P<0.05).

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<th>Diet</th>
<th>OD (n=50)</th>
<th>LNAHK (n=32)</th>
<th>HC (n=29)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD cortisol AUC (nmol.l-1.8hr-1)</td>
<td>1.9 ± 0.1</td>
<td>2.1 ± 0.2</td>
<td>1.9 ± 0.2</td>
</tr>
<tr>
<td>% change (diet period – control period)</td>
<td>16.8 ± 8.9</td>
<td>19.0 ± 8.4</td>
<td>-3.5 ± 5.7</td>
</tr>
</tbody>
</table>

1mean ± SEM

Conclusion – Consumption of 3-4 serves/day of dairy foods resulted in a fall in cortisol secretion compared to a rise seen in two diets requiring some dietary restrictions. This suggests increased dairy intake may have beneficial effects on cortisol secretion in the afternoon/evening period.
Concurrent Session 15: Diet and health

Weight loss with and without exercise improves cardiovascular disease risk markers, but not endothelial function in patients with type 2 diabetes

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Background – Endothelial dysfunction is a key feature of type 2 diabetes (T2D) and plays a significant role in the early development of atherosclerosis. While lifestyle interventions incorporating weight loss and increased physical activity are advocated as the first line of treatment for T2D, the effects of weight loss, particularly when combined with exercise training on endothelial function in patients with T2D are largely unknown.

Objectives - To compare the effects of a moderate energy restricted diet, with and without aerobic exercise training on endothelial function, oxidative stress and established markers of cardiovascular risk in patients with T2D.

Design – Using a parallel randomised controlled study design, 29 sedentary, overweight and obese patients with T2D followed a 12-week moderate energy restricted diet (~5000 kJ/day, ~30% energy deficit consisting of two meal replacements and one self-prepared high protein meal) whilst either maintaining their habitual physical activity levels (DO, N=16) or undertaking a progressive aerobic exercise training program (DE, N=13).

Outcomes – Both interventions resulted in significant reductions in body weight (DO 9.5%, DE 9.0%, P<0.001 for time), body fat (14.3%), waist circumference (9.3%), blood pressure (7/4 mmHg), fasting glucose (24%), HbA1c (18%), triglycerides (38%), total cholesterol (12%, P=0.001) and malondialdehyde (28%, P<0.001), but there were no differences in the magnitude of these effects between treatments. At baseline, endothelial function assessed by brachial artery flow-mediated dilatation FMD was similar in both groups (DO 2.5 ± 5.7%, DE 4.3 ± 4.6%; P=0.26) and did not change after the interventions (P=0.76).

Conclusion – In overweight and obese patients with T2D, weight loss with and without aerobic exercise training did not improve FMD, but was effective in improving glycemic control and a range of cardiovascular risk factors.

Acknowledgment – This study was supported by the Diabetes Australia Research Trust, Pharmacy Health Solutions Pty Ltd., CSIRO Human Nutrition and the ATN Centre for Metabolic Fitness.

A novel whey protein hydrolysate (NatraBoost XR) enhances recovery of isometric muscle torque following eccentric exercise

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Background – A novel hydrolysate (NatraBoost XR, NBXR) of whey protein isolate (WPI) reduced production of tumor necrosis factor-α (TNFα) and increased cell growth in vitro.

Objectives – This study examined whether feeding NBXR could enhance recovery of muscle function following eccentric exercise.

Design – Muscle soreness (MS, by visual analogue scale), serum creatine kinase activity (CK), plasma TNFα and insulin concentrations, and knee extensor peak isometric torque (PIT) were determined in 40 healthy sedentary males at baseline. 100 maximal eccentric contractions (ECC) of the knee extensors were then performed. MS, CK TNFα, insulin and PIT were then reassessed prior to consuming 250 ml of flavoured water (FW; n = 11), or 250 ml of FW containing 25 g of NBXR (n = 6), WPI (n = 11) or casein (C, n = 12) in a double-blind randomised parallel design. All assessments were repeated 1, 2, 6 and 24 hr later, and supplements were consumed at 6 and 22 hr.

Outcomes – There was no difference in PIT between groups at baseline (P = 0.70). PIT decreased in all groups following ECC (P < 0.001), with no difference in the reduction between groups (P > 0.58). PIT remained suppressed in WPI, C and FW, but recovered rapidly in NBXR such that it was not different from baseline by 2hr (P > 0.05) and was greater than all other groups a 6 hr (P < 0.01) and 24 hr (P < 0.001). MS increased in all groups following ECC (P < 0.001) and remained elevated, with no difference between groups (P = 0.93). TNFα (P > 0.83) and CK (P > 0.32) did not change from baseline. Insulin increased transiently in NBXR and WPI only at 1 hour (P < 0.001), but the increases were not different from each other (P = 0.77).

Conclusion – NBXR enhanced recovery of PIT following eccentric exercise. The effect did not appear to be mediated by suppression of inflammation or MS, or by any anabolic effect of insulin. The enhanced recovery may be related to the activity of some novel peptide(s) in the hydrolysate.
Concurrent Session 16: Nutrition for indigenous populations

Nutrition for indigenous populations in Australia

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Background – We will describe briefly the continuing gap in health and life expectancy between the Aboriginal and the broader Australian peoples. While some important advances have occurred in Indigenous health in other countries, Aboriginal people in Australia continue to experience significant inequalities in terms of life expectancy at birth, life chances, health status and life expectancy at almost any age compared to the rest of the population. In addition, the Aboriginal population is only 2.8% of the total, which raises the question of why such a small and geographically dispersed population continues to experience such high levels of social, material and health disadvantage (1).

Objectives – To describe, via an Epidemiological Transition Model (2), some reasons behind the continuing poor morbidity and mortality and use this model to review nutrition programmes in the community context.

Discussion – Indigenous peoples are in a mid 20th century epidemiologic transition of premature disease and disability. This transition occurred for the broader Australian population some 100 or so years ago. At the same time the Indigenous population is increasing and growing younger and not ageing in the same way as we see in the rest of Australian society. These facts challenge many in policy and programme development to design appropriate interventions. Those programmes that work well seem to use a determinants of health model (3) and build on a definition of health that considers not only the lack of physical disease, but also the wellbeing of ones family and community, physically, emotionally and spiritually.

Conclusion – Programmes and interventions must be designed with the target community and population in mind. The use of programmes developed for populations that are in the fifth epidemiologic transition, that is, for the broader Australian community, will not work for those who are still reeling from the effects of disease and disability a century old. As we have seen, those programmes that work do so because they take this into account.

References
Concurrent Session 17: Dietary Antioxidants and Health

Biochemical parameters of anthocyanins that determine the health benefits of blackcurrants and other anthocyanin-containing fruit

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Background – Berry fruit have very high antioxidant capacities as determined by in vitro antioxidant assays such as the oxygen radical absorbance capacity (ORACFL) and the ferric reducing antioxidant power (FRAP) methods. In a selection of blackcurrant (Ribes nigrum L.) genotypes we have found that antioxidant capacities (ORACFL) vary from 71 to 194 µmol TE/g fresh weight. Anthocyanins are the main contributor to antioxidant capacity in blackcurrant and their concentrations range from 180 to 732 mg/100g FW.

Objectives - To further explore the potential of blackcurrant anthocyanins as dietary antioxidants we have used preparative HPLC to isolate the four individual anthocyanins and measured the antioxidant capacities (ORACFL and FRAP) and the ability to protect plasma proteins from peroxynitrite mediated tyrosine nitrosylation for each anthocyanin. In a previous study we found that blackcurrant anthocyanins are absorbed intact into plasma following consumption (1). Therefore we have also investigated the biochemical properties that contribute to the efficacy of the health benefits such as plasma protein binding and octanol partition coefficients.

Outcomes – We have found that the four anthocyanins vary for the parameters measured. The two cyanidin-based anthocyanins have greater (15%) antioxidant capacity than the two delphinidin-based compounds. The mean octanol partition coefficient (log p) is lower for the two rutinosides (-1.56) compared to the two glucosides (-0.71) suggesting there are differences in the ability of the anthocyanins to penetrate cell membranes. The phenolic aglycone component of anthocyanin appears to have a greater effect on protein binding than the sugar component. The percentage of anthocyanin bound to human serum albumin averaged 75% for delphinidin, 69% for cyanidin, 58% for peonidin, and 55% for malvidin.

Conclusion – These results extend our understanding about the potential health benefits of berry fruit containing high concentrations of anthocyanins. Anthocyanins are a large diverse group of compounds and these results indicate that they differ in biochemical properties that are associated with health benefits suggesting that specific compositions of anthocyanins may have increased health benefits.

Reference

Effects of partial replacement of carbohydrate with protein from lean red meat on markers of oxidative stress and inflammation: results of a randomized controlled trial

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Background – Red meat intake has been associated with increased risk of coronary heart disease and type 2 diabetes. The often coupled intake of saturated fat and processing of red meat may be at least partly responsible. Effects of iron derived from red meat to increase iron stores and initiate oxidative damage and inflammation is another possible pathway.

Objective – To determine whether an increase in unprocessed and lean red meat intake, with a concomitant reduction in carbohydrate intake, adversely influences markers of oxidative stress and inflammation.

Design – Sixty participants completed an 8 wk parallel-designed study. They were randomized to maintain their usual diet (control) or to partially replace energy from carbohydrate-rich foods with approximately 200 g/d of lean red meat (protein) in isoenergetic diets. Markers of oxidative stress and inflammation were measured at baseline and at the end of intervention.

Outcomes – Results are presented as the between group difference for protein relative to control. There was a significant decrease in urinary [-137 (-264, -9) pmol/mmol creatinine, P=0.04], but not plasma [-12 (-122, 100) pmol/L, P=0.84] F2-isoprostane concentrations. There was a significant decrease in leucocyte [-0.51 (-0.99,-0.02) X10⁹/L, P=0.04] and lymphocyte [-0.20 (-0.36,-0.05) X10⁹/L, P=0.01] counts, a decrease in plasma high sensitivity C-reactive protein concentrations [-1.6 (-3.3, 0.0) mg/L, P=0.06] of borderline significance, but no significant effect on plasma fibrinogen concentrations [-0.08 (-0.40, 0.24), P=0.63].

Conclusion – Our results do not support the suggestion that an increase in the intake of lean red meat, partially replacing carbohydrate, increases oxidative stress or inflammation.
Concurrent Session 17: Dietary Antioxidants and Health

Antioxidant compositions of selected fruits, vegetables and beverages in Fiji
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Background – This paper reports the antioxidant compositions of fruits, vegetables and beverages in Fiji.

Objectives – The availability of such data will help promote their use in the daily diet of the people in Fiji.

Design – The total antioxidant capacity (TAC) was assayed using trolox equivalent antioxidant capacity (TEAC) decolourization method (1). The total polyphenol (TPP) assay was performed using the Folin-Ciocalteu method (1). HPLC was used to determine the major carotenoid and flavonoid profiles.

Outcomes – Commercial noni (Morinda citrifolia) fruit drink, which is exported to Australia, was shown to have the highest total polyphenol levels (375.1 mg/100g juice) followed by turmeric (Curcuma longa) (320 mg/100g). Sweet potato leaves (Ipomoea batatas) (240-280 mg/100g) and drumstick (Moringa oleifera) leaves (260 mg/100g) were also high in total polyphenols. The paper also discusses the TAC levels of the foods assayed. Flavonoid assay showed that quercetin was present in sweet potato leaves (43-90 mg/100g), drumstick leaves (100 mg/100g) and also in turmeric (41 mg/100g). It appears that polyphenols and carotenoids contribute to the antioxidant capacity of most foods (2).

Conclusion – Attempts are made to publicise and promote the consumption of a variety of the antioxidant-rich vegetables and fruits in the diets of the people of Fiji.

References

Antioxidant capacity of plant extracts: comparing in vitro and in vivo measures
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Background – Polyphenols from different plant sources have been investigated for their antioxidant activities. Polyphenols have been reported to exhibit anti-allergic, anti-inflammatory and cardioprotective effects (1).

Objective – To compare the outcomes of in vitro and in vivo measures of antioxidant activity of palm polyphenols.

Design – In the in vitro experiments, human plasma was incubated with palm polyphenol extracts, and the antioxidant capacity was measured by two methods: 2,2’-azino-bis(3-ethylbenzothiazoline-6-sulfonic acid) radical cation (ABTS⁺) scavenging and ferric reducing antioxidant power (FRAP) assays. For the in vivo study, hamsters were fed an atherogenic diet and supplemented with palm fruit juice (PFJ) for 8 wk. PFJ was administered at three different polyphenol concentrations, 750, 1000, and 1500 mg gallic acid equivalents (GAE)/L. The antioxidant capacity of the hamster plasma was measured at the end of 8 wk by the ABTS⁺ scavenging and FRAP assays.

Outcomes – Incubation of human plasma with palm polyphenols did not result in a significant increase in plasma ABTS⁺ scavenging capacity, but plasma FRAP values were significantly elevated. A similar trend was observed in the in vivo experiments. ABTS⁺ scavenging capacity in hamster plasma was unaffected by PFJ treatment at the different PFJ concentrations administered. Plasma FRAP values, on the other hand, increased from 45.64 ± 24.96 µM Trolox equivalents (TE) in control animals given water, to 82.33 ± 41.26 µM TE in animals supplemented with PFJ at 1500 mg GAE/L.

Conclusions – In vitro measures of antioxidant capacity are useful indicators of possible outcomes of in vivo trials. Nevertheless, the quantitative outcomes of the latter may differ from what could be extrapolated from purely in vitro measures due to absorption, metabolism and bioavailability of ingested antioxidants.

Reference
Concurrent Session 17: Dietary Antioxidants and Health

**Challenges of measuring health properties of antioxidants in food**
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**Background** – Phytochemicals are abundant micronutrients in fruit and vegetables. There is an emerging body of evidence regarding their health benefits, some of which may be due to their antioxidant properties.

**Objective** – To compare chemical antioxidant assays with more biologically relevant cell-based assay systems for measuring antioxidant activities of food polyphenols.

**Design** – The free radical scavenging activities of three flavonoids: quercetin, rutin and catechin, commonly found in apple, onions and tea respectively, were measured. The three flavonoids were evaluated using both oxygen radical absorbance capacity (ORAC) and lipid peroxidation inhibition capacity (LPIC) assays. Cytoprotective effects were measured by the degree of protection against \( \text{H}_2\text{O}_2 \)-induced damage of human Jurkat cells.

**Outcomes** – As expected all compounds exhibited activity in these assays. Quercetin offered the strongest protection against \( \text{H}_2\text{O}_2 \)-induced cell death. A comparison of the results of the assays showed that the ability to inhibit peroxidation of lipids in a liposomal system (LPIC) correlated well with the cytoprotective activities (expressed as EC\( _{50} \)), but not with the ability to protect an aqueous fluorescent substrate in the ORAC assay.

**Conclusions** – In vitro assays can only rank antioxidant activity for their particular reaction system and their relevance to in vivo health-protective activities is uncertain. Therefore, it is prudent to use more than one type of antioxidant assay to measure antioxidant activities, and to include at least one assay that has biological relevance.

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**Antioxidant restriction affects inflammatory response in short-duration exhaustive exercise**
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Nutraceuticals Research Group, School of Biomedical Sciences, University of Newcastle, NSW, Australia

**Background** – Exercise is known to increase the production of reactive oxygen species (ROS) [1]. Dietary carotenoids have antioxidant properties and may possess anti-inflammatory effects [2].

**Objective** – The objective of the study was to determine the effect of dietary antioxidant restriction on short-duration maximal exhaustive exercise induced markers of inflammation, carotenoids and fatty acids in healthy male endurance athletes.

**Design** – Seventeen endurance-trained athletes performed two separate exercise tests. Participants followed their habitual (high) antioxidant diet (HA) and performed an overnight fasting treadmill exercise test. Participants then followed a reduced antioxidant diet (RA) for 2 weeks and then performed the same overnight fasting treadmill exercise test. Blood was collected at rest and post-exercise for the analysis of inflammatory markers, fatty acids and carotenoids in plasma.

**Outcomes** – The RA diet induced a significant increase (P<0.01) in baseline plasma TNF-alpha concentration (612.86 ± 325.23 ng/ml) compared to the HA diet (28.30 ± 39.07 ng/ml). Baseline plasma beta-carotene concentration significantly decreased (P<0.05) in the RA diet (122.61 ± 54.49 ng/ml) compared to the HA diet (194.96 ± 92.07 ng/ml). Exercise decreased plasma carotenoid concentrations in both diets. Exercise significantly decreased (P<0.01) plasma n-6 fatty acid concentration in the RA diet (186.38 ± 94.54, 96.16 ± 48.76 µg/ml) and increased (P<0.05) plasma n-3 fatty acid concentration in the HA diet (14.27 ± 5.04, 18.63 ± 4.94 µg/ml).

**Conclusion** – Healthy endurance-trained adults performing short-duration exhaustive exercise may require higher intakes of carotenoids to combat oxidative stress and inflammation generated through exercise, which can be achieved via a diet containing high-carotenoid foods.

**References**
Concurrent Session 18: Nutrition and Cognitive Development

A controlled trial of homocysteine-lowering on cognitive performance in older people
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Background – The results of observational studies suggest that high plasma homocysteine concentrations are inversely related to cognitive function in older people.

Objective – To test the hypothesis that lowering plasma homocysteine concentration improves cognitive function in healthy older people.

Design – Two year, double-blind, placebo-controlled, randomised clinical trial involving 276 healthy participants, 65 years of age or older, with plasma homocysteine concentrations of at least 13 µmol/L. Homocysteine-lowering treatment was a daily supplement containing folate (1000 µg), vitamins B₁₂ (500 µg) and B₆ (10 mg). Tests of cognition were conducted at baseline and after one and two years of treatment. Treatment effects were adjusted for baseline values, sex, and education.

Outcomes – On average, during the course of the study, plasma homocysteine concentration was 4.36 µmol/L (95% CI, 3.81 to 4.91; P<0.001) lower in the vitamin group than in the placebo group. Overall, there were no significant differences between the vitamin and placebo groups in the scores on tests of cognition (1).

Conclusions – The results of this trial do not support the hypothesis that homocysteine-lowering with B-vitamins improves cognitive performance.

Reference
Concurrent Session 18: Nutrition and Cognitive Development

Sialic acid: a conditional nutrient that enhances learning and memory of newborn piglets

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Background – Breast-feeding is associated with higher intelligence in later life, but the mechanisms remain unknown. The subject is controversial because it is difficult to disentangle genetic, environmental and nutritional factors. Understanding the molecular basis of learning, memory and cognitive development is one of science’s most difficult frontiers, yet of increasing clinical and public health importance. Sialic acid (Sia), a 9-carbon sugar, is a vital component of brain gangliosides and the building block of polysialic acid (PSA) on neural cell adhesion molecule (NCAM). Human milk is one of nature’s richest sources of Sia (~1 g/L), but infant formulas contain little (0–0.25g/L). Gangliosides and polysialated NCAM in the brain have an important role in cell-to-cell interactions, neuronal outgrowth, modifying synaptic connectivity, and memory formation. The alpha 2,8 sialyltransferase IV (ST8SiaIV) is one of two key enzymes for synthesizing PSA on NCAM. In rodents, the level of NCAM polysialylation increases with learning behaviour. The liver can synthesise Sia from glucose, but the activity of the limiting enzyme, UDP-N-acetylgalactosamine-2-epimerase (GNE) is low during the neonatal period. In rat pups, supplementation Sia has been shown to enhance learning concomitantly with increased brain ganglioside-bound and protein-bound Sia content. An exogenous source of Sia may be critical under conditions of extremely rapid brain growth, particularly during the first months after birth.

Objective – We examined the dietary may be a conditionally essential nutrient for early brain development and cognition in piglets, an animal model of human infants.

Design – Piglets (n = 54) were allocated to 1 of 4 groups fed sow’s milk replacer supplemented with increasing amounts of Sia as casein glycomacropeptide for 35 days. Learning speed and memory were assessed using an easy and difficult visual cue in an 8-arm radial maze. Brain ganglioside and sialoprotein concentrations and mRNA expression of two learning-associated genes (ST8SiaIV and GNE) were determined.

Results – In both tests, the supplemented groups learned significantly faster than the control group, with a dose-response relationship in the difficult task (P = 0.018), but not in the easy task. In the hippocampus, there were significant dose-response relationships between level of Sia supplementation and mRNA levels of ST8SiaIV (P = 0.002) and GNE (P = 0.004), corresponding to proportionate increases in protein-bound Sia concentration in the frontal cortex.

Conclusion – Sia may be a limiting nutrient in the neonatal period, facilitating optimal cognitive development in young animals. An exogenous source of Sia enhances brain development, providing a mechanism to explain the link between breast-feeding and higher intelligence.

References
Concurrent Session 18: Nutrition and Cognitive Development

Predictors of nutritional and functional status in residential aged care
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Background – Poor nutrition can adversely affect health and quality of life in the elderly population. Whilst several studies have used diagnostic screening questionnaires as a tool for nutritional risk assessment, few studies have investigated the relationships of score results derived from the questionnaires with the nutritional status indicated by anthropometric measurements and biochemical markers.

Objectives – To determine the nutritional status among a group of Australian aged care residents utilising three available diagnostic screening questionnaires: Mini Nutritional Assessment (MNA), Geriatric Depression Scale (GDS), and Katz Activities of Daily Living (ADL). The associations of the questionnaire results with the nutritional (anthropometry and serum concentrations of 25(OH)D, folate and vitamin B12) and mobility (using the timed up and go, TUG, walking test) status of the study population were examined.

Subjects and Methods – Of 115 participants, 66 were able and willing to complete all three questionnaires, 113 provided a blood sample for biochemical tests and underwent anthropometric measurements, and 46 were able and willing to complete the TUG test.

Results – According to the participants’ responses to the questionnaires, 16% were malnourished (MNA score <17), and 39% were depressed (GDS score ≥6). GDS score was inversely associated with MNA score (greater the depression the lower the MNA score) (r=-.353, P=.015), and serum zinc concentrations (r = -0.343, P = 0.001), and GDS was positively associated with the TUG (r = 0.30, P = 0.030) and ADL score (r = 0.37, P = 0.001).

Conclusions – Nutritional risk assessment using questionnaires indicated that nearly 20% of the study population were classified as malnourished, and more than one-third were depressed. Those who were depressed were at greater risk of malnutrition, and had reduced serum zinc concentrations and reduced mobility. Results from this study indicate that depression is a key factor affecting dietary intake and mobility in elderly populations. Minimising or alleviating depression may therefore assist in increasing food intake, improving mobility, and consequently enhancing the quality of life for aged care residents.
Background – Lipid oxidation is one of the most important chemical reactions, which lead to food spoilage. In vivo oxidation reactions have been associated with several important diseases, including cancer and cardiovascular diseases. Both in foods and in vivo oxidation reactions are complex. Therefore, comprehensive understanding of roles of various antioxidants and their activities is challenging. Natural plant-derived antioxidants continue to be one of the most popular research topics in food science. One of the trends is to search for simple measurements to characterize foods and their potential for providing antioxidants and thus supporting our health.

Review – In foods antioxidants are needed to inhibit lipid oxidation, which may proceed by autoxidation, photodegradation or enzymatic oxidation. Antioxidants act by several mechanisms, e.g. by donating phenolic hydrogen to radicals, chelating metals, and quenching singlet oxygen. In addition, food antioxidants are often multifunctional, i.e. each antioxidant may inhibit oxidation by several mechanisms. The dominant mechanism depends on conditions. For example, composition of foods and experimental systems (oxidizing substrates, initiators, and other components present), physical structure of foods, and temperature are among factors, which may influence the dominant mechanism and antioxidant activities. Partitioning of oxidizing substrates, antioxidants, and pro-oxidants in the studied food is critical. Antioxidant activity may thus be distinctly different in bulk oils and multiphase foods, such as emulsions. In addition, the method used to measure and calculate antioxidant activities has a major impact on the results. For all these reasons, use of several test conditions and methods simultaneously is generally highly recommended. Antioxidant activity in a given food is reliably shown by measuring decrease in the formation of a number oxidation products from different steps of the oxidation chain reactions. Antioxidant activities measured using radical scavenging tests do not take into account the effect of the substrate and its structure and other properties.

In vivo, imbalance between antioxidant defense and initiative factors may lead to oxidation reactions, which cause undesirable changes not only in lipids but also in DNA, enzymes and other proteins. In vivo the role of enzymatic defense is emphasized as compared with food systems. Liberation of antioxidants from foods in digestion may differ from liberation in extraction for antioxidant tests. Further, dietary antioxidants have to be absorbed and localized in active forms in the oxidation site to enable the antioxidant effect. Recently, there has growing interest in measuring total antioxidant activities or total antioxidant capacities of foods by simple radical trapping methods, with the aim of providing data on the nutritional quality of the studied foods. Because of the high number and diversity of individual antioxidants in our foods, efforts to look for simplified procedures is understandable. However, the current approaches still leave many open questions.

Conclusions – When antioxidant activities are considered we need to distinguish the role of antioxidants in foods and in vivo. Factors affecting oxidation reactions and antioxidant activities in foods and in vivo differ. In addition, multifunctionality of many antioxidants complicates further possibilities to find simple approaches for antioxidant activities.

References
Plenary 4: Bioactives: From Composition to Activity and Beyond

Antioxidants: from anthocyanins to zeaxanthin
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Background – Antioxidants have been a rapidly growing area of scientific research over the last decade. The term “antioxidant” is now widely recognised, and to some extent understood, by the general public as media coverage increases and the food industry promotes their health benefits. However, there is still considerable confusion over what compounds are antioxidants, the levels present in different foods, which foods have the highest antioxidant capacity and their particular health benefits. Accurate data on the antioxidant composition of foods is important for a number of reasons, including for the food industry to be able to promote their products and for health professionals to compare different foods in order to make the best recommendations for their clients. It is also an essential tool for population studies and intervention trials in order to translate the promise surrounding the health benefits of antioxidants into validated reality.

Review– Participants at the First International Congress on Antioxidant Methods agreed that antioxidant methods must be standardized but disagreed on the best methods to use (1). Analysis of antioxidants is a complex issue because of the number of compounds involved, the variety of ways in which they act and the different food matrices they are present in. There are several different approaches to quantifying antioxidants:

1) Measure individual antioxidant compounds: Some antioxidants such as vitamin C, vitamin E and selenium are relatively simple to quantify. However, the challenges lie in identifying and quantifying the carotenoids and flavonoids as these groups are made up hundreds and thousands of different compounds respectively. The U.S. Department of Agriculture, Agricultural Research Service (2) is building up food composition databases for selected carotenoids, flavonoids, proanthocyanidins and isoflavonoids. These databases provide useful information but have their limitations and because of the number of compounds present in some foods it may make food labels complex if antioxidants were to be shown.

2) Quantify antioxidants by class (e.g. total phenolics, total carotenoids): This is perhaps the simplest way is to measure some antioxidants. There is consensus that the Folin-Ciocalteu method is an appropriate assay for quantification of total phenolics (3) and simple spectrophotometric methods are available for total carotenoids. There are limitations to these general assays and they do not always provide enough information to be meaningful.

3) Determine antioxidant capacity: This approach has benefits over simply quantifying antioxidant components as it provides a measure of their effectiveness. The difficulty is that no one assay can capture the different modes of action of antioxidants. Current commonly used and accepted methods include the oxygen radical absorbance capacity (ORAC) assay and the Trolox equivalent antioxidant capacity (TEAC) assay (3). These assays are useful measures of in vitro activity but it may be more important to learn how the compounds affect cell activity and if any of the beneficial antioxidants are absorbed. Hence, there is a need to develop better processes for cell model screening of biological activity, and subsequent absorption.

Conclusions – With the growing research and consumer awareness of antioxidants it is important to have accurate antioxidant composition and antioxidant capacity data for consumer education, food labelling and promotion. However, there is still some way to go before a consensus is reached on the best measures to use.

References
Plenary 4: Bioactives: From Composition to Activity and Beyond

Antioxidant analyses of foods

J Lako

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Background – Antioxidants are compounds that help prevent oxidation. Information on their presence in foods and their uses as neutralizers of oxidants or free radical compounds in the prevention of chronic non-communicable diseases has attracted scientists in various fields. Hence information related to their analytical determination is crucial.

Objectives – To discuss the major analytical methods in the determination of antioxidants in foods.

Discussion – The choice of analytical methods in the determination of antioxidants depends on the types of antioxidants of interest. Antioxidants in foods could be analysed either as a functional group, antioxidant groups or as individual antioxidants. Functional group could be measured by the total antioxidant capacity (TAC) in the use of any of the following major assays; trolox equivalent antioxidant capacity (TEAC) decolourization (1), ferric reducing antioxidant power (FRAP) (2) and oxygen radical absorbance capacity (ORAC) (3). The major antioxidant group assays include the determination of total polyphenol (TPP) performed by the Folin-Ciocalteu method, total carotenoids, total anthocyanins and total flavonoids (4). The determinations of individual antioxidants such as carotenoid and flavonoid profiles include the use of HPLC and LC-MS and other complex assays (5).

Conclusion – Attempts are made to validate the antioxidant assays in the Pacific region for use as a routine analysis in regional laboratories.

References

Plenary 4: Bioactives: From Composition to Activity and Beyond

Developments in QA of chemical measurements in food
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Background – Challenges in the analysis of food include new residues that need monitoring, and ever lower concentrations of target compounds. New methods of analysis have provided clever approaches but now quantitative methods need adequate validation and laboratories using those methods need proper quality control. Food analysis has traditionally relied on mutually agreed standard methodology, eschewing approaches such as the Guide to Uncertainty in Measurement (GUM)\(^1\), and thereby foregoing metrological traceability. This paper will explore aspects of quality assurance and will argue that food analysis can be brought into the orbit of normal chemical analysis.

Quality Assurance – Australia has led the world in aspects of metrology ever since minister Dedman stated in Parliament “Measurements must be what they purport to be”\(^2\). The National Association of Testing Authorities (NATA) was the first such accreditation body in the world. A proper quality assurance program will have the following elements: 1. Accreditation of the laboratory, 2. Participation in proficiency testing schemes, 3. Use of certified reference materials (CRMs) for calibration and quality control, 4. Estimation of measurement uncertainty, 5. Appropriate qualification and training of personnel, 6. A client focus to the operations of the laboratory.

Measurement uncertainty – Horwitz has argued against the GUM approach, debating that matrix effects and sampling are so much greater than any ‘bottom up’ uncertainty components\(^3,4\). However it is possible to treat recovery and other aspects in a correct manner that can be justified in terms of accreditation to ISO 17025. A recent approach, that is GUM compliant, uses repeatability and a measurement of run bias to quickly assess uncertainty, has been published by O’Donnell and Hibbert\(^5\). Using suitable CRMs it is possible to construct an uncertainty budget. An example of creatinine in urine will be given to illustrate this method.

Certified reference materials – A consistent approach to quality control requires CRMs that are appropriately matrix matched. Australia’s National Measurement Institute produces reference materials, both pure and matrix, with property values that are certified with stated uncertainties. CRMs are expensive and do not cover the gamut of required materials, but the effort required to certify a material is considerable. An example will be given of the analysis of nitrofurans in prawns by isotope dilution mass spectrometry.

References
Plenary 5: Nutrition and Ageing

**Nutrition for older people**

A Stewart Truswell

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People are living longer. Australia now has the second longest life expectancy (at birth) in the world: about 71 years for males and 74 for females. At 60 years our average health-adjusted life expectancy (HALE) is another 16.9 in men and 19.5 in women (mortality is longer). Around 20% of Australians are now over 65 years old. Many occupations are no longer obliged to retire people at a fixed date and a number continue working past 65. “70 is the new 60!” So we have to adjust the cut offs for “older” people and “elderly”.

Nutrition research in older people is handicapped by (i) great heterogeneity of the people’s health and conditions, (ii) special problems with access, (iii) confounding by medications, (iv) the varied, often indirect criteria used for nutritional status.

Nutrition science’s concerns with this age group can seem to be looking in two opposite directions. “Don’t eat too much, so you’ll stay healthy for longer” (and there’s the calorie restriction hypothesis) OR “We’ll help you get more to eat to keep you healthy for longer”. Which direction depends partly on interpretation of the limited research. It depends more on the stage an individual is at: third age or fourth. Chronological timing of aging is more variable than the timing of growth in teenagers.

For the third age there is much good advice in the NHMRCs ‘Dietary Guidelines for Older Australians’ (1999) (1). Among the messages to be found in it:- “Anyone refusing to give a sprightly 66 year old dietary advice to prevent cardiovascular disease could be accused of age discrimination” (p 85). ‘We know that salt sensitivity (of blood pressure) increases with age’ (p 110). ‘Keep active to maintain muscle strength and a healthy body weight’ (p 29). ‘Older people may become infected with food borne pathogens at low doses that might not produce a reaction in (younger) people’ (p 48). As people age ….. a lowered energy output leads to a lowered energy intake: we eat less food. ‘Because of this older people need foods that are rich in nutrients – nutrient-dense foods – if they are to maintain their intake of essential nutrients’ (p xx i).

The National Nutrition Survey (1995) confirmed lower energy intakes over age 65 y. As to requirements of essential nutrients, the NH&MRC (2005) sets RDIs higher for protein, calcium, riboflavin and (especially) vitamin D for the 70+ year line (than for younger adults).

In the fourth age old people are no longer healthy and under – or malnutrition is likely to be associated. SENECA Study participants who lost 5 kg body weight had a significantly shorter survival. Undernutrition in old people has many, often combined causes. Broadly these are (a) serious disease or advanced aging, and (b) socio-economic and management problems. The first group are for medical care, AUSPEN and high tech nutrition support. The latter group are the main challenge for this society: older people who are not eating what they need because they are socially isolated, have chronic disabilities, were nutritionally depleted by major illness in hospital, are housebound or don’t eat enough in nursing homes.

Different agencies and professionals are theoretically in a position to help nourish and re-nourish people in some of these situations. Nutritionists/dietitians are likely to be advisers rather than at the front line. For most jobs there’s a manual telling the best way to do the job. In nursing homes this has been lacking for nutrition. Bartl and Bunney asked 100 people for practical ways of looking after nutrition and food in nursing homes. This is embodied in their manual (2), which a book reviewer considers “ideal for aged care staff who want a single source of information in plain English, which will assist them, or prompt them, to address all the food and nutrition related standards and guidelines for aged care”.

Housebound elderly are scattered, isolated, out of sight and more difficult for nutritional advice to access. This was discussed – with no major answers – at a conference at Sydney University last year. We heard stories about individuals with food insecurity, about the adverse effects of bad teeth, early Alzheimer’s, depression, social isolation and other disadvantages. In Lipski’s experience at least 30% of independent community living elderly are undernourished, most unrecognised. Meals on Wheels cost more than they used to. Community nurses and care services help some people. An increasing number of commercial companies will deliver meals for those who can pay. It is estimated there will be a large increase of frail older Australians living in the community and not enough people to care for them - ? us. This important exception to the obesity epidemic deserves much more of our attention.

**References**

Plenary 5: Nutrition and Ageing

**Diet in childhood and diet and mortality in old age: findings from the Boyd Orr cohort**

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**Background** – Childhood diet may have important implications for health in old age for two reasons. First, diet in childhood may influence diet in later life. Second, diet in childhood may have direct effects on the pathogenesis of chronic disease processes independent of subsequent adult diet. Few studies have examined the associations of diet in childhood with later diet and mortality in old age prospectively. I will attempt to summarise findings from the Boyd Orr cohort that have examined the association between diet in childhood and later diet and health outcome.

**Methods** – The Boyd Orr cohort is based on the long-term follow-up of 4,999 children who were surveyed in the Carnegie survey of Family Diet and Health in Pre-World War II Britain (1). Socio-economic data, anthropometric data and a seven-day household dietary inventory were collected on 1,352 families living in 16 areas of England and Scotland between 1937 and 1939 and repeat dietary data was collected on over 300 families (1). The name, age and address of the children of the families surveyed were used to trace the children and 88% have been successfully traced (1). In 1997-1998 a self-completion questionnaire that included a 113-item food frequency questionnaire was sent to all 3,182 surviving traced study members (2).

**Results** – A childhood diet rich in vegetables was associated with a healthy diet in early old age. In multivariable models the healthy diet score (a 12 item score) for those in the upper quartile of childhood vegetable intake was 0.30 (95% CI –0.01 to 0.61, p for trend 0.04) higher compared to those in the lowest quartile. (2) Higher childhood energy intake was associated with increased cancer mortality - in multivariable proportional hazard models that adjusted for social variables the relative hazard for all cancer mortality was 1.15 (95% CI 1.06 to 1.24, p 0.001 for every MJ increase in adult equivalent daily intake) (3). Higher fruit intake was associated with reduced risk of incident cancer. In fully adjusted logistic regression models odds ratios (95% CI) across increasing quartiles of fruit consumption were 1.0 (reference), 0.66 (0.48 to 0.90), 0.70 (0.51 to 0.97) and 0.62 (0.43 to 0.90), p for linear trend =0.02. (4) Higher childhood intake of vegetables was associated with lower risk of stroke. After controlling for age, sex, energy intake and range of socio-economic and other confounders the rate ratio between the highest and lowest quartiles of intake was 0.40, 95% CI 0.19 to 0.83, p for trend = 0.01) (5) Higher intake of fish was associated with higher risk of stroke. The fully adjusted rate ratio between the highest and lowest quartile of fish intake was 2.01, 95% CI 1.09 to 3.69, P for trend = 0.01) (5). There was no association between intake of any of the foods and constituents considered and deaths attributed to coronary heart disease or all cause mortality (5). The reported childhood diet-cancer associations were robust to adjustment for measurement error (6).

**Conclusions** – Though these results are based on household measures on children across a range of ages measured in the 1930s they do suggest that diet in childhood influences diet in old age and cancer risk. These findings require replication but suggest that childhood diets rich in vegetables and fruit may be beneficial.

**References**

Plenary 5: Nutrition and Ageing

**Healthy ageing: 10-year trends in food and nutrient intakes among older Australians**

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**Background** – Healthy ageing depends, in part, on good nutrition, to compress morbidity, or, in other words, to minimize the time spent in states of ill-health in the later years of life. Little information is available in Australia about trends in food and nutrient intakes of any age group, including older people. The Blue Mountains Eye Study, a population based cohort study, provided an excellent opportunity to study trends in intakes of foods and nutrients, measured three times over a 10-year period on a large cohort of older people. Such data enable the exploration in patterns of dietary change among the same people as they age over time, which is not possible with population cross sectional surveys. We have also begun to analyse the dietary trend data in relation to health outcomes, to see whether particular patterns of intake predict better health status and longevity.

**Review** – The Blue Mountains Eye Study is a population-based cohort of older people living in two postcode areas west of Sydney. At baseline (1992-1994) 3654 people aged 49 years and over (82% of those eligible) were examined (mean age at baseline 62 years). Five years later (1997-1999) 2334 people were re-examined, and ten years after the baseline data collection (2002-2004) 1952 people were re-examined (75% of survivors). A validated 145 item food frequency questionnaire (FFQ) was used to assess food and nutrient intake at each of the three assessments. During the ten year period, 1166 people completed the FFQ satisfactorily on all three occasions. Mean intakes of foods and nutrients were examined. In addition, food and nutrient intakes at baseline were examined in relation to various health outcomes, including weight gain, eye disease, and mortality. Mean intakes of energy and sugars significantly increased among women over the 10 year period (7920kJ vs 8272kJ, p<0.05; 118g vs 127g sugar, p<0.05). Mean intakes of n-3 polyunsaturated fatty acid (PUFA) and fish significantly increased among women and men over the ten year period (n-3 PUFA: women 0.9g vs 1.1g, p<0.05; men 1.0g vs 1.1g, p<0.05) (fish: women 27g vs 38g, p<0.0001; men 26g vs 36g p<0.0001). Mean dietary folate intake increased in women and men, reflecting changes to food supply during the study period (folate (µg): women 323 vs 376, p<0.001; men 346 vs 393, p<0.001). Study participants consumed significantly lower quantities of cuts of red meat (red meat cuts: women 42g vs 36g, p<0.0001; men 49g vs 40g, p<0.0001), but more mixed dishes containing red meat over the ten year period (red meat dishes: women 54g vs 62g, p<0.001; men 69g vs 73g, p=0.23 not sig). Whole milk consumption decreased and low fat yoghurt increased (whole milk: women 98g vs 78g, p=0.002; men 131g vs 102g, p=0.002; yoghurt: women and men 18g vs 30g, p<0.0001). There were no significant changes in total fruit and vegetable intake, though some sub-types of fruits and vegetables increased, notably canned fruit and avocado (p<0.05). Mean intakes of wholemeal bread decreased over the 10 year period (52g vs 40g, p<0.05). Amongst men, mean intake of beer decreased but wine increased (210g vs 166g for beer, p<0.01, 68g vs 78g for wine, p=0.05). People who consumed the highest tertile of fruit and vegetables were more likely to consume lean red meat and fish (p<0.0001). At baseline 57.9% of participants were overweight or obese and ten years later 65.9% were overweight or obese. During the 10 years of follow-up median weight gain was 2.4kg and 31% of people had weight gain greater than 5kg. Participants with the highest vs lowest quintile of n-3 PUFA at baseline had a lower risk for incident early age-related macular degeneration (ARM) at five years (OR 0.41, 0.22-0.75), and there was a 40% reduction of incident early ARM associated with fish consumption of at least once a week (OR 0.58, 0.37-0.9).

**Conclusions** – Many of the observed changes in diet over a 10-year period among older Australians were in line with current population dietary recommendations, including, an increase in intakes of fish, n-3 fatty acids, folate and low fat dairy products. However, some changes resulted in poorer dietary choices, such as decreasing use of wholemeal bread. A full analysis of the dietary trends will inform nutrition policy and programs targeted to older Australians.

**References**


**Funding support:** National Health and Medical Research Council, Meat and Livestock Australia
Plenary 5: Nutrition and Ageing

Calorie restriction and life extension
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Background – Long-term calorie restriction (CR) extends the life of many lower animals, including rats, mice, fish, flies and worms. However, in humans there are no life-long studies, only short term trials over 2 to 6 years which indicate that CR reduces the risk factors for cardiovascular disease and diabetes.

Review – In 1935 McCay (1) clearly showed that prolonged CR extended the life of rats. This has been repeatedly confirmed by later investigators, who also showed that CR delays the onset of various age-related diseases and thereby extends life. No life-long CR studies have been performed in humans. However the inhabitants of Okinawa (islands south of Tokyo) who are the longest lived people on earth eat 40% fewer calories than the Americans and live 4 years longer (2). The Okinawans have a lower mortality from stroke and cancer. In developed countries human life expectancy has increased in the 20th century by an average of nearly 30 years, mainly due to reduced deaths from infectious diseases, accidents and cardiovascular disease (3). During the latter part of the 20th century diets in developed countries were improved by increasing the intake of fruit, vegetables and fish and decreasing saturated fat consumption. However, calorie intake has increased since 1970 by about 30% in USA and in many countries is leading to overweight, which is life-shortening. Overweight in middle age shortens life by 3 years and obesity by 7 years (4). Obesity in young adults takes 13 years off life. Thus CR to prevent overweight and obesity could add 3 to 13 years to life expectancy. The semi-starvation (20% CR) of wartime in the 1940s in Scandinavian countries reduced the incidence of cardiovascular disease. In the 1990s, 20% CR studies on healthy adult humans over a 6 year period produced significant falls in the risk factors for cardiovascular disease and diabetes (5). A recent 25% CR study on overweight adult humans over 6 months reduced their body weight and decreased body temperature and plasma insulin, which are biomarkers of longevity (6) indicating increased life expectancy.

Conclusions – Thus CR over 6 months to 6 years has been able to reduce the risk factors (body weight, blood pressure, cholesterol, glucose) for the major diseases that kill humans and improve metabolic functions (body temperature, plasma insulin) that determine life expectancy. While these studies indicate that CR should extend human life, the only proof will come from very long-term CR studies over 50 or more years.

References
5 Fontana L, Meyer TE, Klein S, et al. Long-term calorie restriction is highly effective in reducing the risk for atherosclerosis. PNAS 2004; 101:6659-6663
P01  Wheat bran plus resistant starch-enriched food beneficially modulate the colonic microflora in individuals with ulcerative colitis
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Background – Current treatments and outcomes for Ulcerative Colitis (UC), a form of inflammatory bowel disease (IBD), are generally disappointing hence new forms of therapy are urgently required. It has been proposed that manipulation of the gut microbiota with a diet containing wheat bran plus resistant starch (WBRS) may have the ability to modulate the colonic microflora towards a more remedial community and thus potentially act as a novel therapeutic approach in the management of UC.

Objective – To examine the effect of a diet containing high (~32 g/day) levels of WBRS compared to a diet containing low (~10 g/day) levels of WBRS, on the composition of the colonic microflora in individuals with UC.

Design – Single blind randomised 48-day crossover dietary intervention, where a total of five subjects (two women, three men) between the age of 18 and 54 years with UC in remission, consumed dietary supplements containing low and high levels of WBRS.

Outcomes – Compared to the low WBRS diet, the high WBRS diet significantly reduced the numbers of the Bacteroides-Prevotella spp. group (P = 0.043) and increased the numbers of the Bifidobacterium spp. group (P = 0.04). No effects on the total number of bacteria, Enterobacteriaceae including Escherichia coli, Clostridium spp. group, Eubacterium spp. group and Lactobacillus spp. group were observed.

Conclusions – Addition of high level WBRS supplements to the diet of UC subjects provided favourable changes to specific groups of bacteria, in particular the Bacteroides-Prevotella spp. group and the potentially beneficial Bifidobacterium spp. group, which suggest this novel combination of dietary fibres may be useful in the management of UC.

P02  The effect of multivitamin supplementation on nutritional status and quantitative heel ultrasound in aged care residents
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Background – Food fortification and/or multivitamin supplementation may improve nutritional status in aged care residents who are at risk of malnutrition and related diseases.

Objective – To assess the effectiveness of a multivitamin tablet, and calcium-vitamin D₃ fortified milk supplementation for six months, on serum indices of nutritional status and bone quality (quantitative heel ultrasound, QUS) in a group of Australian aged care residents.

Design – With a 2x2 factorial design, subjects were randomized to receive either a placebo (P) or multivitamin (MV) tablet containing various vitamins including 5 µg cholecalciferol, 250 mg calcium carbonate, 20 µg cyanocobalamin and 200 µg folic acid (1 tablet/day), and, matched on mobility levels, to receive fortified milk (7 g protein, 200 mg calcium and 5 µg cholecalciferol), or usual milk for six months. Measurements of body weight, QUS, and serum concentrations of nutrients were performed at baseline and at six months.

Outcomes – Low compliance in consuming the fortified milk caused by the difficulties in delivering the milk to the participants led to the cessation of milk after 16 weeks of the study. Therefore only the effect of multivitamin supplementation was examined. Of 115 participants entering the study, 92 (49 MV and 43 P) completed the study. Following supplementation after six months, compared to the P group, the MV group had a greater rise in serum 25(OH)D (33.4 ± 2.6 nmol/l), folate (13.4 ± 2.8 nmol/l), and vitamin B12 (163.5 ± 40.3 pmol/l). The number of participants with adequate 25(OH)D concentrations (>50 nmol/l) increased from 23% to 77% for the MV group, and was reduced from 17% to 10% for the P group. After adjustment for baseline levels, the MV group had an improvement in QUS by 2.7 dB/MHz, compared to -2.5 dB/MHz for the P group (P=0.041).

Conclusions – Daily multivitamin supplementation improved nutritional status with respect to serum 25(OH)D, and raised vitamin B12 and folate concentrations. Additionally, there was an indication of a positive effect on bone density; this could in the long term contribute to a reduction in falls and fractures.
P03
Squalene supplementation alters genes associated with liver cholesterol metabolism
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Background – Squalene is a component of shark liver oil and has been speculated to have cholesterol reducing properties. High levels of total and LDL cholesterol have been shown to contribute to the development of chronic heart disease. The liver is central to the regulation of cholesterol metabolism and dietary intervention has long been recognized as a primary means to reduce the risks of chronic heart disease and related ailments.

Objectives – To determine the effect of dietary squalene supplementation on gene transcripts associated with liver cholesterol metabolism. Specifically the effect of squalene supplementation on mRNA levels for proteins that regulate cholesterol biosynthesis (HMDH & ERG1), cholesterol elimination (SRB1), bile synthesis (CP7A1 & CP27A) and cholesterol excretion by the liver into bile (ABCG5 & ABCG8) was investigated.

Design – Rats (n=32) were divided into four groups and supplemented for 12 weeks. Groups one and two were fed a cholesterol rich diet for six weeks followed by six weeks of a cholesterol rich diet plus 1.75mg/day of squalene or 3.5 mg/day. Group three was fed a cholesterol rich diet for 12 weeks and group four was fed standard rat chow for 12 weeks. Blood lipid levels were monitored during the study and liver gene expression was determined at the conclusion of the feeding trial via RT-PCR.

Outcomes – 3.5 mg/day of squalene lowered total and LDL cholesterol in rats consuming a cholesterol rich diet. This dose of squalene also resulted in constant levels of HMDH and ERG1 whereas the cholesterol rich diet halved mRNA levels of these enzymes. Furthermore 3.5 mg/day of squalene caused a greater than 3.0 fold increase in mRNA levels of the proteins SRB1, CP7A1, CP27A and ABCG5.

Conclusion – Dietary squalene supplementation at a dose of 3.5 mg/day lowers total and LDL cholesterol in rats consuming a cholesterol rich diet. These reductions in cholesterol levels may be due to increased cholesterol elimination, bile synthesis and cholesterol excretion by the liver into bile mediated by changes in gene expression of key enzymes involved in these metabolic pathways

P04
The effects of four ad libitum diets of varying fibre content on cardiovascular risk factors
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Background – Inverse associations between fibre intake and cardiovascular risk factors are reported in many studies. In a randomised controlled trial we have previously shown that dietary fibre, in the form of a supplement, decreases cardiovascular risk factors in the postprandial period in overweight and obese individuals. The effects of dietary fibre in conjunction with a healthy diet on cardiovascular disease have not been studied in overweight and obese subjects.

Objectives – To evaluate the effects of dietary fibre with or without a healthy eating plan on blood lipids and glucose in overweight and obese individuals.

Design – A 12-week randomized controlled trial, including ad libitum diets and fibre supplements, was undertaken using four groups: (1) control, (2) control plus fiber supplement, (3) healthy diet and (4) healthy diet plus fibre supplement. Participants in groups 2 and 4 were given extra fibre in the form of supplements (36 grams psyllium husk per day). The healthy diet groups (3 and 4) followed a healthy eating plan based on the Australian Dietary Guidelines. Fasting blood triglyceride, total cholesterol, LDL-cholesterol, HDL-cholesterol and glucose were measured at the baseline, six and twelve weeks.

Outcomes – In total, 70 overweight and obese subjects were recruited and 57 (81%) completed the trial. In primary ‘intention to treat analysis’, total cholesterol and LDL-cholesterol were significantly different between all treatment groups and control group (P=0.000 for total cholesterol and LDL-cholesterol). In comparison with control group, total and LDL-cholesterol decreased by 3% and 9% respectively in the control plus fibre group (P=0.03 and P=0.002 for total cholesterol and LDL-cholesterol respectively), by 6% and 8% respectively in healthy diet group (P=0.001 and P=0.013 for total cholesterol and LDL-cholesterol respectively) and by 12% and 13% respectively in healthy diet plus fibre group (P=0.000 for total cholesterol and LDL-cholesterol). There were no differences in triglyceride, HDL-cholesterol and glucose between the groups.

Conclusion – These results suggest that consumption of additional fibre in the form of psyllium husk is as effective as a healthy dietary plan to improve fasting blood cholesterol and LDL-cholesterol in overweight and obese individuals.
P05
Tanita foot-to-foot bioelectrical impedance validated in healthy overweight adults
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Background – Bioelectrical impedance analysis (BIA) has been commonly used as a convenient, cost effective way to measure body composition in large population studies. However, the validity of this technique remains uncertain.

Objective – To compare measurements of body fat mass using single frequency BIA with dual-energy X-ray absorptiometry (DEXA).

Design – Forty-two overweight and obese (body mass index 25 to 40 kg/m2) but otherwise healthy volunteers aged 30 to 70 y were recruited from the general population. In a cross sectional analysis, fat mass was measured using foot-to-foot BIA (Tanita Scale Model TBF-300) and whole body DEXA (GE Lunar Prodigy scanner).

Outcomes – Although fat mass measured using BIA was strongly correlated with DEXA (r²=0.89), this analysis is not useful when comparing methods of measurement. There was bias in the measurement of fat mass with BIA measuring lower than DEXA (mean±SD: -2.96±2.91 kg). In weighted least products regression there was a significant fixed bias (mean (95% CI): -6.24 (-10.75, -1.72). However, there was no significant proportional bias (1.09 (0.96, 1.23)). That is, the slope did not differ significantly from 1. This implies that the difference between the methods did not increase with increasing fat mass.

Conclusions – Although the results suggest that there may be some concern regarding accuracy of the BIA technique in overweight and obese individuals, this method may be useful for estimating of fat mass in large cross-sectional and longitudinal population studies, as well as in intervention studies.

P06
The effects of soy and whey dietary proteins on gene expression during tumourigenesis
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Background – Both soy and whey proteins have been shown to have additional health benefits beyond their basic nutritional value, including anti-carcinogenic properties against colorectal, breast and prostate cancers. At present, limited knowledge exists of the mechanisms by which soy and whey exhibit these anti-carcinogenic properties and whether anti-tumour properties extend to other tissues.

Objective – To determine the effects of soy and whey protein-based diets on the incidence and progression of N-nitrosodiethylamine (NDEA)-induced, pre-neoplastic lesions and gene expression in the liver.

Design – Pre-neoplastic lesions were induced in the livers of Wistar rats by NDEA injections (25mg/kg body weight, 2 times week for 3 weeks). Rats (9 per treatment) were fed control (meat-based rodent chow), whey-based or soy-based diets for 15 weeks. Following euthanasia, liver samples were obtained and the total area occupied by preneoplastic lesions was determined by immunohistochemical staining for GST-qp. DNA microarray analysis is being undertaken to investigate the effects of the diets upon gene expression.

Outcomes – The incidence of preneoplastic lesions in whey-fed rats (0.31% total liver area) was reduced by 41% compared to rats fed a control diet (0.53% total liver area; P < 0.05). Soy-fed rats showed an 81% increase in lesion incidence (0.98% total liver area; P < 0.013).

Conclusions – Whey-based diets protect against initiation and progression of NDEA-induced preneoplastic lesions in liver compared to either meat- or soy-based diets. A similar pattern of protection has been observed against colorectal tumours. The molecular mechanisms of this protection remain to be elucidated.
**P07**

**Dietary intake of long chain n-3 polyunsaturated fatty acids in adults with asthma**

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**Background** – Increases in the prevalence of asthma may be explained by changes in the dietary intake of long chain omega-3 polyunsaturated fatty acids (LCn-3 PUFA’s), which are shown to have anti-inflammatory properties.

**Objective** – To evaluate the dietary intake of LCn-3 PUFA’s in adult women with and without asthma and to examine the effect of inhaled corticosteroid use (ICS) on dietary intake.

**Design** – We recruited asthmatic women (n=34) and non-asthmatic controls (n=26). Participants completed a food frequency questionnaire and dietary analysis was determined using Foodworks software, Xyris, QLD.

**Outcomes** – There were no significant differences in age and BMI between the asthmatic and non-asthmatic control groups. Asthmatic women had lower lung function compared to controls (Mean ± SEM) (FEV1%; 96 ± 2% vs. 100 ± 1%, P=0.51). The median (Q1-Q3) inhaled corticosteroid dose for asthmatic women was 625 (287.5-1000) µg/day. A significant difference in the dietary intake of LCn-3 PUFA’s between asthmatic and non-asthmatic controls was observed (Mean (g/day) ± SEM) (Asthma: 0.16 ± 0.42, Control: 0.05 ± 0.005, P=0.02). The control group had a lower LCn-3 PUFA intake compared to the Australian average (0.159 g/day) (1). Further subgroup analysis showed that there was no significant difference in dietary intake of asthmatic women using ICS compared to asthmatic women who were steroid naïve.

**Conclusions** – An unexpected elevation in the LCn-3 PUFA intake was seen in these asthmatic women. This may be likely to represent an increased awareness of the health benefits associated with LCn-3 PUFA consumption in asthma, leading to an increased dietary intake. These results also indicate that the non-asthmatic control group are failing to meet Australian intake recommendations for LCn-3 PUFA’s.

**References**


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**P08**

**Knowledge and consumption of long chain n-3 polyunsaturated fatty acids (LCn-3PUFA) in young adult tertiary students**

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**Background** – LCn-3PUFA are known to have beneficial effects on human health. However, changes to the human diet in the past 150 years appear to have resulted in reduced intakes of LCn-3PUFA which now fall well short of an adequate intake for optimal health.

**Objective** – To examine awareness of and intake of LCn-3PUFA major food sources by young adult consumers.

**Design** – Questionnaires about knowledge and consumption of omega-3 fats were completed by 78 tertiary students (28 male and 50 female). Demographic variables were considered as influences on behaviour.

**Outcomes** – Intake of LCn-3PUFA (ALA, EPA and DHA) was considerably lower in females (60 mg/day) than in males (100 mg/day). These intakes were both lower than the average Australian adult intakes (females 159 mg/day and males 222 mg/day), and much lower than the recommended 430 mg/day for females and 610 mg/day for males. Seventy four percent of participants did not know about the best food sources of n-3 PUFA or the potential health benefits of consuming these fatty acids.

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<tr>
<th>Fatty Acid</th>
<th>Australian adult intake (mg/d)</th>
<th>Student intake (mg/d) (n=28)</th>
<th>Australian adult intake (mg/d)</th>
<th>Student intake (mg/d) (n=50)</th>
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<tbody>
<tr>
<td>20:5n-3 (EPA)</td>
<td>66</td>
<td>20</td>
<td>47</td>
<td>10</td>
</tr>
<tr>
<td>22:6n-3(DHA)</td>
<td>124</td>
<td>70</td>
<td>90</td>
<td>40</td>
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<tr>
<td>EPA+DPA+DHA</td>
<td>222</td>
<td>10</td>
<td>159</td>
<td>60</td>
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<tr>
<td>18:3n-3 (ALA)</td>
<td>1380</td>
<td>420</td>
<td>987</td>
<td>280</td>
</tr>
<tr>
<td>Total n-3PUFA</td>
<td>1602</td>
<td>520</td>
<td>1146</td>
<td>340</td>
</tr>
</tbody>
</table>

**Conclusions** – The low intake of LCn-3PUFA by young adults is a concern. It is possible that awareness and consumption increases with age, as reflected in the Australian adult population. Consideration should be given to promotions targeting young adults to ensure an adequate consumption to maximise the health benefits in later years.
The inflammatory response of acute maximal exercise in athletes
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Background – Pro-inflammatory cytokines are released in response to conditions of stress such as trauma, surgery, burns, sepsis and exercise. Exercise has been suggested to affect the immune system in a J curve, where moderate exercise improves immune function and chronic exercise impairs the immune system and increases the risk of upper respiratory tract infection [1, 2].

Objective – The objective of the study was to determine the effect of acute maximal exercise on plasma markers of inflammation, carotenoids and fatty acids in healthy endurance athletes and untrained adults.

Design – Twenty endurance trained athletes and 15 sedentary adults completed an overnight fasting treadmill VO$_2$max test, a 7-day physical activity record and a 4-day weighed food record. Blood was collected at baseline and post-exercise for the analysis of inflammatory markers, fatty acids and carotenoids in plasma.

Outcomes – Plasma monocyte concentration ($\times 10^6$ cells/ml) significantly increased ($P < 0.001$) in all participants from baseline ($1.35 \pm 0.33$) to post-exercise ($2.65 \pm 1.10$). Athlete monocyte concentration was significantly higher ($P < 0.05$) at baseline ($1.44 \pm 0.37$) and post-exercise ($3.00 \pm 0.80$) compared to sedentary adults ($1.25 \pm 0.24$, $2.23 \pm 1.29$). There was no difference in the plasma inflammatory markers IL-6, TNF-alpha and LTB$_4$ at baseline and post-exercise. Acute maximal exercise significantly increased plasma lutein/zeaxanthin ($P < 0.001$), beta-cryptoxanthin ($P < 0.001$) and lycopene ($P < 0.01$) concentrations. Plasma non-esterified fatty acid (NEFA) significantly increased but total fatty acids remained unchanged in response to exercise.

Conclusion – In healthy human adults acute maximal exercise can increase plasma monocyte, carotenoid and NEFA concentration without a change in inflammatory mediators.

References

Effect of age, gender and ethnicity on glycaemic responses
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Background – The in vivo glycaemic index (GI) testing of foods can give a broad range of results between laboratories and even within laboratories for the same food item. Demographic factors such as gender, ethnicity and age of participants may influence the glycaemic responses in the individuals to a standard Oral Glucose tolerance test (OGTT), hence may affect the determination of the GI value of foods.

Objective – To determine effect of age, gender and ethnicity of the subjects attending the GI testing site on their glycaemic response (GR) to a standard OGTT.

Design – Glucose response data was collected on 204 subjects of varying age, ethnicity and gender from multiple OGTT (minimum =3, maximum=11). The individuals were grouped based on their ethnicity into: Western European ($n = 105$), Asian ($n = 83$) and Indian and Middle Eastern ($n = 16$), as well as age groups: 18 - 26, 27 – 35 and 36- 45 years, and male and female gender.

Outcomes – There was no significant difference in the area under the curve (AUC) for the 50g glucose solution in Asian, Western European and Indian and Middle Eastern ($F (2, 201) = 10.3, P= 5.2$). The blood glucose level in Indian and Middle Eastern subjects tended to return to the fasting level very slowly compared to other ethnicities. The effect of age on glucose responses was not significant. Statistical analysis also showed no significant differences in the AUC based on gender (57.3% female; 42.6% male), $F (1, 202) = 0.42, P= 0.5$.

Conclusion – Ethnicity, gender and age do not have significant influence on the GR and thus may have no impact on GI determination of foods.
P11

Effect of racial differences on glycaemic responses:
Western European vs. South East Asian
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Background – Glycemc Response (GR) is the extent to which any food raises the blood glucose level and is controlled by the structure of the carbohydrate and its rate of digestion and absorption by the small intestine. Glycaemic index (GI) is a measure used to rank carbohydrates based on their effect on the blood glucose level relative to a standard such as pure glucose. One of the factors which may change the rate of gastrointestinal emptying, digestion and absorption and hence influence the GR and GI value is ethnicity.

Objective – To ascertain the effect of racial differences on glycaemic response and glycaemic index of white bread: comparing Western European vs. South East Asian cohorts.

Design – The standard Oral Glucose Tolerance Test (OGTT) was performed for both the standard food (glucose solution) and the test food (white bread) on 40 healthy individuals, age 18 to 45 years from Western European and South East Asian backgrounds. The “Homebrand” white bread was selected as the test food and was consumed on one occasion. A 50g glucose solution was used as the standard food and consumed on 3 occasions by the subjects. Finger prick blood samples in duplicates were obtained and instant blood glucose concentration was measured using automatic analyzers (HemoCue® glucose 201) over a two hour period. The area under the curve (AUC) for each 2h blood glucose response to the glucose solutions and the white bread was calculated and used to determine the GI value of the test food.

Outcomes – There were 55% females and 45% males in each ethnic group. The AUC for both the glucose standard (M = 234, SD = 8.1) and the test food (M = 174, SD = 13.4) were greater in Asian subjects compared with Caucasians (M = 214, SD = 12.6) and (M = 153, SD= 4.2). An ANOVA test showed no significant differences in the GI value of white bread F (2, 37) = 0.29, P =0.6 between Asian (M= 78, SEM= 5.4) and Caucasians (M= 73, SEM= 8.6).

Conclusion – The in vivo determination of the GI value of foods can not be influenced by ethnicity of the participants.

P12

Influencing children’s food preferences: parents’ strategies
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Background – The origins of children’s food preferences remain largely unexplored. However, experimental research suggests they are affected by parents’ feeding behaviours. Outside of the laboratory context, in daily life, there is little indication of how parents attempt to influence their children’s food likes and dislikes, and associations between feeding behaviours and children’s food preferences. Furthermore, parents’ use of feeding behaviours may be partly determined by characteristics of the child, especially their food neophobia.

Objective – To explore parents’ use of strategies for influencing their preschool-aged children’s food preferences, and associations with children’s food preferences and food neophobia.

Design – Semi-structured interviews were conducted with three groups of parents: those of (a) children with healthy food preferences (N=20), (b) children with unhealthy food preferences (N=18), and (c) food neophobic children (N=19). Parents were asked to describe how they tried to influence their children’s food preferences in general, as well as a specific time when they attempted to promote liking or disliking of a food. Interviews were transcribed verbatim and entered into a qualitative software package (N6) for thematic analysis and extraction of quotes.

Outcomes – Several themes concerning parents’ feeding behaviours emerged, some of which differed by group. Themes that arose from parents of children with healthy food preferences included use of exposure, repeated exposure, encouragement, parental modelling, manipulating peer influence and involving children in food preparation and selection. Conversely, themes emerging from parents of unhealthy or food neophobic children included forcing, fighting, restricting and controlling, rewarding or bribing and indulging children’s desires.

Conclusions – The results support the hypothesis that parents’ feeding behaviours may be a source of variation in children’s food preferences. Parents’ use of feeding behaviours promoting unhealthy food preferences may be partially in response to children’s food neophobia. Education of parents about effective strategies for promoting healthy food preferences in children, and especially food neophobic children, is needed.
P13
Lycopene supplementation does not influence cytokine profile in asthma patients
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Background – Carotenoids are fat soluble pigments, which may play an anti-inflammatory role. Their circulating levels are low in the asthma, a disease that is defined as chronic inflammation of the airways. It has been shown that lycopene supplementation can reduce exercise-induced oxidative stress in stable asthma.

Objectives – The aim of this study was to determine the effect of the lycopene supplementation (as tomato juice and lycopene capsules) on the plasma levels of selected cytokines in stable asthma.

Design – Thirty-two asthma patients visited the clinic on 7 occasions over the 51-day period. They received 3 different treatments ie tomato juice, lycopene capsules, and placebo for 7 days each, in random order with a 10 day washout period between each treatment. During the study period, patients were advised to consume a low antioxidant diet. Blood samples were collected and interleukin-6, interleukin-8, high sensitivity CRP, and TNF-α levels in plasma were measured by ELISA. The difference between the levels of different cytokines after each treatment was analyzed by Friedman test, and the change during the initial washout period was analyzed by Wilcoxon test.

Outcomes – Seventeen subjects completed the study. There was no significant difference between the levels of each cytokine after each treatment, and the levels of the cytokines were not statistically different following the initial washout period. There was a trend toward decreased CRP after tomato juice and lycopene capsules, but because of small sample size and high variability of the data, these changes were not statistically significant.

Conclusion – Treatment of asthmatic subjects with lycopene supplements has not led to changes in systemic inflammation.

P14
Does HERO always HELP? Differences in nutrient intake among obese subjects with and without type 2 diabetes mellitus prior to dietary intervention
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Background – Dietary intervention for obese populations is vital in light of the growing incidence of obesity within Australia. The Healthy Eating Lifestyle Program (HELP) and Healthy Eating for the Reduction of Obesity (HERO) are randomized controlled dietary intervention studies that target this condition. Both studies aim to assist overweight volunteers with weight loss through structured dietary prescriptions.

Objective – This study aimed to identify differences in nutrient intakes and food patterns between obese subjects with and without type 2 diabetes mellitus (T2DM).

Design – HELP study included adult healthy obese subjects while HERO study included adult obese subjects with T2DM. Participants were recruited through the local media and internet mailing lists. Dietary macronutrient intakes were assessed at baseline using diet history interviews and analysed using FoodWorks Professional (version 4.00.1178). Gram amounts of macronutrient intake were obtained and compared using independent sample t-test. Reported foods were grouped for each study based on the Australian Guide to Healthy Eating food groups and fatty acid content.

Outcomes – Thirty-eight (15 males, 23 females) healthy obese subjects without T2DM and 50 (22 males, 28 females) obese subjects with T2DM were recruited. Weight (89.6 ± 13.2; 92.8 ± 15.4) and BMI (31.8 ± 3.5; 33.2 ± 4.2) of subjects, were not significantly different between studies. Reported intakes were significantly lower among obese volunteers with T2DM for energy (P<0.001), total fat (P=0.011), saturated fat (P<0.001), protein (P=0.018) and carbohydrate (P<0.001). Meat-based dishes, dairy foods and ‘extra’ foods were the major food groups contributing to saturated fat in both groups. No differences were found in reported intakes of monounsaturated fat, polyunsaturated fat and fibre between obese subjects with or without T2DM.

Conclusion – Presence of a disease state in obese subjects appear to have a significant impact on dietary intake and subjects appear to follow a lower-energy and lower-fat dietary pattern when they are diagnosed with T2DM.

Funding Source – HELP Study: National Health and Medical Research Council, HERO Study: California Walnut Commission.
P16

A survey of New Zealand women’s beliefs about osteoporosis
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Background – Osteoporosis is a disease which places considerable burden on the health budget, and brings pain, disability and possibly death to those in whom it develops. As it is essentially incurable, a preventative public health approach is required. Perceptions of personal susceptibility, belief in the seriousness of the disease and in the efficacy of recommended risk reducing behaviours have been shown to be critical in bringing about behavioural change.

Objective – To investigate the attitudes and knowledge of New Zealand women towards osteoporosis risk factors and risk reduction.

Design – A descriptive, web-based survey was completed by 622 Auckland women between the ages of 20 and 49 years. Two validated questionnaires measured levels of knowledge about osteoporosis and preventative behaviours, and perceptions of personal susceptibility and seriousness of the disease. Subjects were recruited by email and the sample was opportunistic.

Outcomes – The subjects reported higher than average educational attainment, and were well motivated to take care of their health. However, over 60% of the women denied feeling any susceptibility to osteoporosis, and 78% did not believe the disease to be crippling. Although most women (90%) agreed that a diet low in calcium increased the risk, 77% thought that calcium-rich foods contained too much cholesterol and 87% did not feel good about eating calcium-containing foods.

Conclusion – The findings of this study suggest that public health strategies aimed at increasing osteoporosis-preventing behaviours in pre-menopausal women should address attitudes about personal susceptibility and the seriousness of the disease. Further research into the opinions of women about the cholesterol content of calcium-rich foods would be valuable.
P17  Pro-arrhythmic actions of dietary saturated fat are independent from changes in myocardial membrane fatty acids
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Background – Whilst in most cases changes in diet and lifestyle can account for the sharp increase in morbidity and mortality from cardiovascular disease (CVD) in many Asian countries, the relatively high incidence of CVD in Sri Lanka cannot be fully explained by traditional plasma lipid markers or by an excessive total fat intake. Nevertheless, an excessive intake of saturated fat derived primarily from coconut (oil/milk/flesh), and a low consumption of polyunsaturated fatty acids (PUFA) coupled with a background diet rich in highly digestible carbohydrates may promote vascular endothelial dysfunction leading to the development of CVD.

Objective – To evaluate the effect of dietary saturated fats on the vulnerability to cardiac arrhythmia in the rat.

Design – Twelve weeks old rats were fed ad libitum the standard AIN-97 diets containing different dietary fats. The control diet contained 5% (w/w) fat from canola oil and the test diets were made by replacing canola oil with either lard, or a mixture of coconut oil (CO; 4.5% w/w) and sunflower oil (0.5%w/w). After a 3 month pre-feeding period, myocardial ischaemia was induced by temporary occlusion of the left anterior descending coronary artery. Parameters of cardiac arrhythmia including % incidence and duration of ventricular tachycardia (VT), ventricular fibrillation (VF) and arrhythmia score (AS) were calculated.

Outcomes – Compared to the control group, CO and lard diets resulted in significant increase in the duration (sec) of VT (1.9±0.8 control; 38.8±13.4 lard; 31.0±10.1 CO, P<0.01). VF was absent in the control group, compared to 58% (lard) and 91% in the CO group. The duration of VF and the % mortality from VF was also higher in the CO fed rats. The PUFA profile of myocardial phospholipids was unchanged by the dietary manipulation.

Conclusions – CO appears to have direct pro-arrhythmic actions in the rat model of cardiac arrhythmia and sudden cardiac death. Some of these actions may be elicited at the vascular endothelium level. Therefore, strategies directed at promoting vascular integrity and function may afford protection in such situations.


P18  A systematic literature review of food security in the Aboriginal and Torres Strait Islander populations in Australia
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Background – Ready access to a safe and affordable food was identified as an important element for food security at the 1996 World Food Summit in Rome (1). In 1994, 30% of Indigenous adults worried at least occasionally about going without food (2). The health status of Indigenous people remains the worst of any subgroup within the population, with little evidence of significant improvement over the past two decades (3). The causes of health disadvantage are complex, however, improved diet, access to food and health care play a role in improving health3.

Objectives – Examine the literature for evidence of food security in the Indigenous population and examine the amount and type of materials published over the last 20 years.

Design - Biomedical databases were interrogated to determine the amount and type of materials published over the last two decades. Other resources, including departmental reports, were also examined.

Outcomes – Of the materials collected, 84% were published in the second decade. Most of those published in the first decade were descriptive and focused on Indigenous health, nutrition, diet and factors affecting food access. During the second decade, the focus was more on the development of policy and intervention programs. Most related to the Northern Territory.

Conclusion – Lack of food security in many communities is a major concern contributing to poor health status in Indigenous communities. Over the last decade this issue has received more attention in the literature. Policies have been developed to address food insecurity in some jurisdictions; however few report implementation of these policies. Little work, if any, was reported levels of food insecurity in the urban environment nor interventions undertaken to address it.

References
**P19**  
Effects of daily ingestion of chilli on serum oxidation in adult men and women  
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**Background** – Laboratory studies have shown that the resistance of isolated low density lipoprotein (LDL) cholesterol or linoleic acid to oxidation is increased in incubations with chilli extracts or capsaicin - the active ingredient of chilli. It is unknown if these in vitro antioxidative effects also occur in serum of people eating chilli regularly.  

**Objective** – To investigate the effect of daily ingestion of chilli on serum oxidation in adult men and women  

**Design** – This study investigated the effects of regular consumption of chilli on in vitro serum lipoprotein oxidation and total antioxidant status, in healthy adult men and women. In a randomized cross over study, twenty seven participants (13 men and 14 women) ate 30g/day of ‘Freshly chopped chilli’ blend (55% cayenne chilli) and no chilli (bland) diets, for four weeks each. Use of other spices such as cinnamon, ginger, garlic, mustard was restricted to minimum amounts. At the end of each dietary period serum samples were analysed for lipids, lipoproteins, total antioxidant status (TAS) and copper-induced lipoprotein oxidation. Lag time (before initiation of oxidation), and rate of oxidation (slope of propagation phase) were calculated.  

**Outcomes** – There was no difference in the serum lipids, lipoproteins and TAS at the end of the two dietary periods. In the whole group, the rate of oxidation was significantly lower (mean difference MD -0.23 $A*10^{-3}$/min; $p = 0.04$) after the chilli diet, compared to the bland diet. In women, lag time was higher (MD 9.61min; $p < 0.001$) after the chilli diet, compared to the bland diet.  

**Conclusions** – Regular consumption of chilli for four weeks increases the resistance of serum lipoproteins to oxidation.

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**P20**  
Change in mean Glycemic Index of Australian diets over a 10 year period  
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**Background** – In Australia, the concept of the Glycemic Index (GI) was introduced to the general public through dietitians, other health professionals and the popular press in the mid 1990s, with the recommendation to consume more low-GI foods.  

**Objective** – To determine whether general advice to consume more low GI foods has impacted the mean dietary GI of a representative sample of older Australians over the last 10 years.  

**Design** – Prospective cohort study of 3,654 people aged 49 years or older in the Blue Mountains region of NSW. A total of 2,868 people completed a 145-item semi-quantitative food frequency questionnaire satisfactorily in 1992-94 (BMES 1), and were followed up in 1997-1999 (BMES 2), and 2002-4 (BMES 3). This data analysis includes those people who satisfactorily completed the FFQ on all three occasions (n=1166). Nutrient intake data were analysed in a custom-built database using the NUTTAB (1-2) databases and Australian GI values (3). One-way analysis of variance was used to determine differences between mean dietary GI.  

**Outcomes** – Mean dietary GI was 56.5±4.2 in BMES 1, 56.4±4.3 in BMES 2 and 56.2±4.3 in BMES 3 ($P=0.037$). Post-hoc comparisons using the Tukey HSD test indicated that mean dietary GI for BMES 3 was significantly lower than BMES 1, but BMES 2 did not differ significantly from either BMES 1 or 3.  

**Conclusion** – Mean dietary GI values of older Australians have dropped by a small but significant amount since the mid 1990’s. Recommendations to consume more low-GI foods may be having a positive effect on older Australians’ diets.  

**References**  
P21  Evaluation of an interactive, personalised, Internet-based weight loss program
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Background – One of the most effective intervention methods to assist with lifestyle modifications for weight management involves individual counselling with face to face contact, however, this method is time intensive and costly for patients. Recently, internet based interventions and education programs have been developed. The internet can access a large number of consumers in a more cost effective manner than other information delivery channels.

Objectives – To determine whether an online, personalised weight reduction program including dietary advice plus exercise is more effective in reducing weight than an exercise only program over 12 weeks.

Design – Participants were randomized to either an exercise only group (EX) or a diet plus exercise group (ED). Body Mass Index (BMI) and 24 hour dietary records were collected at baseline and week 12. Participants attended a baseline and final intervention visit where anthropometric measurements were performed. Subjects wore a pedometer, recorded daily steps and set weekly goals to increase daily steps through the internet program. The ED group also received healthy eating advice, set dietary goals via the internet and received personalised email assistance.

Outcomes – Seventy three participants commenced and 53 completed (EX n = 26; ED n = 27; BMI (mean (SD)), 29.7 (2.5) kg/m²; age 46.3 (10.8); 21% male). The percent weight changes were: EX, 2.1 (0.6) %; ED, 0.9 (0.6) % (P = 0.15), and change in total energy intake was EX, +110 (666.6) kJ ED, -1812.6 (803.4) kJ, P = 0.07 between groups, with no difference in daily step change (ED 3525 (896.7), EX 3148 (848.2) steps, P = 0.76).

Conclusions – An internet-based program with goal setting resulted in a mean weight loss of 1-2%. The combined exercise and dietary modifications did not result in a greater weight loss when compared to exercise alone. Dietary education did not enhance weight loss over 12 weeks and there was an indication of a greater weight loss in the exercise only group, even though the ED group reported a similar increase in physical activity and a greater fall in energy intake. It may be that those randomised to the exercise group made additional lifestyle changes that we were unable to detect.

P22  General Practitioner initiated lifestyle advice for overweight and hypertension
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Background – In recent years, there has been a focus on using the general practice setting for health promotion including improving dietary and exercise practices among patients.

Objectives – To determine the extent to which Australian-based GPs advise overweight and obese patients to make lifestyle changes for weight loss and advise hypertensive patients to reduce intake of salt and/or salty foods.

Design – A face to face survey was conducted on a representative sample of South Australian residents. Respondents provided information on height and weight (self-report), whether they had received lifestyle advice from their GP for weight loss, whether their GP had recorded their weight in the past 12 months, if they had ever been told that they had high blood pressure, their current use of anti-hypertensive medication and if they have ever received advice to reduce their intake of salt and/or salty foods.

Outcomes – The sample included 2947 people aged 18 years or older (47% female; BMI (mean (SD)), 26.6 (5.3) kg/m²; age, 50.7 (18.0) years). Ninety-six percent of respondents had visited their GP in the past 12 months. Forty-one percent of males and 25% of females were overweight and 19% of males and 20% of females were obese. Forty-five percent of overweight or obese respondents were weighed and 27% received lifestyle advice for weight loss purposes from their GP (5.5% received only dietary advice, 6.5% received only exercise advice and 15% received both dietary and exercise advice). Thirty-three per cent of all respondents had been told in the past by their doctor that they had high blood pressure. Of these, 66.7% were taking medication for blood pressure control and 33.7% had been advised to reduce salt intake.

Conclusion – Although almost 1/2 of overweight and obese patients had been weighed, less than 1/3 of these had received lifestyle advice that could assist with weight loss. Additionally just over 1/3 of those who had been told they have high blood pressure by a doctor received advice to reduce salt intake. There are potentially missed opportunities in which GPs could provide re-enforcement of benefits of lifestyle changes with respect to weight and blood pressure control. Strategies should be investigated to encourage GPs to assess risk of overweight, obesity and that would support GPs in providing simple advice to assist patients in making positive lifestyle changes that could at least assist in the prevention of weight gain and reduce blood pressure.
P23  
Weight loss improves heart rate recovery in overweight and obese men with features of metabolic syndrome

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Background – Heart rate recovery (HRR) is an independent risk factor for cardiovascular disease and mortality and is inversely associated with insulin resistance and co-related metabolic risk markers.

Objective – The objective of this study was to determine the effects of weight loss on HRR and it’s association with traditional cardiovascular risk markers in overweight and obese men with components of the metabolic syndrome.

Design – HRR (defined as the decrease in HR from peak HR to that measured 1 minute after a standardised graded treadmill test) and a range of well-established cardiovascular risk factors, were measured in 42 overweight and obese men (BMI: 33.8±0.6 kg·m²; age: 46.5±1.3 yrs) who had no symptoms of cardiovascular disease, but had components of the metabolic syndrome, before and after 12-weeks of weight loss.

Outcomes – The dietary intervention resulted in a 9% weight reduction (P<0.001). There were significant reductions in waist circumference, blood pressure, plasma triglycerides, total, LDL and HDL cholesterol, triglyceride:HDL ratio, CRP, plasma insulin, glucose and HOMA (P<0.05). Although peak heart rate remained unchanged, HRR at 1 minute improved from 33.4±1.4 to 37.0±1.2 bpm (P<0.001) after weight loss. There were no changes in either cardiorespiratory fitness (P=0.30) nor physical activity levels (P=0.67). The improvement in HRR was significantly correlated with decreases in body weight, BMI, waist circumference, plasma glucose, serum triglycerides and triglyceride:HDL ratio, but was only independently associated with changes in weight and plasma glucose concentrations.

Conclusion – In addition to improving a range of well-accepted cardiovascular and metabolic risk factors, weight loss also improves HRR after exercise, a less well-recognised risk factor.

Acknowledgment – This work was funded by a Medical Research grant from Meat and Livestock Australia. None of the authors had any conflict of interest.

P24  
A survey of foods marketed to children in Australia

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Background – There is a growing concern over the increasing prevalence of obesity, diabetes and dental erosion amongst Australian children. Association of the effect of marketing such as television advertising of low nutrient, high energy dense foods with childhood obesity is becoming an issue of concern for public health (1).

Objectives – The purpose of this study was to determine the nutrient content, particularly fat and sugar content, of food products marketed to children in Australia.

Design – Packaged food products (408) were purchased from supermarkets in different Brisbane regions on random days in April, June and July in 2005. A further 23 products were purchased from fast food outlets. Food products were chosen based on the marketing techniques directed at children. The food products were categorized into 17 food types. A Microsoft Access database was created to consolidate information on nutrients, labels and marketing techniques of the products evaluated. The RED category criteria tables from the Smart Choices food and drink selector (2) and the Nutrition Australia Selection Guidelines (3) were used as the benchmarks for mean energy, total fat, saturated fat, sugar and sodium levels. Statistical analyses were performed using MINITAB 14.

Outcomes – Important marketing strategies included ease-of-use packaging that is well-designed for children (88.9%), use of popular personality (63.3%) and television advertising (37.4%). Mean total fat, saturated fat and/or mean sugar content of most food types were found to be significantly higher (P<0.05) than the comparable benchmark values. The majority of the 431 food products were classified into the RED category of the Smart Choices food and drink selector ie foods that are high in energy, saturated fat, and/or added sugar and/or sodium.

Conclusion – Manufacturers use a variety of techniques to market food products to children. Most of the food products especially marketed to children used in this study are not the most appropriate and healthiest food choices.

References
P25  

The effect of honey versus sucrose, mixed sugars and a sugar-free diet on weight gain in young rats

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**Background** – Obesity is a major concern for westernised populations and one of the leading contributors is the prevalence of foods that are high in fats and sugars. Honey is a ready source of sugar that offers nutritional benefits over the use of sucrose.

**Objectives** – To assess whether replacing sucrose in a standard western diet with honey would have any impact on weight, food intake or blood sugar and cholesterol levels.

**Design** – Forty rats, aged 6 weeks were fed one of four experimental diets that contained either no sugar, 8% w/w sucrose, 8% w/w mixed sugars as in honey or 10% w/w high peroxide/high antioxidant rewarewa honey (honey is 20% w/w water). The diets were fed *ad libitum* for 6 weeks. The carbohydrate/fat/protein ratio of each diet was formulated to be equivalent to a typical New Zealand diet based upon data from the 1997 NZ National Nutrition Survey. During the experiment, the rats were housed in standard rat cages (2 animals per cage) that had a raised mesh floor. Animals’ weights and food intakes were assessed weekly. On day 42, all rats were anaesthetised using CO₂ gas. Blood samples were taken via cardiac puncture, and analysed for glycated haemoglobin (HbA1c) and fasting lipid profiles. After euthanisation, each rat was minced using a Sunmile SM-G50 mincer (Vantage) and total body fat and protein levels determined using soxtec fat extraction and LECO total combustion method, respectively.

**Outcomes** – Overall percent weight gain in honey-fed rats was significantly reduced by 16.7% compared with sucrose-fed rats (*p* < 0.01), and similar to that observed in rats fed a sugar-free diet after 6 weeks. Total food and calorie intake was significantly higher in all sugar treatments compared with the sugar-free treatment group (*p*<0.01); however, no statistically significant differences in total food intake were observed between the three sugar treatments. No differences in HbA1c, total-, LDL- and HDL-cholesterol or triglyceride levels were observed between the three sugar treatments. Body fat measurements were inconclusive due to large data variability, but no significant differences in total body protein levels were observed.

**Conclusion** – The replacement of sucrose with honey in the diet can lead to lower weight gains in young animals despite a similar food intake. Mixed sugars (as in honey) did not show decreased weight gains suggesting the effect with honey may be due to other components of the honey.

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P26  

Adhesion and competitive exclusion - basis for development of new probiotics

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**Background** – Adhesion and colonization of the mucosal surfaces by probiotics are possible protective mechanisms against pathogens through competition for binding sites and nutrients (1) or immune modulation (2).

**Objectives** – The objective was to test the abilities to inhibit, to displace and to compete with pathogens in order to screen the most effective adhesive probiotic combination, and to develop methods for new probiotic characterization.

**Design** – A human intestinal mucus model was used to assess probiotics strains and their combinations. The strains were selected on the basis of their use as a commercial probiotic strains and they have each demonstrated to have beneficial *in vivo* health effects.

**Outcomes** – Probiotic strains showed different abilities against pathogen adhesion. These properties were strain- and combination-specific indicating the need of a case-by-case characterization. All combination were able to reduce (*p*<0.05) the pathogen adhesion and in some cases over 40-50% of inhibition was demonstrated, but not all strains alone were able to inhibit pathogen adhesion. Thus, the selection of probiotic strains or combination to inhibit or displace a specific pathogen could be the basis for both product development and future clinical intervention studies on prevention or treatment of dysfunctions.

**Conclusion** – Our results suggest that different probiotic combinations can be formulated to enhance the inhibition and the displacement percentages to pathogen adhesion to intestinal mucus. New combinations could be useful in inhibition and displacement of pathogen adhesion than a single strain. Further studies are needed to characterize each combination and to understand their role in inhibition mechanisms.

**References**

P27
Associations between diet quality, quality of life and Medicare costs in mid-aged women from the Australian Longitudinal Study on Women’s Health
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Background – Epidemiological studies suggest that adhering more closely to National Dietary Guidelines is associated with improved diet-related health outcomes, with a reduction in morbidity and mortality. A number of methods have been used to generate dietary scores to measure diet quality and variety.

Objectives – To evaluate whether an association exists between diet quality and indices of quality of life, health service use and Medicare costs in the Australian Longitudinal Study of Women’s Health (ALSWH).

Design – Cross-sectional measurement of association between an Australian Recommended Food Score (ARFS), self-reported variables and Medicare costs in women (n = 11,194, 50-55 yr) participating in the 2001 survey of the mid-aged cohort of ALSWH. ARFS was derived from responses to the Dietary Questionnaire for Epidemiological Studies FFQ and increases as the number of foods consistent with Australian Dietary Guidelines consumed at least once a week, increases. ARFS was divided into quintiles with higher scores having more favourable macro and micronutrient profiles. Data linkage allowed examination of associations with Medicare costs.

Outcomes – More women in the lowest quintile of the Australian Recommended Food Score reported their general health as fair or poor compared to those in the highest quintile (18 vs 10%, P<0.0001). The mean SF36 general health perception domain score was higher for those in the top ARFS quintile compared to the bottom (mean (95%CI); 75.3 (74.3, 76.2) vs 67.1 (66.2, 68.0) P<0.0001). Fewer women in the highest ARFS quintile reported four or more GP consultations in the previous year compared to the lowest (13% vs 17%, P=0.0024) but there was no difference in Medicare costs across the quintiles, P>0.05.

Conclusion – Higher ARFS is associated with improved self-reported indices of quality of life, but not reduced Medicare costs. Longitudinal evaluation will determine whether a higher ARFS is protective in terms of predicting health outcomes or reducing long-term health costs.

P28
Delayed gastric emptying may contribute to prolonged postprandial hyperglycaemia in meal-fed cats
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Background – Following ingestion of a meal, postprandial hyperglycaemia in cats persists for 20-24 hrs, and the reasons for this are unknown.

Objectives – To describe the patterns of postprandial plasma glucose, D-lactate, and L-lactate concentrations, and gastric emptying time in meal-fed cats, and to assess the effects of meal volume on gastric emptying time.

Design – Eleven healthy cats were fed a commercially available, high carbohydrate (54% metabolisable energy) diet for 2 weeks. In the third week, on two separate occasions, fasted cats were fed a meal of 50 kcal/kg and consumed at least 90% within 30 mins. On the first occasion, the cats underwent repeated ultrasound examinations over 26 hrs to determine gastric emptying time. On the second occasion, plasma glucose, D-lactate and L-lactate concentrations were measured over 24 hrs. To assess the effect of volume of food eaten on gastric emptying time, 2 weeks later, five of the same cats were fed a meal of the same composition but half the volume (25 kcal/kg) and a second series of ultrasound examinations was performed.

Outcomes – Glucose concentrations were significantly higher than baseline from 1 to 18 hrs after feeding (P<0.001), reaching a peak at 10.7 ± 5.3 hrs (mean ± SD) after the meal. Median time to gastric emptying when cats were fed their total daily energy intake in a single meal was 24 hrs (range 16-26 hrs). In contrast, times to gastric emptying were substantially shorter when cats were fed 50% of their daily intake in a single meal (median 14 hrs; range 12-14 hrs). D- and L-lactate concentrations did not change substantially after feeding.

Conclusion – These results suggest that prolonged gastric emptying time contributes to the prolonged postprandial hyperglycaemia observed in meal-fed cats. They also show that gastric emptying is faster if the meal size is reduced.
P29

Switching to an ultra-low carbohydrate diet has a similar effect on postprandial blood glucose concentrations to administering acarbose to healthy cats fed a high carbohydrate diet

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Background – The alpha-glucosidase inhibitor, acarbose, can improve glycaemic control in diabetic dogs and cats when combined with insulin therapy. However it is unknown whether the benefits of adding acarbose to a high carbohydrate diet can also be achieved by simply feeding an ultra-low carbohydrate diet.

Objective – To assess the effect of acarbose in decreasing postprandial glucose concentrations when administered to healthy cats fed diets with high or ultra-low carbohydrate content, fed as one meal or multiple meals each day.

Design – Twelve cats were used in a four-period cross-over study. Following consumption of a maintenance cat food for 2 weeks and baseline testing, three cats were then randomly allocated to each of four diet-treatment sequences: Ultra-low [6.6% metabolisable energy (ME)] or high (57.9% ME) in carbohydrate, each with and without added acarbose. Within each diet, postprandial glucose concentrations were assessed when diets were fed as a meal, and when the diet was fed as multiple meals. The acarbose dose was 25 mg/cat once daily for meal-fed cats, and 12.5 mg/cat twice daily for cats fed multiple meals. All diets were fed for 2 weeks prior to testing in the third week.

Outcomes – Amongst cats fed the high carbohydrate diet, the 12-hour mean AUCglucose and mean glucose concentration was significantly lower when acarbose was administered (P<0.001). In meal-fed cats receiving the high carbohydrate diet and acarbose once daily, acarbose action was only significant in the first 12 hrs.

Conclusion – We conclude that acarbose significantly decreased postprandial hyperglycaemia in cats fed a high carbohydrate diet. High carbohydrate diets resulted in significantly higher (24-hours) postprandial glucose concentrations than ultra-low carbohydrate diets.

P30

Folate intake in Vitilevu, Fiji

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Background – Most plant foods, especially green vegetables, wholegrain breads and cereals and peas and dried beans contain folates. There is a critical need to estimate dietary folate intakes for nutrition monitoring and food safety evaluations in the South Pacific.

Objectives – One objective of this survey was to ascertain the knowledge of the people of the Central and Eastern parts of Viti Levu in the Fiji Islands about the importance of folates in their diet. Another objective was to collect information on the types of food consumed by the population in order to select folate containing foods and to analyse their folate content. A third objective was to assess whether the people surveyed were getting sufficient folates in their daily diet.

Design – A short qualitative food frequency questionnaire (FFQ) to assess folate intake was developed. A random sample of 200 males and females was interviewed in the year 2005. The average age for the study sample was 35 years old. 50% were from rural areas and 50% from urban.

Outcomes – The FFQ showed that most of the foods high in folic acid/ folate were being consumed only once a week in both the male and female population. In the research study of folate levels in Fiji leafy vegetables, Chinese cabbage (Brassica chinensis) and Bele (Abelmoschus manihot) were found to have high levels of folates (1). However, it was noted that of the female population surveyed, none consumed these vegetables on a daily basis.

Conclusion – There is a need to explore ways to improve folate intakes in the overall population in Fiji Islands and the South Pacific to prevent folate deficiency diseases, especially neural tube defect in females of child bearing age.

Reference

P31

Chewing and Caco-2 cells as part of an in-vitro human digestive model
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Background – In-vitro models of the human digestive system are useful for identifying factors that may influence the molecular behaviour of nutritional ingredients during digestion and passage into the circulatory system. It is important that models faithfully represent important digestive processes with the minimum of operational complexity. Current models (a) usually use mechanical size reduction to mimic chewing and (b) sometimes use a Caco-2 epithelial cell monolayer to estimate uptake into cells, but not to evaluate metabolism across the cell layer.

Objectives – To investigate (a) whether chewing can be substituted by mechanical size reduction and (b) whether passage across Caco-2 cells can be used to assess the potential for metabolism of food components during uptake.

Design – (a) Using fresh and processed fruit as example foods, the size profile and microstructure of chewed (ready to be swallowed) pieces was examined. Subsequent release of fruit sugars during simulated gastric and intestinal processing was monitored. (b) The passage of beta-carotene and catechin across a Caco-2 epithelial cell monolayer was studied.

Outcomes – (a) Physiologically, chewing cannot be simulated with simple size reduction methods because of the heterogeneity of chewed particle sizes (75 µm – 7 cm) and shapes, and the effects of oral processing on bolus characteristics. The large size (> 0.5 cm) of chewed fresh or dried fruit results in incomplete release of sugars after simulated gastric and small intestinal digestion (up to 47% lower compared with juice). (b) After 2 h assay, beta-carotene is metabolized by the Caco-2 cell monolayer more extensively (in total, approximately 8.03% conversions to retinol) than catechin (about 1.43E-5% conversion to catechin metabolites).

Conclusion – (a) Chewed particle characteristics are a likely determinant of subsequent nutrient release from solid foods and should not be overlooked in the development of in-vitro digestion models. (b) the Caco-2 cell monolayer can be used to monitor metabolic transformation of nutrients that may be relevant to first pass metabolism in-vivo.

P32

Daily dietary selenium intake of a randomly selected population of Victorian women: Age group differences and food sources
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Background – Selenium deficiency may be associated with increased risk of viral virulence, cancer, negative mood states and immunological dysfunction, and Se intakes above the minimum requirements appear to have a positive effect on the later three. There is relatively little detailed information on selenium intake in Australian adults.

Objective – This study aimed to estimate selenium intake of a randomly selected population of Victorian women enrolled in the Geelong Osteoporosis Study; to ascertain the main food groups contributing to daily selenium intake and to investigate the effect of the age group differences in food choices on Se intake and Se sufficiency.

Design – A detailed-history semi-quantitative food frequency questionnaire (FFQ) was administered to randomly selected women (n=556), aged 20–88 y, from the Barwon Statistical Division, representative of Australia in several demographic factors. Se values for Australian foods were used where available (Australian NZ Food Authority).

Outcomes and conclusion – The FFQ captured responses on 359 foods. Se intake (mean±SD) was 77±29 µg/day; median 73 µg/day – which is higher than NZ and most European countries, but lower than US and Canadian mean Se intakes. Mean intake was 1.1±0.4 µg/kg body weight (range (0.2 – 3 µg/kg). 43% of women consumed less Se compared to the Australian NHMRC recommended intake (70 µg/day) for women. Wheat products, fish, vegetables, beef, fruit (Australian canned fruit has relatively high Se), dairy and poultry provided 20%, 10%, 10%, 10%, 9%, 9% and 7% respectively of the total Se intake. Significant age group differences were also found. Women 40-49y were those mostly at risk of Se insufficiency and older women consumed more Se from fruits, lamb, peas and beans. Younger women consumed more Se from mixed dishes (includes many “take away” food), chocolate foods and non-wheat grains.
P33

Folate composition of fresh Australian pork 2005/6
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Background – Australian fresh pork composition was last analysed in 1994; since then rearing and butchering practices have improved considerably with potential to affect composition of pork as available at the present time.

Objective – To assess the folate composition of nationally representative retail fresh pork cuts in 2005/6

Design – Fresh pork cuts were purchased anonymously in three capital cities in 2005/2006 according to a sampling design that generates representative independent duplicate samples per state. Pork loin chop was studied as independent state duplicates, and other cuts were analysed as national homogenates. Gross composition was measured at Food Science Australia and lean and fat homogenates, raw and cooked, were formed for freight as fresh chilled samples for folate measurement in triplicate by the tri-enzyme method (1), modified with a fourth lipase enzyme treatment.

Outcomes – Folate levels varied from 0–83 µg/100 g in raw lean, and from 0-37 µg/100 g in raw fat. The nationwide average folate levels for all cuts in µg/100 g (mean ± SD) were: raw lean, 39.8 ± 24.8, cooked lean, 28.6 ± 23.2, raw fat, 17.8 ± 12.3, cooked fat, 25.9 ± 21.5.

Conclusions – Australian raw fresh pork contains highly variable levels of folate. The average levels of folate in Australian pork were higher than expected, and were much higher than reported for British or American fresh pork.

Reference

Funding - Study funded by Australian Pork Limited.

P34

How women cope with pregnancy and early mothering after recovery from an eating disorder: a grounded theory of women’s experience
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Background – Maternal nutrition plays a major role in a healthy outcome for pregnancy. Increasing numbers of women have experienced an eating disorder and recovered. Does this influence weight gain and nutrition in pregnancy?

Objective – To explore how some women recover from an eating disorder (ED) and manage the experience of pregnancy and mothering specifically weight gain and the nutritional needs of themselves and their child.

Design – Two groups of women were studied, the ED group (10) and the reference group (8) women of comparable body mass who said they had never had an ED. This was a qualitative research study which used Grounded Theory as the research method.

Outcomes – Recovery involved adopting more constructive coping strategies (exercise) to “measure up”. Their pregnancies were characterised by predominantly high weight gains( 6/10 women gained 18-30 kgs i.e. more than the upper recommended limit for women with a low BMI however only 3 of those 6 women were in the low prepregnancy BMI range, 2/10 women gained in the normal weight range and 2/10 gained less than recommended), above normal infant birth weights (8/10 babies weighed >3300gms and none were in the low birth weight range and successful breastfeeding(all women breastfed for a minimum of 4 months and 7/10 breastfed for 6months or longer). None of the 10 women reported they received any personalised nutritional information from their health professional during their pregnancies.

Conclusions – ED recovered women are characterised by having a need to “measure up” throughout their lives. They are highly motivated to have healthy pregnancies and can be particularly receptive to nutritional guidance at this time.
P35

Blood loss a stronger predictor of iron status in UK men than C282Y heterozygosity or diet
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Background – Approximately 12% of people of Northern European descent are heterozygous for the C282Y mutation of the HFE gene (homozygosity for which mutation is associated with hereditary haemochromatosis). Improved phenotypic characterization is needed to assess health risks for the heterozygote genotype.

Objective – To determine the relative importance of HFE genotype, diet, lifestyle, and blood loss for predicting iron status in a sample of UK men aged 40 years or over.

Design – Iron status (serum ferritin (SF), transferrin saturation (TS), soluble transferrin receptor (sTfR)) was measured in 44 C282Y heterozygote and 85 age- and BMI-matched wildtype men. Dietary intake of iron (total, haem and non-haem), and components that influence iron bioavailability, was determined using a validated Meal-Based Intake Assessment Tool. Lifestyle and blood loss data were obtained by questionnaire, and height and weight measured. Linear mixed models were used to determine the predictors of iron status controlling for matching.

Outcomes – C282Y heterozygosity was associated with 18% higher TS (95% CI: 7%, 31%) but no difference in SF or sTfR concentrations. Blood donation was negatively associated with TS (-13% (-3%, -22%)) and SF (-58% (-44%, -68%)), and had a marginally significant positive association with sTfR concentration. Self-reported faecal blood loss was negatively associated with SF concentration (-35% (-54%, -7%)). Alcohol was the only dietary variable associated with iron status and was associated with all three of the iron status indices. Serum ferritin concentration was positively associated with BMI (10% increase per BMI unit increase (6%, 15%)).

Conclusions – Blood loss was a stronger predictor of iron status than either C282Y heterozygosity or diet in this population of UK men.

P36

Validity of segmental bioelectrical impedance analysis in estimating body composition
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Bioelectrical impedance analysis (BIA) measures the impedance and resistance associated with passage of an alternating current through the body. The aforementioned are proportional to total body water (TBW) and therefore can be used to provide expedient estimates of body composition. However, little validity information is available for popular commercially available bathroom scale type devices which perform segmental measurements (lower limbs). The aim of this study was therefore to compare body composition estimates between a commercially available easy to use segmental BIA device (Tanita BC-532, Tanita Corp, Tokyo, Japan) and criterion values in a group (n = 9) of healthy males (mean ± SD: 48.6 ± 18.8 yr; 173.8 ± 4.5 cm; 72.8 ± 8.9 kg). Criterion four compartment body composition determinations involved measures of body density, TBW and bone mineral mass. The results (mean ± SD) are summarised below:

<table>
<thead>
<tr>
<th>Measures</th>
<th>BIA</th>
<th>Four compartment</th>
<th>Four compartment - BIA</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Body fat</td>
<td>20.8 ± 5.5</td>
<td>21.0 ± 6.2</td>
<td>0.2 ± 2.5</td>
<td>0.785</td>
</tr>
<tr>
<td>Fat free mass (kg)</td>
<td>57.4 ± 4.9</td>
<td>57.0 ± 4.2</td>
<td>-0.4 ± 1.8</td>
<td>0.543</td>
</tr>
<tr>
<td>TBW (kg)</td>
<td>39.3 ± 3.5</td>
<td>41.1 ± 3.2</td>
<td>1.8 ± 1.2</td>
<td>0.002</td>
</tr>
</tbody>
</table>

While the mean %BF and fat free mass values for both methods were not significantly different, considerable intra-individual differences were observed. BIA values varied from the four compartment values by -3.0 to 4.4% BF and -3.3 to 1.9 kg fat free mass. The BIA estimates of TBW were significantly different from the criterion measures and intra-individual differences displayed a large range of -0.6 to 3.6 kg. Significant underestimations of TBW via BIA are concerning given that this is the parameter initially established by this method. Furthermore, the BIA data resulted in a FFM hydration value of 68.5% which was significantly (P<0.001) lower than the four compartment value of 72.0%. Presumably the BIA algorithms use an assumed FFM hydration value to determine body composition. In conclusion, the BIA device tested displayed poor individual accuracy for the estimation of body composition compared with a criterion method.
P37

**Dietary folate: Mandatory fortification and supplementation for the prevention of NTDs**

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**Background** – Since mandatory fortification of folic acid of flour has contributed to the reduction of neural tube defects (NTDs) in the U.S., Canada and Chile (1), mandatory folic acid fortification in bread-making flour has been proposed for Australia and New Zealand (2).

**Objectives** – To determine patterns of eating behaviour of women of childbearing age, and evaluate the appropriateness of bread-making flour as the selected food vehicle of folic acid fortification.

**Design** – A population sample of 197 women aged 19-45 years were recruited to complete a food frequency questionnaire (FFQ). Data on women’s dietary preferences and intakes were collected and analysed.

**Outcomes** – For all subgroups, average intakes of bread and cereal products did not meet recommendations set in the Dietary Guidelines for Australian Adults (3). Bread consumption averaged three to four slices per day. With fortification of bread, dietary folate intake would increase by 117-156 µg/day, achieving the proposed target. However, the survey revealed that one third of women did not eat sufficient bread to benefit from fortification.

**Conclusion** – Although potentially beneficial, folic acid fortification warrants an educational campaign, particularly for women with low bread consumption.

**References**

P38

**Evaluation of a self administered glycemic load questionnaire**

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**Background** – The majority of epidemiological studies examining associations between glycemic load (GL) and risk of chronic diseases have used validated food frequency questionnaires with carbohydrate correlation coefficients ranging from 0.4 to 0.8. Few have reported the degree of agreement between the questionnaire and reference intake.

**Objectives** – To test the validity of a GL questionnaire (GLQ) by comparison with a detailed diet history.

**Design** – 54 women aged 42 to 82 years were recruited from a cohort of 511 participants in the Longitudinal Assessment of Ageing in Women (LAW). Carbohydrate intake was assessed by a specially-designed GLQ; GL [carbohydrate (g) x glycemic index (%)] values were summed to provide the average daily GL. Data were validated against a diet history.

**Outcomes** – Mean ± SEM intakes from the diet history were 6% higher than those from the GLQ for carbohydrate (216 ± 6 versus 203 ± 8 g/day, P<0.05) and the GL (110 ± 4 versus 103 ± 4, P=0.1), respectively. There were significant correlations between methods for carbohydrate (r=0.54, P<0.01) and GL (r=0.57, P<0.01). 95% limits of agreement determined by Bland Altman plots ranged from -111 to 83.7 g for carbohydrate, with almost half the subjects recording a difference of ±40 g; and -60.0 to 46.6 for GL, with a third of subjects recording a difference of ±25 units or more.

**Conclusion** – Our GLQ had acceptable validity in terms of correlation with the dietary history. From a clinical perspective however, substantial error existed in estimation of individual carbohydrate and GL intakes. We suggest that studies using food frequency questionnaires to estimate GL state limits of agreement instead of or as well as correlations when discussing validity. Failure to accurately assess carbohydrate intake could explain some of the discrepancies in results of dietary studies investigating associations between GL and the development of chronic diseases in individuals.
P39

Antioxidant activities and total phenolic content of four blueberries cultivars grown in New Zealand

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Background – Blueberries are considered a healthy addition to the diet as a rich source of antioxidants. Although the nutritional content of blueberries is highly affected by environmental growing conditions, no research has been published on New Zealand-grown blueberry varieties.

Objective – To investigate antioxidant activities and total phenolic content of four NZ grown blueberry cultivars.

Design – Atlanta, Burlington, Jersey and Stanley blueberries were harvested from one commercial producer in Canterbury, New Zealand. Total phenolic content (TPC) was measured using Folin–Ciocalteu reagent and antioxidant activities using the superoxide anion (O₂⁻) scavenging activity (SASA) method and the DPPH method.

Outcomes – TPC of NZ blueberries ranged from 230.10 ± 18.00 to 497.10 ± 63.20 mg GAE.100g⁻¹. Burlington blueberries had significantly (P<0.001) higher TPC than other varieties. Antioxidant activity (SASA) was significantly (P<0.05) different between cultivars. Burlington showed highest activity (1369 ± 141GAE mg/100 g).

There was a significant correlation between TPC and SASA (r = 0.58, P<0.05). Antioxidant activity by DPPH showed no differences between cultivars (P >0.05).

Conclusion – TPC of NZ blueberries is similar to blueberries grown in America. This study suggests Burlington may offer a slight advantage in antioxidant content over Atlanta, Jersey and Stanley cultivars.

P40

Total phenolics content and antioxidant activities from commercial coffee drinks

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Background – Coffee is a very popular beverage and it contains several bioactive compounds. Antioxidant activities have been reported in coffee, however, little is known on the level of phenolics and the antioxidant capacity in commercial coffee drinks.

Objective – To determine the phenolics content of six commercial coffee drinks (espresso, long black, filtered, flat white, latte and cappuccino) from 4 different coffee retailers, and to investigate their antioxidant activities.

Design – Six commercial coffee drinks were purchased from 4 different retailers on 3 different days. Total phenolics concentration (TPC) was determined using the Folin–Ciocalteu method. Antioxidant activities of the coffees were estimated using the DPPH and the superoxide anion (O₂⁻) scavenging activity (SASA) methods.

Outcomes – Black coffee (espresso, long black, and filtered) was higher (P < 0.001) in TPC /g freeze-dried extract compared with white coffee (flat white, latte and cappuccino). Based on the serve of coffee, TPC (GAE/ cup) from different retailers was not different (P > 0.05), whereas white coffee had higher (P < 0.001) TPC GAE/ cup compared with black coffee. The overall %SASA per serve is higher (P < 0.001) in white coffee than in black coffee. A similar trend was seen using DPPH assay. Significant correlations were found between TPC; SASA and DPPH.

Conclusions – The data show that coffee is a good source for antioxidants, but variation between retailers and within retailers can affect the daily intake of phenolics from coffee.
P41
The effects of voluntary exercise on hepatic gene expression during tumourigenesis
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Background – Many studies have documented that exercise and nutrition both have regulatory effects upon carcinogenesis. Indeed the progression of lesions and cancers can be reduced or eliminated. Both soy and whey proteins have been shown to have additional health benefits beyond their basic nutritional value, including anti-carcinogenic properties against colorectal, breast and prostate cancers. At present, limited knowledge exists of the mechanisms by which exercise and/or in combination with nutrition exhibit these anti-carcinogenic properties and whether anti-tumour properties extend to other tissues.

Objective – To determine the effects of moderate voluntary exercise on the incidence and progression of N-nitrosodiethylamine (NDEA)-induced, pre-neoplastic lesions and gene expression in the liver.

Design – Pre-neoplastic lesions were induced in the livers of Wistar rats by NDEA injections (25mg/kg body weight, 2 times week for 3 weeks). Rats (9 per treatment) were then allowed voluntary access to exercise for up to 12 weeks. Following euthanasia, liver samples were obtained and the total area occupied by preneoplastic lesions was determined by immunohistochemical staining for GST-yp. DNA microarray analysis was undertaken to investigate the effect of exercise upon gene expression.

Outcomes – This study found that pre-neoplastic lesions failed to progress after 9 and 12 weeks of exercise (P<0.01). Exercising also resulted in altered gene expression profiles which were consistent with enhancement of the immune system. Exercise also counteracted many of the effects upon gene expression due to the presence of lesions.

Conclusions – Moderate exercise has prevented the progression of NDEA-induced preneoplastic lesions in liver compared to sedentary controls possibly via a mechanism involving modulation of gene expression. The interactive effects of exercise with dietary change is being further investigated.

P42
The in vivo antioxidant action and the reduction of oxidative stress by Boysenberry extract is dependent on base diet constituents in rats
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Background & Objectives – Dietary antioxidants are often defined by in vitro measures of antioxidant capacity. Such measures are valid indicators of the antioxidant potential, but provide little evidence of efficacy as a dietary antioxidant. This study was undertaken to assess the in vivo antioxidant efficacy of a berry fruit extract.

Design – Rats were fed basal diets containing fish and soybean oil likely to generate different levels of oxidative stress. After two weeks oxidative stress was assessed by measuring biomarkers of oxidative damage to protein (carbonyls), lipids (malondialdehyde, MDA), and DNA (8-oxo-2’deoxyguanosine urinary excretion) and plasma antioxidant status (antioxidant capacity ORAC, vitamin E). Boysenberry (Rubus loganbaccus x baileyanus Britt) extract was used as the dietary antioxidant.

Outcomes – The basal diets (chow (CD), synthetic/soybean oil (SD), or synthetic/fish oil (FD)) had significant effects on the biomarkers of oxidative damage and antioxidant status with rats fed FD having the lowest levels of oxidative damage and the highest antioxidant status. For example, plasma MDA was 45 ng/mL for the FD fed rats and significantly higher with 182 ng/mL for the SO fed rats. Furthermore the plasma antioxidant capacity was 9.2 mmol TE/L for the FD fed rats and significantly lower at 7.3 mmol TE/L for the SD fed rats. When Boysenberry extract was added to the diet, there was little change in 8-oxo-2’deoxyguanosine excretion in urine, oxidative damage to proteins decreased, and plasma malondialdehyde either increased or decreased depending on the basal diet. For example, the mean protein carbonyl concentration for the CD fed rats was 0.21 nmol/mg protein for the control rats and was significantly lower at 0.07 nmol/mg protein when 10% boysenberry extract was added to the diet. Interestingly for MDA, concentrations decreased to 36% of the control for the SD rats, increased by 256% for the FD, and remain unchanged for the CD fed rats when 10% boysenberry extract was added to the diet.

Conclusion – This study showed that Boysenberry extract functioned as an in vivo antioxidant and raised the antioxidant status of plasma while decreasing some biomarkers of oxidative damage, but the effect was highly modified by basal diet. These results are further evidence of complex interactions between dietary antioxidants, background nutritional status as determined by diet, and the biochemical nature of the compartments in which antioxidants function.
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**Dairy foods, fat and human bowel health**

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**Background** – Dairy foods such as cheese and yogurt provide a health promoting option, and components present within their fat could be offering some significant benefits. Dairy fat has an optimal ratio of w6/w3 fatty acids (2), along with conjugated linoleic acids (CLA) are also present (particularly cis-9, trans-11 18:2) which have been identified as potentially beneficial to bowel health eg antiinflammatory and cancer preventing effects (1).

**Design** – Dairy fat has undergone investigation in experimental animal models of disease, and in human clinical studies, to evaluate potential benefits with respect to bowel cancer prevention.

**Outcomes** – A rat study of high fat diets showed cheese was an optimal source of w3 fatty acids producing high concentrations of long chain w3 fatty acids: EPA and DHA in liver triglycerides. A report by Larsson et al (2) from the women’s mammography prospective cohort study showed that over 15 years of observation the highest intakes of full fat dairy products (≥ 4 serves/day) were associated with reduced expression of colorectal cancers (down by 41%, p trend = 0.002) relative to those ingesting ≤ 1 serve of dairy per day. CLA intake in this study also showed there was a significant inverse association (multivariate rate ratio 0.71, p trend = 0.004). Increased apoptosis was identified in animal studies as a possible protective mechanism.

**Conclusions** – Dairy foods have an important role to play in health and carry some functionally significant components (w3FAs and CLA) of benefit in maintaining bowel health.

**References**

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**Effectiveness of DPA in comparison to DHA in lowering plasma triglyceride levels and other cardiovascular risk factors**

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**Background** – Numerous health benefits have been attributed to both eicosapentaenoic acid (EPA, 20:5n3) and docosahexaenoic acid (DHA, 22:6n3) found in fish oil. However, docosapentaenoic acid (DPA, 22:5n3) found particularly in red meat has been less well studied. Australians consume 6 times more meat than we do fish. The richest commercial capsule source of DPA available is seal oil.

**Objective** – To compare the effects of DPA rich seal oil supplementation with DHA rich fish oil, on measures of plasma lipids in hypertriglyceridaemic subjects.

**Design** – A randomised, parallel, placebo controlled, double blind study was conducted in 52 hypertriglyceridaemic subjects. They were randomly allocated to one of three groups receiving a total of 1g/d EPA, DPA & DHA but different relative amounts: seal oil capsules (360mg EPA, 250mg DPA, 450mg DHA), fish oil capsules (210mg EPA, 30mg DPA, 810mg DHA) or placebo capsules (containing a vegetable oil) for 6 weeks. Fasting blood samples were taken at baseline and at 6 week post intervention. Blood samples were tested for red blood cell (RBC) fatty acids and plasma lipids (triglycerides, total cholesterol, LDL-C and HDL-C).

**Outcomes** – Seal oil supplementation significantly increased incorporation of DPA (from 2.5-2.7%), DHA (from 4.9-5.8%) and EPA (from 1-1.8%), p<0.0005), whereas fish oil increased incorporation of DHA only (from 5.2-6.2%), p<0.01 into RBC. Plasma triglycerides remained unchanged in the placebo group (2.30-2.19mmol/l), whilst reductions of 7% (2.24-2.09mmol/l) and 14% (2.54-2.19mmol/l) were seen in the fish oil and seal oil groups respectively, but only the seal oil group reached significance (p<0.05).

**Conclusion** – Seal oil supplementation increased RBC levels of DPA, EPA and DHA whilst DHA rich fish oil supplementation increased RBC levels of DHA only. It appears that seal oil may be more effective than fish oil at lowering plasma triglyceride levels in hypertriglyceridaemic subjects.

**Acknowledgement** – Supported by funding from Meat and Livestock Australia.
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Development of the lower glycemic index rice cracker
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Background – Control of postprandial hyperglycemia is one of the main therapeutic targets in diabetic patients, glucose-intolerant and normal subjects. High amylose starch, as found in Indica rice and corn flour, suppress blood glucose levels and insulin responses when compared with the low amylose starch. Since the traditional Japanese rice crackers are generally made from Japonica rice, which has a low amylose content (16 – 18 % amylose), they have a high glycemic index (GI, 91). We developed a rice cracker using Indica rice with high amylose content (25 – 35 % amylose) and non-digestible dextrin.

Objective – To determine the GI and insulimemic index (II) of the new rice cracker, plasma glucose and insulin concentrations were monitored in healthy volunteers for 2 hr after consumption of the reference starch solution (Trelan-G), the traditional Japanese rice cracker and the new rice cracker.

Design – Twelve healthy volunteers, 6 men and 6 women aged 28.6±6.6 y, with normal body mass indexes (20.5±1.7 kg/m²) participated. The blood samples were collected before and 15, 30, 45, 60, 90, 120 min after the intake of the reference starch solution (Trelan-G), the traditional Japanese rice cracker and the new rice cracker.

Outcomes and Conclusions – The GI and II of the traditional Japanese rice cracker were 87±28 and 142±123, respectively. The GI and II of the new rice cracker were 63±24 and 85±55, respectively. It was clarified that the GI and II of the new rice crackers were significantly low when compared with those of the traditional Japanese rice crackers. These results indicated that the new rice crackers might be useful for the prevention of the metabolic syndrome.

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Qualitative analysis of the effects of chickpea supplementation on habitual diet
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Background – A balanced diet is an important aspect of disease prevention. Legumes are high in fibre and plant protein, low in fat and cholesterol and have a low glycaemia index. They are an important addition to a balanced diet. Despite their healthy nature, consumption of legumes within Australia is low. Qualitative research into the perceived benefits and barriers of legume consumption is an important step in addressing this. Hypocholesterolaemic properties and enhanced sensations of satiety have been reported. Through increasing satiety chickpeas may replace other food items in the diet potentially leading to beneficial nutrient changes.

Objective – To determine the effect of chickpea supplementation on other food consumption in an ad libitum diet, and the participants’ perception of chickpea consumption.

Design – In an ordered crossover study, 42 participants consumed their habitual diet for four weeks, an ad libitum diet supplemented with 104 g day⁻¹ chickpeas for 12 weeks, and their habitual diet for another four weeks. Fifteen participants from the above study took part in focus groups exploring factors that determine food choice, the acceptability of chickpeas, and the benefits and barriers of legume consumption.

Outcomes – When chickpeas were added they replaced foods in the cereals, vegetables and dairy food groups. Focus groups identified many factors influencing dietary choice and many barriers to and benefits of legume consumption. Participants were particularly concerned with choosing healthy foods, and eating a variety of different foods that are tasty, convenient and accepted by other family members. A number were concerned about flatus.

Conclusions – Chickpeas mainly replaced carbohydrate rich foods. The health benefits of legumes are the main characteristics encouraging their consumption, while inconvenience and gastrointestinal upset discourage consumption.
P47  Efficacy of an isocaloric high protein low GI weight loss diet compared to a low GI high carbohydrate diet in overweight/obese men
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Background – Although diets with increased protein to carbohydrate appear more effective for improving body composition and metabolic outcomes in women, they have been poorly studied in men.

Objective – Our study aimed to comprehensively assess the efficacy of a high protein low GI diet (HP) compared to a high carbohydrate low GI diet (HC) for weight loss in overweight/obese men.

Design – One hundred and twenty three overweight men aged 49±9 y and BMI 34±6 kg/m² were randomized to one of 2 isocaloric (7MJ) weight loss diets for 12 weeks. HP: (Protein:CHO:Fat;%Sat Fat = 35:40:25:8%) or HC (17:58:25:8%). Outcome measures were regional fat and lean loss as well as cardiovascular risk markers.

Outcome – Weight loss on both diets was similar; 8.9±4.2kg (mean±SD). Total abdominal fat mass loss was significantly greater on HP compared with HC even after controlling for baseline differences (HP -0.76±0.38 kg vs HC, -0.56±0.36 kg; P=0.02). Triglycerides (TG) fell by 0.45±0.70 mmol/L, LDL cholesterol by 0.48±0.66 mmol/L, blood pressure by 11/12±10/8mmHg and HDL cholesterol remained unchanged independent of diet composition. Glucose and insulin fell by 0.27±0.58mmol/L and 4±6m U/L respectively. CRP fell significantly only in those subjects with TG>2 mmol/L and on HP (P=0.03 time/diet/TG status interaction). Plasma folate increased 7% on both diets and homocysteine remained unchanged at 7.7 µmol/L. Plasma B12 increased significantly only on HP by 20% (P=0.027 for diet interaction).

Conclusion – Both high protein diets and high carbohydrate low GI diets are effective in improving cardiovascular risk in obese men but with some metabolic advantages on the higher protein pattern.

P48  Epithelial cell folate is an accurate marker when compared with whole tissue biopsy folate for examining the role of folate status in colorectal cancer
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Background – Epidemiological studies have shown low folate status is associated with colorectal cancer. Colonic tissue folate levels at different stages of cancer development should give important information, but different methodologies to extract the colonic tissue folates have been used. This has hampered progress in defining the relationship between systemic and tissue folate levels.

Objective – To evaluate two methods of colonic tissue preparation for estimation of total folate content.

Design – Whole tissue punch biopsy samples were obtained from the descending colon of 31 individuals following a normal colonoscopy. Blood samples were obtained for the determination of plasma homocysteine (Hcy), red cell folate (RCF), methylenetetrahydrofolate reductase 677C>T genotype, and serum vitamin B12 and folate. Colonic tissue folate was measured both in washed whole tissue biopsies and in epithelial cells isolated from tissue biopsies.

Outcomes – Whole biopsy and epithelial cell folate concentrations were significantly correlated (R=.375; P=.038). Hcy was inversely correlated with both measures (R=-.365; P=.043 and R=-.364; P=.044 respectively). RCF was significantly correlated with isolated epithelial cell folate (R=.477; P=.007) but not with whole tissue biopsy folate (R=.264; P=.151). There were no significant associations between serum and colonic folate in this study.

Conclusion – Both methods are useful for comparing systemic and localised tissue folate status but epithelial cells may provide more reliable data.
P49  Effect of dairy based replacement meals on food intake and appetite in lean and obese subjects
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Background – The incidence of obesity is increasing and products that suppress appetite and subsequently food intake may be important in controlling body weight. Murray Goulburn Nutritionals has produced a dairy based supplement that has been shown to stimulate cholecystokinin (CCK), a potent satiating hormone, release in vitro. This product may potentially influence appetite leading to a reduced food intake.

Objective – To determine if a dairy based meal replacement product can stimulate the release of CCK to increase satiety and decrease food intake in obese and lean volunteers.

Design – Double-blind, randomised, placebo-controlled, cross-over study with 15 lean (age 27.3 ± 5.7 yr; BMI 22.0 ± 1.3 kgm⁻²) and 15 obese (age 38.2 ± 9.5 yr; BMI 35.3 ± 4.6 kgm⁻²) men. On separate days, volunteers consumed 250 mL dairy fraction (test) and placebo beverages following an overnight fast. Plasma CCK concentrations and visual analogue scale assessments of appetite were measured. Subsequent food intake was assessed at a buffet meal.

Outcomes – Food intake (kilojoules) was lower in both lean and obese volunteers after the placebo supplement (Lean 7.98% less, Obese 7.39% less) with no difference between groups (P = 0.99). Obese volunteers rated themselves as less hungry and more full after the test supplement, whereas lean volunteers rated themselves less hungry and more full after the placebo; however these were not significant. CCK concentrations increased following both the test and placebo supplement (P < 0.001) but there was no difference in the CCK response between lean and obese volunteers (P = 0.13).

Conclusions – Although the test product proved inactive, this approach could be used to evaluate other nutrients which have the potential to suppress appetite. Further investigation of possible alterations in appetite and food intake response to novel dairy based supplements in lean and obese volunteers is warranted

P50  Effects of dietary fibre and fish oil on gut contractility
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Background – Experimental and epidemiological data suggest that dietary fibre and resistant starch (RS) promote bowel function through faecal bulking and short-chain fatty acid (SCFA) production. Our data has recently shown that dietary n-3 polyunsaturated fatty acids (PUFA) from fish oil (FO) also have important actions on the gut (1).

Objective – To feed normotensive and the spontaneously hypertensive rat (SHR) diets supplemented with FO and RS and examine indices of gut health including effects on in vitro contractility.

Design – In experiment 1, young Sprague Dawley (SD) rats were fed 4 diets that contained 100 g/kg fat as sunflower oil or FO and with 10% fibre supplied as α-cellulose or high amylose maize starch rich in RS. In experiment 2, older SHR and WKY control rats were fed 3 diets with 50 g/kg fat as lard, canola oil, or FO. We measured gut tissue fatty acid composition, muscarinic receptor binding properties, the SCFA pool and agonist-induced gut contraction.

Outcomes – FO supplementation lead to increased n-3 PUFA content of gut tissue while RS resulted in increased caecal content of SCFA, especially as butyrate, and lowered pH. There were no changes in total muscarinic binding in gut tissue of older SHR. However, in young SD rats FO supplementation altered the sensitivity of the M₁ receptor subtype compared to the other diets. In SD ileum, FO feeding also led to higher 8-iso-PGE₂ (83%) PGE₂ (259%) and PGE₂₉₉-induced (203%) maximal contractility with a RS effect noted for carbachol (105%). Lower prostanoid effects in young SD rats and older SHR were also enhanced by FO. It was noted for SHR, FO supplementation also resulted in the first observation of increased maximal contraction of the colon. While a 5% canola oil diet rich in α-linolenic acid lead to a marginal increase in total tissue n-3 PUFA in SHR ileum, there were no effects on contractility.

Conclusion – Although little interactive effects were noted for FO and RS, the data suggests developmental changes in ileal receptor systems with independent effects of RS and FO on some bowel properties of juvenile rats. In older SHRs, FO supplementation increased contractility of ileum and colon and restored depressed prostanoid contractility in ileum with docosahexaenoic acid (DHA) indicated as the active agent. FO and RS produce positive outcomes for bowel health, likely by independent mechanisms which may be of interest to the food industry.

Reference
Screening of plant-based extracts for colorectal cancer prevention
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Background – Colorectal cancer (CRC) is the second ranked cause of cancer related death in Australia. A healthy lifestyle based on a good diet is the most attractive preventative strategy to fight this disease. Dietary fruits, vegetables, legumes and cereals are recommended for the prevention of CRC development. It is desirable to know which particular foods posses specific anticancer properties. From our research, several plant-derived products with anticancer properties have been identified and found to protect at different stages of the complex process of carcinogenesis.

Objective – The objective was to identify dietary plant sources with anti-proliferative and apoptotic properties against HT-29 colon cancer cells.

Design – Aqueous-ethanolic extracts of edible part of plants, nuts and herbs were tested in exponentially growing HT-29 cells in 96 well plates using the cell titre blue (CTB) assay. Lead samples with anti-proliferative activity were then further tested for their specific effects on apoptosis, histone deacetylase (HDAC) activity, cell cycle phase, and expression of cyclooxygenases (COX) and enzymes implicated in CRC such as quinone reductase and glutathione synthase transferase (GST).

Outcomes – Salicylate at 10 mM inhibited the growth of HT-29 cells up to 55 % with no effect on apoptosis, conversely butyrate at 10 mM inhibited the growth of HT-29 cells at about 30 % and induced apoptosis up to 25%. We found several plant genera including rosemary, chives, bay leaves, coriander, basil, cardamom and cloves demonstrated anti-proliferative and apoptotic activity comparable to salicylate and butyrate and altered activity and expression of key enzymes linked to CRC development.

Conclusion – We have identified leads from food extracts with potential anticancer properties. We intend to further validate these lead extracts in animal models of CRC to develop functional foods and nutraceutical products that might prevent the development of human CRC.

Chickpeas influence P:S ratio and fibre content of ad libitum dietary intake and improve serum lipid profile, and glycaemic control
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Background – There has been a gradual development of interest in the contribution of pulses to a healthy lifestyle, as awareness of ethnic diets and lifestyles has grown. A couple of controlled dietary intervention studies with chickpeas have shown a small but significant reduction in serum low density lipoprotein (LDL-C) and total cholesterol (TC) concentrations in women and men. But a question remains as to the potential effect of chickpeas on nutrient intake, metabolic and physiological changes in a more realistic ad libitum setting.

Objective – To estimate the effect of including a realistic quantity of chickpeas in an otherwise ad libitum diet in free-living adults.

Design – An ordered crossover design of 20 weeks duration with four weeks of habitual diet at commencement and end. Forty-five adult women and men, as a group slightly hypercholesterolaemic but normoglycaemic, included 104g of chickpeas per day in their habitual diet for 12 weeks. Comparison was made of macronutrient and dietary fibre consumption, body mass index, fasting plasma glucose, serum lipids, lipoproteins, insulin, leptin and ghrelin concentrations, after habitual diet supplemented with chickpeas and after four weeks of post chickpea ad libitum diet. Semi-quantitative assessment of bowel function was made using anchored visual analogue scales. All data was analysed with repeated measures ANOVA using GLM with robust standard error estimation and ordinal logistic regression for ordinal data.

Outcomes – Chickpea-related increases in mean dietary fibre and PUFA intake were associated with significant decreases in serum TC and LDL-C, fasting insulin and HOMA-IR (p<0.05 for all) when compared to the usual dietary phase. Small but significant reductions in body weight (p=0.001) and improved bowel function were noted during the chickpea phase compared to the usual dietary phase.

Conclusion – Adding chickpeas to the diet is a sensible option for individuals wanting to modify their diet-associated CVD risk factors.
**P53** Effects of a controlled diet supplemented with chickpeas versus wheat on serum lipids, glycaemic control, satiety and bowel function  
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**Background** – Chickpeas are common in many ethnic diets and are rich in polyunsaturated fatty acids (PUFA), dietary fibre and resistant starch. However, little information is available on the health effects of regular chickpea consumption.  
**Objective** – To compare the effects of a diet supplemented with chickpeas to a wheat-supplemented diet of similar fibre content on serum lipids and glycaemic control, and to compare these diets plus a wheat based diet of low fibre content on satiety and bowel function.  
**Design** – Twenty-seven free-living adults followed two randomized, crossover dietary interventions each of five weeks duration. The chickpea diet included canned chickpeas (140g/day), bread and biscuits containing 30% chickpea flour. The diets were isoenergetic to the participants’ usual diet, matched for macronutrient content and controlled for dietary fibre. Following on from the second randomised intervention, a sub-group of 18 participants underwent a third lower-fibre wheat diet. Measures at the end of the diets were compared by repeated measures ANOVA using GLM.  
**Outcomes** – Serum TC was 0.25 mmol/L ($p < 0.01$) and LDL-C was 0.20 mmol/L lower ($p=0.02$) following the chickpea diet compared to the wheat diet. An unintended significant increase in PUFA and corresponding decrease in MUFA consumption occurred during the chickpea diet and statistical adjustment for this reduced the effect on serum lipids by about 50%. There was no significant difference in glucose or insulin concentrations. Perceived general bowel health improved significantly during the chickpea diet although there was considerable individual variation. Greater satiety was reported by some participants and was significantly greater than on the low fibre diet.  
**Conclusions** – The small but significantly lower serum TC and LDL-C during the chickpea diet could provide a valuable health benefit.

**P54** Comparison of two sets of criteria to classify ‘extra’ foods in the Australian diet  
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**Background** – The high consumption of non-core or ‘extra’ foods is of concern as they may contribute to excessive energy intakes and replace more nutritious foods in the diet. The definitions used to classify ‘extra’ foods are inconsistent and need to be standardised.  
**Objective** – To develop a classification system to identify ‘extra’ foods which can be used in the analysis of dietary intake data and development of nutrition policy in Australia.  
**Design** – Two sets of criteria to identify ‘extra’ foods were developed based on standards for fat and sugar content; one set was based on principles outlined in the Australian Guide to Healthy Eating (AGHE) and, the other set was more stringent and followed the additional principles outlined in the Dietary Guidelines (AGHE+). The energy and nutrient contribution of ‘extra’ foods based on these two sets of criteria were compared, using dietary data for children aged 2-18 years who participated in the 1995 NNS.  
**Outcomes** – Using the AGHE criteria, ‘extra’ foods contributed 41% of energy, 19% of protein, 48% of fat, 54% of sugar and 20-30% of micronutrient intakes. By comparison, using the AGHE+ criteria, ‘extra’ foods contributed 70% of energy, 58% of protein, 82% of fat, 80% of sugar and 60-70% of micronutrients.  
**Conclusion** – ‘Extra’ foods contribute to a large proportion of energy, fat and sugar intake in the diets of Australian children, using either set of criteria. However, the AGHE+ system is too stringent, in that it includes many foods that would be regarded as high-fat or high sugar forms of core foods. We recommend the AGHE criteria be considered more widely for use in identifying ‘extra’ foods. This set of criteria uses defined cut-points for each food category and yields results similar to the few international studies which have assessed the contribution of energy-dense, nutrient-poor foods to the total diet. It is important that there is agreement on standardised criteria to identify ‘extra’ foods.
P55  Retention of major minerals and some trace elements in the newly hatched broiler chick  
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**Background** – The first week after hatch is the most critical period in the life of a broiler chicken. Several recent studies have examined the utilisation of energy and protein in the newly hatched chick, but corresponding data on mineral utilisation is scanty.

**Objective** – To determine the retention of major minerals (Ca, P, Mg, K and Na) and some trace minerals (Fe, Mn, Zn and Cu) of diets based on wheat, sorghum and maize during the first two weeks post-hatch of broilers.

**Design** – Three diets containing wheat, sorghum and maize as the cereal base were formulated. All three diets were formulated to contain similar levels of energy, amino acids and major minerals. Each diet was fed ad libitum to six replicate groups (8 birds/replicate) from days 1 to 14 post-hatching. On days 3, 5, 7, 9 and 14, total excreta collection method was employed to determine the mineral retention.

**Outcomes** – For all minerals, the retention values were higher at day 3 and then declined during 5 to 9 days, before increasing at day 14 post-hatching. Among minerals analysed, the retention of Na was the highest and those of Zn and Cu were the lowest. Cereal effects were significant only for Ca and P, with sorghum-based diets having high retention values.

**Conclusion** – The capacity to absorb and retain minerals appears to be limiting during the first week of life in modern fast-growing broilers.

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P56  Influence of diet on iron status in the Tasmanian population with and without the haemochromatosis genes  
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**Background** – Hereditary haemochromatosis is one of the commonest genetic disorders in Australia. There is considerable variability in the rate of end-organ disease in people with susceptible HFE genotypes for hereditary haemochromatosis, possibly due to variability in the rate of iron accumulation.

**Objectives** – To estimate the association between dietary iron and other nutrients, and iron status.

**Design** – A community cross-sectional survey of 114 men and 119 women with different HFE genotypes conducted in northern Tasmania. Macro- and micro-nutrient intake was assessed by food-frequency questionnaire.

**Outcomes** – 67% of men and 71% of women with C282Y homozygous genotype had elevated transferrin saturation. The median ferritin in C282Y homozygous men under age 35 was 151 µg/dL and 809 µg/dL over age 35. Only 33% of C282Y homozygous women (all over age 50) had ferritin levels over 350 µg/dL. Serum transferrin saturation and ferritin levels were strongly associated with dietary fat intake in C282Y homozygotes, but not in heterozygous and normal genotypes. Serum ferritin levels were strongly associated with dietary haem iron in homozygotes with ferritin > 350 µg/dL but not below this. When the two factors were analysed together in this group, 1 SD increase in haem iron increased serum ferritin by 470 µg/dL (CI95% 82 to 857; P=0.03) and 1 SD total fat increased serum ferritin by 310 µg/dL (CI95% 31 to 589; P=0.036). There was no association between dietary non-haem iron and iron status.

**Conclusions** – There is a strong association between haem iron intake and ferritin in C282Y homozygotes with elevated ferritin levels. Total fat intake had an independent strong association. In these people dietary change may slow iron accumulation and may delay the need for venesection.
P57  Relationship between the rate of intestinal glucose absorption and glycemic index in rats

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Background – The incretin hormones such as GIP and GLP-1 are released from endocrine cells in the intestinal mucosa after ingestion of carbohydrates and enhance postprandial insulin release from the pancreatic beta cells. The released insulin stimulates glucose uptake in skeletal muscles and adipocytes, and the enhancement of the glucose disappearance rate from blood (glucose clearance: GC) is promoted by the facilitative subcellular redistribution of the glucose transporter isoform (GLUT4) from an intracellular compartment to the plasma membrane. The ability to stimulate incretin hormone secretion differs among the various types of carbohydrates.

Objective – To clarify the relationship between the insulin release (AUC of plasma insulin concentration: AUCINS) and GC after intravenous and oral administration of glucose, and to examine whether the relationship can be used to predict the intestinal glucose absorption rate after intakes of various types of carbohydrates such as sucrose.

Design – The glucose was intravenously infused into male Wistar rats. The oral glucose tolerance test (OGTT) was also performed using Trelan-G. Sucrose was administered orally. The alterations of plasma glucose and insulin concentrations were measured, and the simple kinetic model was used to determine their GC.

Outcomes and Conclusions – The values of AUCINS and GC after oral administration of glucose were greater than those after intravenous infusion of the same amount of glucose. There was a strong positive correlation between AUCINS and GC after either intravenous or oral administration of glucose. It was clarified that the intestinal glucose absorption rate after intake of sucrose could be predicted from the relationship between AUCINS and GC.

P58  Available oxalate content of nuts

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Background – Nuts are often referred to as high oxalate containing foods but reliable data on the oxalate content of many commonly eaten nuts are hard to find.

Objectives - This study was conducted to determine the oxalate contents in common nuts either grown or imported into New Zealand. Samples of imported nuts were purchased from supermarkets in Christchurch while home-grown nuts were obtained directly from the growers. Gastric soluble and intestinal soluble oxalates were extracted from the nuts using an in vitro assay. The extracted oxalates were then determined by HPLC chromatography.

Outcomes – The gastric soluble oxalate contents of the nuts represent the total oxalate in the samples, however, the more interesting fraction is the intestinal soluble oxalate. This is the fraction that will be absorbed in the small intestine. Peanuts, Spanish peanuts, peanut butter, ginkgo and pecan nuts all contained relatively low levels of intestinal soluble oxalate ranging from 129 to 173 mg intestinal soluble oxalate/100 g fresh weight (FW). Almonds, Brazil, cashew and candle nuts contained higher levels of intestinal soluble oxalate ranging from 216 to 305 mg/100 g FW. Pine nuts contained the highest levels of intestinal soluble oxalate (581 mg/100 g FW) while in contrast, chestnuts and pistachio nuts were low (72 and 77 mg/100 g FW). Over all the nuts studied the mean soluble oxalate contents was 78% of the total oxalate content (range 41 to 100%).

Conclusion – The results obtained in this study confirm that the soluble oxalate contents of nuts range widely and people who have a tendency to form kidney stones would be wise to moderate their consumption of certain nuts.
**P59**  
Ad libitum feeding; is it metabolically efficient?  
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2NSW Department of Primary Industries, EMAI, PMB 8, Camden, NSW 2570

**Background** – Studies in both humans and rodents have shown an endogenous entrainment of 24 h rhythms in plasma glucose and insulin metabolism (1). These rhythms are regulated by the suprachiasmatic nucleus and are independent of the influence of feeding activity (1). Little is known of these metabolic rhythms in the domestic pig despite the fact that pigs housed in commercial environments are maintained at ambient photoperiod.

**Objectives** – To determine 24 h profiles in insulin, glucose and feeding behaviour in pigs fed ad libitum and entrained to a 12 h (0600 to 1800 h) light regimen.

**Design** – Ten entire male pigs were allocated randomly to individual pens in the same room maintained at 22.0 ± 0.7°C. Jugular cannulae were introduced into each pig via the ear vein 24 h prior to the onset of sampling. Blood samples (3mL) were taken at intervals of one hour for 24 h and the plasma stored at -20°C until assayed. Circulating insulin concentrations were determined by radioimmunoassay and plasma glucose concentrations by enzymic analysis. Feeding behaviour was monitored by video analysis over the sampling period.

**Outcomes** – Feeding behaviour was characterized by a distinct photoperiod entrainment with activity greater during the period of light compared to the period of darkness. Both glucose and insulin concentrations displayed an ultradian rhythm although plasma insulin secretion was correlated to neither feeding behaviour nor glucose status.

**Conclusions** – The data suggest that pigs consume food at regular intervals throughout the daylight hours. Feeding animals ad libitum may not be metabolically efficient as insulin secretion is not correlated with feeding behaviour.

**Reference**

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**P60**  
Effects of processing on folate retention in food  
AK Shrestha, JL Paterson, J Arcot  
1Centre for Nutrition and Food Sciences, University of Queensland, St. Lucia, Brisbane, QLD 4072, Australia  
2Food Science and Technology, School of Chemical Science and Engineering, The University of New South Wales, Sydney 2052

**Background** – Folates are sensitive to temperature, pressure and exposure to light and thus can be affected during food processing.

**Objective** – To review some of the common practices of processing foods and their impact on folate stability.

**Review** – A number of studies in the literature have reported thermal destruction of folate in model systems when temperatures were up to 100°C and under UHT conditions, and in food systems. In particular, the concentration of folic acid and 5-methyl tetrahydro folate (THF) were followed. Given the different extraction methods used for folate analysis using the microbiological assay, data vary largely. The traditional technique using single enzyme method on cereals, in particular, gave one third to almost one half of the amount of folate detected by the tri-enzyme method. Common processing methods in such as boiling, fermentation, roasting and baking, where heating may be dry or moist, caused considerable losses of folic acid in foods. Several studies on effects of the baking process on wheat products (eg. bread) have been done on pilot scale and it is generally agreed that despite the increase in folate during fermentation, total folate is lost due to the high baking temperatures employed. Other studies reveal a loss of 40% of total folate during commercial soy milk processing compared to the total folate concentration in the raw beans (1). This paper will analyse existing data on the effects of processing keeping in mind the differences in extraction methods used for folate analysis in foods.

**Reference**
P61  Reference database on nutrient levels in Australian foods
RL Sobolewski, JH Cunningham
Food Composition, Food Standards Australia New Zealand, ACT 2610

Background – Accurate, representative data for the level of nutrients found in foods are critical for the assessment of the quality of a nation’s food supply and population nutrient intakes. Due to the dynamic nature of the food supply, advances in nutrition research and the need for comprehensive data for public health and labelling purposes, the task of providing official, up-to-date nutrient composition data is both difficult and ongoing. Analytical difficulties such as sampling variability and inadequate methods of analysis make this process even more difficult.

Objective – To compile and publish quality up-to-date data on the nutrient composition of Australian foods.

Design – Nutrient data were derived primarily from Australian analytical data, with a strong focus on including new foods and known changes in food practices that could affect nutrient levels within the constraints of available resources. Nutrient data will be released in a form similar to the USDA, capturing not only the nutrient composition of each food, but also a detailed description and sample details for each food. The revised data will be published as a web-based database with additional downloadable PDF files.

Outcomes – A revised reference database of nutrient values found in Australian foods called NUTTAB06 to replace the current nutrient database NUTTAB95. NUTTAB06 will include additional nutrients such as iodine and selenium and will be available to the public for free. NUTTAB06 will form the underlying dataset for the development of the survey nutrient database for the National Nutrition and Physical Activity Survey and will be available as summary PDF files by the end of 2006 and in a web-based searchable format by early 2007.

Conclusions – NUTTAB06 will reflect current knowledge of the nutrient content of the food supply within time and funding restraints. Updating nutrient data is a difficult and time consuming process and it is inevitable that the database will only represent knowledge at any one particular time. The dynamic nature of the food supply, with the introduction of fortified foods and consumer desire for nutrient-modified products, changes in food production practices and analytical techniques all contribute to the difficulties in maintaining an up to date set of data.

P62  Modelling the dietary impact of mandatory fortification of food with folic acid
RL Sobolewski¹, JH Cunningham¹, TL Hambridge², J Boorman², B Joseph²
¹Food Composition, Food Standards Australia New Zealand, ACT 2610
²Dietary Modelling, Food Standards Australia New Zealand, ACT 2610

Background – A recent Food Regulation Ministerial Council policy guideline endorsed mandatory fortification of the food supply with folic acid as an effective public health strategy for reducing the prevalence of neural tube defects.

Objective – To conduct a comprehensive risk assessment including the determination of an appropriate food vehicle for adding folic acid and assessing the potential impact of a mandatory fortification program on intakes.

Design – The steps involved in assessing folic acid intakes include (1) the compilation and evaluation of nutrient data from sources such as food composition programs and the uptake of provisions allowing voluntary fortification of foods with folic acid by manufacturers; (2) the identification of food composition and/or food consumption data gaps and addressing them; and (3) dietary modelling of different scenarios and interpretation of results. Bread was selected as the vehicle for folic acid fortification due to the high consumption of bread by the target group, women of child-bearing age. A number of levels of fortification were assessed Mean intakes and proportion of respondents exceeding the Upper Level of intake were determined for women of child-bearing age and selected non-target groups.

Outcomes – There was no level of fortification that resulted in the target group reaching the recommended 400 µg of folic acid a day which reduces the risk of neural tube defects without at least one other population group having an undesirable proportion exceeding the Upper Level of intake. However a fortification level that maximises benefit but minimises risk can be identified.

Conclusion – Mandatory food fortification can assist in increasing folic acid intakes in women of child-bearing age but other strategies, such as voluntary fortification in a number of foods and peri-conceptional supplement use must still be continued.
P63 The effects of high walnut and cashew nut diets on the antioxidant status of subjects with metabolic syndrome

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²School of Physiology, Nutrition &Consumer Science, North-West University, Potchefstroom Campus, South Africa

Background – Nut consumption is associated with a protective effect against coronary heart disease, partly due to its high antioxidant content. It is hypothesized that the inclusion of nuts in the diet will improve the antioxidant status of subjects with metabolic syndrome who may be vulnerable to impaired antioxidant status.

Objective – To investigate the effects of high cashew nut and high walnut diets on the antioxidant status of subjects with metabolic syndrome.

Design – Sixty-four volunteers (29 male and 35 female, 45±10y) with metabolic syndrome (diagnosed by using the ATP III criteria) received a prudent control diet, prepared in the metabolic kitchen of the North-West University, Potchefstroom campus (NWU-PC) for a period of 3 weeks (run-in). The participants were grouped according to gender and age and randomized into three groups, receiving either the walnut, cashew nut or the control diets for 8 weeks, while maintaining a stable body weight. Nuts provided 20% of daily energy intake. Fasting blood samples were taken after the run-in period (baseline) and at the end of the intervention period and analysed for various antioxidant capacity markers.

Outcomes – The oxygen radical absorbance capacities (ORAC) of the walnut and cashew nut diets were significantly higher than the control diet (2277±160 and 2142±73, respectively vs 1457±226 mmol TE/g wet mass in the control diet). Despite this, the walnut and cashew nut diets had no significant effects on serum ORAC, reduced (GSH), oxidized (GSSG) glutathione, GSH:GSSG or hydroperoxide levels compared to the control group. However, all three groups showed significant improvements in antioxidant status from baseline to end (GSSG and hydroperoxide levels decreased; GSG:GSSG ratio and ORAC levels increased). This might have been due to a general increased antioxidant intake from the prudent diet compared to the habitual diets.

Conclusion – Although the inclusion of walnuts and cashew nuts into a prudent diet resulted in an increased antioxidant capacity (ORAC) of the nut diets, compared to the control diet, it did not improve the serum antioxidant profiles of subjects with metabolic syndrome.

P64 – Paper withdrawn
**P65**

**Does presence of inherent or added fat in foods interfere with folate extraction?**

S Vishnumohan, J Arcot

*Food Science and Technology, School of Chemical Science and Engineering, The University of New South Wales, Sydney 2052*

**Background** – The current folate extraction methods for analysis in foods uses a tri-enzyme technique namely, addition of protease and \( \alpha \)-amylase for hydrolysis of the protein and starch in foods to free the folate and a conjugase (chicken pancreas or human plasma or rat plasma) to further convert the polyglutamyl form of the folate to monoglutamate for determination using the traditional microbiological assay or the chromatographic methods. Given that there are high fat containing foods, the effect of addition of a lipase enzyme was investigated.

**Objective** – To assess the effect of the presence of inherent and added fat on the folate extraction from foods by modifying the existing method (Tamura *et al*, 1997) with the addition of a fourth enzyme namely lipase.

**Design** – Several foods under the Milk, cereal and meat category were analysed for folate with and without the addition of a fourth enzyme namely lipase. The foods were purchased at least from three different outlets and homogenised in the laboratory using a Waring blender and stored as composite samples at -20°C until extraction.

**Outcomes** – In the milk category, the amount of folate was on an average 71% higher (21 \( \mu \)g/100g) when lipase was added than when only the trienzyme technique was used (6 \( \mu \)g/100g) in cheese; processed cereal foods indicated a mean increase of 60% (20 \( \mu \)g/100g) in croissant with added lipase; 71% mean increase in jam doughnuts; 75% mean increase in Chicken thigh; 68% mean increase in lamb loin chops; 85% mean increase in beef blade steak; 78% mean increase in tuna; 80% mean increase in egg yolk; 50% mean increase in potato chips.

**Conclusions** – The presence of fat in foods certainly interfered with the maximum extraction of folate in the selected foods, more so in foods containing inherent fat and further systematic studies on animal foods is warranted.

**Reference**


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**P66**

**Concentrations of some minerals in cow’s milk vary with season**

GP Walker, PT Doyle, FR Dunshea

*Department of Primary Industries, Victoria*

**Background** – Milk can be an important source of minerals in the diet. In Australia, seasonal variation in the nutritive characteristics of pasture is likely to be associated with seasonal variation in the concentrations of minerals in milk.

**Objective** – To determine if there is seasonal variation in the concentrations of some minerals (table) in milk.

**Design** – Milk samples representative of calving groups (autumn and spring) within commercial dairy herds located in northern Victoria were taken at 6 – 7 week intervals and analysed for concentrations of minerals. Summary statistics (table) are based on the entire data set, where \( 158 \leq N \leq 166 \) for the mean of each mineral; units are mg mineral/kg milk except for selenium where units are \( \mu \)g/kg milk. Seasonal variation in concentrations of minerals for mid autumn (April), mid winter (July), mid spring (October) and mid summer (January) are representative of the bulk milk supply, where \( N=12 \). Values with a subscript in common are not significantly different (\( P<0.05 \)).

<table>
<thead>
<tr>
<th>Mineral</th>
<th>Mean</th>
<th>S.E.</th>
<th>Min.</th>
<th>Max.</th>
<th>April</th>
<th>July</th>
<th>October</th>
<th>January</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>1072</td>
<td>6.6</td>
<td>864</td>
<td>1310</td>
<td>1104</td>
<td>1044</td>
<td>1170</td>
<td>1110</td>
</tr>
<tr>
<td>Magnesium</td>
<td>98</td>
<td>0.8</td>
<td>73</td>
<td>122</td>
<td>1044</td>
<td>97</td>
<td>100</td>
<td>108</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>885</td>
<td>5.4</td>
<td>640</td>
<td>1040</td>
<td>859</td>
<td>919</td>
<td>975</td>
<td>896</td>
</tr>
<tr>
<td>Potassium</td>
<td>1534</td>
<td>12.0</td>
<td>1250</td>
<td>2010</td>
<td>1366</td>
<td>1664</td>
<td>1704</td>
<td>1575</td>
</tr>
<tr>
<td>Selenium</td>
<td>12.6</td>
<td>0.48</td>
<td>1.7</td>
<td>37.1</td>
<td>15.9</td>
<td>8.4</td>
<td>11.4</td>
<td>13.0</td>
</tr>
<tr>
<td>Zinc</td>
<td>3.46</td>
<td>0.041</td>
<td>2.15</td>
<td>4.91</td>
<td>4.07</td>
<td>2.73</td>
<td>3.37</td>
<td>3.39</td>
</tr>
</tbody>
</table>

**Outcomes** – The range in concentrations for all minerals was large with maximum concentrations approaching twice that of minimum values for the macro-minerals calcium, magnesium, phosphorus and potassium, and exceeding twice that of minimum values for the micro-minerals selenium and zinc. The average concentrations of all components examined also varied with season.

**Conclusion** – Environmental factors (farm management and season) are important determinants of the concentrations of some minerals in milk produced in northern Victoria. Milk produced in pasture-based production systems should not be considered as a uniform product across seasons.
P67  Concentrations of some cow’s milk lipids associated with health benefits for humans vary with season
GP Walker¹, C Wijesundera², PT Doyle¹, FR Dunshea¹
¹Department of Primary Industries, Victoria
²Food Science Australia, Victoria

Background – There is increasing evidence that milk contains a range of lipids that can promote health. In Australia, seasonal variation in the nutritive characteristics of pasture is likely to be associated with seasonal variation in the concentrations of lipids in milk.

Objective – To determine if there is seasonal variation in the concentrations of some milk lipids (table) that may be associated with health benefits in humans.

Design – Samples representative of the milk supply from northern Victoria for mid autumn (April), mid winter (July), mid spring (October) and mid summer (January) were analysed for concentrations of milk lipids (g component/kg milk fat). Values with a subscript in common are not significantly different (P<0.05).

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>S.E.</th>
<th>Min.</th>
<th>Max.</th>
<th>April</th>
<th>July</th>
<th>October</th>
<th>January</th>
</tr>
</thead>
<tbody>
<tr>
<td>β-carotene</td>
<td>7.4</td>
<td>0.12</td>
<td>3.7</td>
<td>11.5</td>
<td>8.9</td>
<td>8.2</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>Butyric acid</td>
<td>42.2</td>
<td>0.32</td>
<td>21.8</td>
<td>55.4</td>
<td>43.3</td>
<td>38.1</td>
<td>40.5</td>
<td>42.4</td>
</tr>
<tr>
<td>α-linolenic acid</td>
<td>6.2</td>
<td>0.10</td>
<td>3.5</td>
<td>11.5</td>
<td>5.1</td>
<td>6.0</td>
<td>5.4</td>
<td>5.3</td>
</tr>
<tr>
<td>Rumenic acid</td>
<td>6.1</td>
<td>0.48</td>
<td>0.7</td>
<td>29.8</td>
<td>8.0</td>
<td>7.8</td>
<td>11.1</td>
<td>4.4</td>
</tr>
<tr>
<td>Sphingomyelin</td>
<td>1.93</td>
<td>0.018</td>
<td>1.28</td>
<td>2.85</td>
<td>1.98</td>
<td>1.89</td>
<td>1.85</td>
<td>1.89</td>
</tr>
<tr>
<td>Vaccenic acid</td>
<td>32.8</td>
<td>5.71</td>
<td>5.7</td>
<td>164</td>
<td>14.7</td>
<td>10.1</td>
<td>56.0</td>
<td>26.5</td>
</tr>
</tbody>
</table>

Outcomes – The range in values observed for all components was large with maximum values being a whole number multiple of minimum values. The average concentrations of all components examined, with the exception of sphingomyelin, varied with season.

Conclusion – Environmental factors (farm management and season) are important determinants of the concentrations of some lipids in milk produced in northern Victoria. Milk produced in pasture-based production systems should not be considered as a uniform product across seasons.

P68  Physical properties of thickened fluids used in dysphagia management
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³School of Health and Rehabilitation Sciences, and ⁴School of Molecular and Microbial Sciences,
University of Queensland, St Lucia, QLD 4072, Australia

Background – Dysphagia (swallowing disorders) affects 30-60% of nursing home residents giving rise to serious health issues, amongst which is dehydration is the most important affecting up to 25% of non-ambulatory residents. Thickened fluids are used to manage dysphagia but their efficacy is modified by the particular thickening agent, the liquid medium being thickened and lack of standardised preparation to achieve a given density and viscosity.

Objective – To determine the rheological properties of fluids (fruit juices, cordials and milk) thickened with commercially available thickening agents.

Design – Laboratory based measurement of density and viscosity of thickened fluids at 20°C using a strain controlled rheometer. Yield stress was extrapolated from rheology data.

Outcomes – The density, yield stress and viscosity of the thickened fluids were significantly influenced (P < 0.05) by the type of dispersing liquid and thickener (xanthan or guar gums and modified starch). Rheological models, determined for each medium, were used to predict the viscosity at an assumed shear rate of 50s⁻¹ for swallowing. Physical properties of thickened food are sensitive to changes in solids content, and errors in preparations can be better minimised using weights rather than volumes from scoops and spoons that are not standardised.

Conclusions – The rheological models defined in this study can be used as the basis of a standardised method of preparation of thickened fluids. Reduced compliance with fluid intake due to incorrect fluid preparation affects hydration state. Elderly persons may then suffer poor nutrition, dwindling health and medical complications associated with failure to thrive.
**P69  New resistivity constants for bioimpedance analysis of body composition**

JM Dyer, LC Ward

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**Background** – Bioimpedance spectroscopy (BIS) is recognised as a more accurate method for the assessment of body composition than single frequency bioimpedance analysis (BIA). Nevertheless the method still relies on certain assumptions, most notably the assumed values for the resistivities of intra- and extracellular water (ICW and ECW respectively). Currently used values for adults originate from a study in an Italian population using D$_2$O and Br dilution as reference methods for total body water (TBW) and ECW respectively.

**Objective** – To determine resistivity constants for BIS by two methods in an Australian population.

**Design** – ECW was measured in 12 healthy control subjects (9 M, 3F) by Br dilution and TBW by D$_2$O dilution or from fat-free mass measurements using DXA (Hologic Discovery) assuming an hydration constant of 0.732. Concurrently, whole body BIS measurements were performed using an SFB7 impedance instrument (Impedimed, Brisbane) and apparent resistivity constants calculated according to the mixture theory model of impedances of body fluid volumes.

**Outcomes** – TBW$_{DXA}$ and TBW$_{D2O}$ were highly and significantly correlated ($r = 0.88, P < 0.001$). The resistivity constants for ECW were 201.5 ohm.cm and 183.6 ohm.cm for males and females respectively. ICW resistivity constants differed dependent upon whether D$_2$O or DXA was used as the reference method: 735.8 ohm.cm$_{DXA}$ and 770.8 ohm.cm$_{D2O}$ for males and 690.8 ohm.cm$_{DXA}$ and 757.2 ohm.cm$_{D2O}$ for females respectively.

**Conclusions** – Resistivity constants for use in BIS analysis of body composition were derived in an Australian population. The exact values of the constants depend upon the reference method used in their derivation and thus they should not be used interchangeably. It is recommended that the appropriate constants be used where body composition data, derived from BIS, are to be compared with those from either DXA or dilution studies.

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**P70  Assessment of body fluid volumes by bioimpedance analysis in the obese**

LC Ward$^1$, C Verdich$^2$, TIA Soerensen$^2$, M Petersen$^2$, P Barbe$^2$ and JM Oppert$^2$

on behalf of the NUGENOB Study.

$^1$School of Molecular and Microbial Sciences, University of Queensland, Queensland and $^2$NUGENOB Study Group (http://www.nugenob.org)

**Background** – Although obesity is primarily an increase in the fat mass of the body the condition is also associated with changes in body fluid content. In the morbidly obese (BMI > 40 kgm$^{-2}$) the extracellular water compartment (ECW) is often expanded such that the ECW:ICW (intracellular water) ratio is increased (> 0.8) and may remain so even after weight reduction.

**Objective** – To determine the size of body fluid compartments in obese, but not morbidly obese, subjects.

**Design** – Whole body impedance was measured in 92 obese (mean BMI = 34.9 kgm$^{-2}$) but otherwise healthy females using multiple frequency bioimpedance analysis (Bodystat Quadscan 4000). Total body water (TBW), ECW and ICW volumes were determined according to the mixture theory model of body fluid volumes using different published values for fluid resistivity constants and also using the proprietary Bodystat Quadscan software. Fat and fat-free mass measurements were simultaneously obtained using DXA analysis.

**Outcomes** – Predicted TBW volumes varied slightly depending upon the specific resistivity constants used for calculation but averaged 37.2 L or 40 % of body weight (BW). This compares to a TBW of 50-60 % BW commonly observed in normal weight individuals. Irrespective of the method of calculation, the mean ECW:ICW ratio was 0.62, typical of that found in normal weight subjects.

**Conclusions** – Despite the subjects being obese, with a body fat content approaching half (45.7 %) of body weight, this study showed no evidence of expansion of ECW compared to normal individuals unlike that previously reported for the morbidly obese.
P71  Fatty acid composition of dairy products derived from certified organic and conventional agricultural methods
A Wong, ZI Ahmad, J Phuyal, S Samman

Human Nutrition Unit, School of Molecular and Microbial Biosciences, University of Sydney, NSW 2006.

Background – The potential for agricultural practices to influence the nutritional quality of food has long been debated particularly when comparing foods produced by organic and conventional agricultural methods. Whilst it has been established that different feeds affect the quality of cows’ milk, there are relatively few studies that compare the effect of organic agricultural practices on the fatty acid composition of dairy products.

Objectives – To determine the fatty acid composition of dairy products that are available on the Australian market that have been produced through certified organic or conventional agricultural methods.

Design – Sixty two samples of certified organic dairy products [milk, n=11; cheese, n=14; cream, n=6; and yoghurt, n=31]; and 45 conventional samples [milk, n=7; cheese, n=13; cream, n=5; and yoghurt, n=20] were purchased from a range of commercial outlets in Sydney. The samples were homogenised, the lipids were extracted and the fatty acid composition was determined by using gas chromatography.

Outcomes – Small but statistically significant differences were observed in the saturated fatty acid composition, with lower percentages of lauric (2.2 vs 2.4, P<0.05) and myristic (10.1 vs 10.5, P<0.05) acids detected in organic dairy products as compared to their conventional counterpart, respectively. No differences were noted in either the ω-3 or ω-6 fatty acids between the organic and conventional samples. However, organic cheese was found to have a lower total polyunsaturated fatty acids content (P<0.05), and milk was found to have a higher ω-3:ω-6 ratio (P<0.05) compared to the matched conventional products.

Conclusion – Dairy products that are produced by organic or conventional methods have small but significant differences in their fatty acid composition. Whilst the decrease in lauric and myristic acids and increase in ω-3:ω-6 ratio indicate a potentially favourable fatty acids profile in organic products, the magnitude of the differences is small and the observation cannot be applied uniformly to all dairy product categories.

P72  The Victorian food security network
B Wood, J Osborne

Victorian Local Governance Association, 60 Leicester Street, Carlton VIC 3053

Background – The VicHealth initiative Food for All: Improving access to food for healthy eating. A food security program will progress Victorian improvement in food security through a number of creative projects over several years. One of these projects is the e-based Food Security Network (1) auspiced by the Victorian Local Governance Association (VLGA).

Objectives – The network aims to provide support for local governments and other stakeholders, who are working with their communities to reduce barriers to local food access for healthy eating, and to improve food security.

Design – The VLGA website provides up to date news and events in the local government sector. Open access to the network provides entry to links for other organizations and resources related to food security. The discussion forum creates a space for ongoing interactive debate, discussion, support and resources around the issues of food security, particularly those in local government areas. This information can be accessed by anyone. The actual discussants have been initially restricted to organisations or individuals in Victoria who are registered discussion group members.

Outcomes – After one year of operation, questionnaire evaluation of the evolving website indicates that it is beginning to fulfil the purpose intended, with 70 registered members from local governments and a range of other settings. Local food policies and municipal public health plans linked to municipal strategy statements and corporate plans include opportunities for improving food security through the natural, built, economic, social-cultural, and health environments for residents in all neighbourhoods. Other important stakeholders include residents, self-help groups and clubs, primary health care partnerships, primary health care agencies, community services, welfare organisations, and health institutions such as local hospitals.

Conclusion – The Food Security Network provides information and support for local governments who have a whole of population responsibility and for other stakeholders who can contribute to improved community health and well-being through equitable and local food chain systems.

Reference
P73  Dietary deficiency of n-3 fatty acids affects BDNF gene expression and spatial learning behaviour in young rats
L Wang1, Y Xiao2, ZY Chen2, RJ Xu1
1Dept of Zoology, The University of Hong Kong, Pokfulam Road, Hong Kong
2Dept of Biochemistry, The Chinese University of Hong Kong, Shatin, NT, Hong Kong

Background – Brain tissue contains large quantity of n-3 fatty acids, particularly decosahexaenoic acid (DHA). DHA is derived from its precursor alpha-linolenic acid, a dietary essential n-3 fatty acid, or it can be obtained directly from dietary sources. Dietary deficiency of n-3 fatty acids leads to impairment of spatial learning and memory in experimental animals, and dietary supplementation with DHA appears to improve mental development in human infants. How DHA influences brain memory function is not fully understood although a number of potential mechanisms have been proposed. One of the possible mechanisms is to affect the synthesis of neurotrophic factors in the brain.

Objectives – The present study aimed to investigate the effect of dietary n-3 fatty acid deficiency on brain-derived neurotrophic factor (BDNF) gene expression and spatial learning performance in young rats.

Design – Sprague Dawley rats were fed on an n-3 fatty acid deficient diet for three generations. The rat pups of the third generation were tested for their spatial learning performance using Morris Water Maze at four and ten weeks of age. At the end of the behaviour test, the rat pups were killed and the brain tissue was dissected for measurement of BDNF and its mRNA levels using ELISA and real-time PCR techniques respectively.

Results – Dietary n-3 fatty acid deficiency led to a marked depletion of DHA in the brain tissue. The concentration of BDNF mRNA in the cerebral cortex and the hippocampus was significantly lower in n-3 deficient rat pups than in the control counterparts (P<0.05), although BDNF level in the brain tissue did significantly differ between the control and n-3 deficient animals. In comparison with the control animals, n-3 deficient rats performed significantly poorer in Morris Water Maze task (P<0.05), and the effect was particularly evident at four weeks of age.

Conclusion – Dietary n-3 fatty acid deficiency leads to the impairment of spatial learning and memory performance and to a reduction of BDNF gene expression in the brain, the latter is a neurotrophic factor known to be involved in the memory function of the brain.

P74  Labelled magnitude scale for perceived satiety – a tool for diverse populations
MK Zalifah1, DR Greenway1, NA Caffin1, B D’Arcy1, MJ Gidley2
1School of Land and Food Sciences, University of Queensland, QLD 4072
2Centre for Nutrition and Food Sciences, University of Queensland, QLD 4072

Background – The labelled magnitude scale (LMS) has been found to provide better discrimination of satiety sensations compared to other scales for a homogenous population1. Verbal anchors were placed on the scale to represent numerical ratios of perceived satiety. The satiety perception in a diverse population such as Australia may produce differences in the numerical ratios due to language acquisition and diversity.

Objective – To investigate whether LMS is an appropriate methodology to assess satiety in a diverse population.

Design – Forty three subjects (28 female, 15 male) took part in the study. Of this group, 44% had English as their first language (EFL) while 56% had other language as first language (EOL). Subjects quantified the semantic meaning of 47 English words denoting hunger/fullness at various intensities. Ambiguous words were removed and geometric means (GM) were calculated. Eleven final words were chosen for anchors for scale construction.

Outcomes – Words removed due to ambiguity differed between EFL and EOL groups as these words have no equivalent in non-English first languages e.g. ravenous and voracious. An asymmetrical scale was constructed. The scale developed for this diverse population had some differences in magnitude of numerical ratios of words such as extremely full/hungry and very full/hungry compared to previous study1.

Conclusions – Provided ambiguous words are avoided, labelled magnitude scale can be used in English to assess satiety in populations differing in their first language.

Reference
P75 Does food architecture have an effect on perceived satiety?
MK Zalifah1, B D’Arcy1, NA Caffin1 MJ Gidley2
1School of Land and Food Sciences, University of Queensland, QLD 4072
2Centre for Nutrition and Food Sciences, University of Queensland, QLD 4072

Background – Food macronutrient composition is linked to satiety, but does not define the physical architecture of foods. Little is known about the effect of food architecture on satiety for the same macronutrient composition.
Objective – To determine the effects of food architecture with other factors in determining perceived satiety.
Design – Fifteen lean subjects (8 male, 7 female) who were non-smokers, non-diabetic, regular breakfast eaters, non-athletic, not on medication affecting appetite and complying to a questionnaire (1) were selected. Subjects consumed a breakfast test meal (188g) of beef steak (BS) or beef mince (BM). As a control for method familiarization, cereal with milk (CM) was used. Subjects fasted overnight, consumed the test meal with 200ml water and recorded feeling of satiety on a pre-constructed scale. Pizza lunch was provided and subjects ate until comfortably full. Food intake for the rest of the day was recorded and energy intake was calculated using Food Works Software Version 3.02 (Australia).
Outcomes – Subjects reported being moderately hungry, prior to the test meal consumption. Subjects felt fuller 3 hours after BM than BS consumption although the difference was not significant. Satiety scores were significantly lower (P<0.05) after CM at all points of recording except at the 75th min.
Conclusions – Food from similar raw material with difference in its architecture may exert some differences in satiety perception after BS or BM breakfast but differences were not significant. A more extreme difference in food architecture e.g. a sausage-type meat emulsion will now be studied in comparison to the beef steak.
Reference

P76 Effect of food intake on total body bone mass accretion in Chinese girls
Q Zhang1,2, H Greenfield1, K Zhu1, LH Foo1, GS Ma2, X Du1, CT Cowell, DR Fraser1
1Faculty of Veterinary Science, University of Sydney, NSW 2006
2Institute for Nutrition and Food Safety, Chinese Centre for Disease Control and Prevention, 100050, China

Background – Nutrition is known to have an important influence on bone mass accretion during puberty.
Objective – To assess, in a longitudinal study, the effect of differences in food intake on total body bone mass accretion in Chinese girls during puberty, using a mixed model analysis.
Design – Subjects were 377 Chinese girls who had participated in a two-year milk supplementation trial and a three year follow-up study from the ages of 10 to 15 yr. Total body bone mass was measured by dual energy x-ray absorptiometry at baseline and then at 12, 24, 48 and 60 m later. Food intake was estimated from a 7-d food record at baseline and then subsequently from a 3-d food record over two weekdays and one weekend day. The quantity of cereals, vegetables and fruit, legumes and nuts, meat, eggs, dairy products, and “other” foods consumed was estimated from these records.
Outcomes – After adjusting for age, total body bone mineral content (tBMC) from baseline to the end of the follow-up study was positively associated with the quantity of dairy products (β=0.043, P=0.01) and eggs (β=0.172, P=0.03) consumed for all subjects, with or without milk supplementation. In contrast, when tBMC of the control group (representing typical girls in China at puberty) was analysed separately, the only dietary association was with consumption of dairy products (β=0.075, P=0.02). For all subjects, the foods associated with tBMC were dairy products and eggs during the intervention study (P<0.05). However, during the 3 yr follow-up study positive associations were found with the intake of dairy products (P=0.05). The effect of dietary variation on total body bone mineral density (tBMD) differed slightly from that on total body BMC in the intervention trial and the follow-up study. In general, tBMD was positively associated with the consumption of eggs (P<0.05).
Conclusions – The quantity of dairy products consumed was the most significant dietary factor related to total body BMC in Chinese girls at puberty. The quantity of eggs consumed might also be related to bone mass accretion in these subjects.
Acknowledgement –This study was funded by Dairy Australia, Danone-China and the Nestle Foundation
**P77 Zinc assessment in Australian naturopathic practice: its influences, methodology and perceived validity**

R J Arthur-Andrews, T Gruner

*Southern Cross University, NSW 2480*

**Background** – Diminished taste acuity as an early symptom of zinc deficiency has been demonstrated in animals and humans. A number of trials have also documented hypogeusia in association with low zinc in patients with a variety of aetiologies and in ‘healthy’ individuals in different life-stages, while others have failed to demonstrate such a correlation. Diagnosis of hypogeusia in these studies has been based on a range of chemical gustometry designs and more recently electrogustometry techniques.

**Objectives** – To identify the preferred methods of zinc assessment used by Australian naturopaths.

**Design** – Questionnaires were sent to 205 naturopaths regarding their zinc assessment methods.

**Outcomes** – A response rate of 57% was achieved. A taste acuity test proposed by Bryce-Smith in 1984 \(^1\) was the primary method of zinc assessment in 80% of respondents with only 4% not ranking this method in their top three assessment tools. The use of hair mineral analysis was also prevalent with 30% of naturopaths identifying this as their second preferred method. Other methods reported with lower frequency include kinesiology, plasma zinc, live blood analysis and electro-dermal screening.

**Conclusion** – The preliminary data suggests that the ‘zinc taste test’ is overwhelmingly the most frequently employed method for zinc assessment by naturopaths and is used in combination with clinical assessment but independent of any other biochemical index for zinc.

**Reference**


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**P78 withdrawn**
Abstract omitted from 2005 Proceedings

**Effect of sialic acid supplementation on gene expression of UDP-N-acetylglucosamine-2-epimerase/N-acetylmannosamine kinase in piglets**

B Wang¹, B Yu², H Hu¹, P Petocz³, J Brand Miller¹

¹Human Nutrition Unit, School of Molecular and Microbial Biosciences, ²Department of Molecular and Clinical Genetics, Central Clinical School, University of Sydney, NSW 2006 and ³Department of Statistics, Macquarie University, NSW 2109 Australia

**Background** – Sia is a structurally important component of brain gangliosides and glycoproteins, playing a vital role in nerve cell transmission, memory formation and cell-to-cell communication. Bifunctional UDP-N-acetylglucosamine-2-epimerase/N-acetylmannosamine kinase (Gne) is the limiting enzyme in the biosynthesis of sialic acid (Sia).

**Objective** – To examine effect of dietary Sia supplementation on gene expression of Gne in training piglets.

**Design** – 3-day-old male piglets (n=53) were randomly allocated to one of 4 groups fed milk replacer supplemented with varying amounts of protein-bound form Sia for 5 wks: 140 mg/L (control), 300 mg/L (group 2), 635 mg/L (group 3) and 830 mg/L (group 4). All piglets were trained to learn the visual cue in an 8-arm radial maze for 14 days. Quantitative analysis of Gne mRNA in the hippocampus, cortex and liver was performed using SYBR Green and ABI 7900 HT platform. The relative quantification of mRNA levels was expressed using the formula:

$$\text{Ratio} = \frac{(E_{\text{target}})^\Delta(\text{MEAN}_{\text{Control}} - \text{MEAN}_{\text{Sample}})}{(E_{\text{reference}})^\Delta(\text{MEAN}_{\text{Control}} - \text{MEAN}_{\text{Sample}})}.$$

**Outcomes** – The supplemented groups had higher mRNA levels of Gne gene in the liver and hippocampus with a significant dose-response relationship (P= 0.009 and 0.004 respectively). The relative mRNA level in the liver and the hippocampus of group 4 was 2.3 and 3.0-fold higher than that of control group (P=0.002) and group 2 (P=0.004). The expression of Gne mRNA level in the liver was significantly higher than the brain frontal cortex (P=0.0001) and hippocampus (P=0.001).

**Conclusion** – Dietary supplementation with Sia increased both learning performance and capacity to synthesise Sia in piglet hippocampus and liver. There may be an increased demand for Gne expression during learning.
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