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Proceedings of the Nutrition Society of Australia

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The aims of the Asia Pacific Clinical Nutrition Society (APCNS) are to promote the education and training of clinical nutritionists in the region and to enhance the practice of human nutrition and related disciplines in their application to health and the prevention of disease.

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Robert A Gibson  awarded 3 December  2002
2003 NSA/MEAT AND LIVESTOCK STUDENT PRIZE

The 2003 NSA/Meat and Livestock student prize for oral presentation went to

Qian Zhang
Faculty of Veterinary Science, University of Sydney, NSW 2006

Q Zhang, GS Ma, H Greenfield, XQ Du, K Zhu, DR Fraser
Effects of fortified milk consumption on regional bone mineral accrual in Chinese girls

2004 NSA STUDENT PRIZES

The 2004 NSA student prize for oral presentation went to

Jo Zhou

SJ Zhou, M Makrides, RA Gibson, P Baghurst
Effect of iron supplementation in pregnancy on IQ of children at 4 years of age

The 2004 NSA student prize for poster presentation went to

Wendy Foley

WL Foley
How does dietary advice for diabetes management divide families?
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<td><em>Enhancing health active compounds in milk through cow management</em></td>
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<td>Dr Peter Doyle, Department of Primary Industries, VIC</td>
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<td><em>Flavonoids in functional foods: potential to improve vascular function and cardiovascular health</em></td>
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<td>Dr Jonathan Hodgson, University of WA, School of Medicine &amp; Pharmacology, WA</td>
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<td>1440</td>
<td><em>Role of whey and whey components in regulating adipose tissue and skeletal muscle metabolism</em></td>
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<td>Assoc Prof Gwyn Jones</td>
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<td>1635–1715</td>
<td><em>Nutrient reference values for Australia and New Zealand: process and outcomes</em></td>
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<td>Dr Katrine Baghurst, CSIRO Health Sciences &amp; Nutrition, SA</td>
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<td>0830–1030</td>
<td><strong>Invited Speakers Plenary 2: Vitamin D &amp; Bone Health</strong></td>
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<td>0830</td>
<td><em>The significance of vitamin D to health in Australia</em></td>
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<td>Assoc Prof Caryl Nowson, Deakin University, VIC</td>
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<td>0855</td>
<td><em>Vitamin D to prevent falls in older people in residential care</em></td>
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<td>Professor Leon Flicker, University of WA, WA</td>
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<td>0920</td>
<td><em>Vitamin D: new insights into an old seco-steroid</em></td>
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<td>Assoc Prof Rebecca Mason, University of Sydney, NSW</td>
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<td>0945</td>
<td><em>Do vitamin D and calcium in pregnancy influence offspring health?</em></td>
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<td>Dr Ruth Morley, Murdoch Children's Research Institute, VIC</td>
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<td><strong>Municipal dimensions and opportunities for improving food security in an urban area</strong> &lt;br&gt; Wood B, Streker P</td>
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<td><strong>How well do Australian preschool children’s food preferences match consumption recommendations?</strong> &lt;br&gt; Russell CG, Worsley A</td>
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<td><strong>Choosing breakfast: convenience, cost or quality?</strong> &lt;br&gt; Woods J, Walker KZ</td>
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<td>1215-1230</td>
<td><strong>Breakfast and obesity—a matter of sex</strong> &lt;br&gt; Kent L, Worsley A</td>
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| 1430–1445    | Behavioural effect of prenatal iron supplementation in children: long term follow up of a randomised controlled trial  
                Zhou SJ, Makrides M, Gibson RA                                      |
| 1445–1500    | Characterising the nutritional intake of preterm infants <33 weeks gestation  
                Collins CT, Miller JA, McPhee AJ,  
                Gibson R, Makrides M                                                |
| 1500–1515    | BMI and waist circumference at 7/8 yr and metabolic profile in adolescence  
                Garnett SP, Baur LA, Srinivasan S, Lee J,  
                Cowell CT                                                          |
| 1515–1530    | Resting energy expenditure in 18-20 year old males and females: Validation of indirect calorimetry and Harris-Benedict prediction equation  
                Riddell LJ, Dardarian N, McKinney S                                |
| 1430–1530    | **Concurrent Session 5**                                                 |
| 1430–1445    | Diets of stunted toddlers in urban Cambodia: low nutrient densities result in inadequate intakes of calcium, zinc, and vitamin A  
                Anderson VP, Cornwall J, Jack S, Hem N,  
                Hok P, Gibson RS                                                    |
| 1445–1500    | Effects of gamma-tocopherol supplementation on thrombotic risk factors and measures of oxidative stress  
                Singh J, Turner AH, Sinclair AJ, Li D,  
                Hawley JA                                                          |
| 1500–1515    | Calcium supplementation for improving bone density in children: a systematic review  
                Winzenberg TM, Shaw K, Fryer J, Jones G                            |
| 1515–1530    | Folate, vitamin B12, plasma thiols and cognitive function in an elderly population sample  
                Roach PD, Naumovski N, Dufficy L,  
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<p>| 1530–1600    | <strong>Afternoon Tea</strong>                                                        |</p>
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| 1600–1730| **Tackling child malnutrition in the context of Iranian primary health care system: barriers to effective nutrition programs**  
Javanparast S, Coveney J, Saikia U  
Withdrawn                                            | **The effect ofCLA on body composition in humans: systematic review and meta-analysis**  
Voedvin M, Sinclair A, Gibson R, Makrides M                                              | **The evaluation of a brief pilot nutrition and exercise intervention for the prevention of weight gain in general practice patients**  
Booth AO, Nowson CA, Huang N, Lombard C, Singleton KL                                    |
| 1600-1615| General practitioners’ perception of their role in dietary counselling  
Pomeroy S, Worsley T                                                                  | Anti-inflammatory activity of lipid-rich extract in Chinese mussels  
Li D, Yao T                                                                          | The effect of weight loss on blood pressure response to acute mental stress  
Torres SJ, Nowson CA                                                                   |
| 1615-1630| Implementation of the folate–neural tube defect health claim in Melbourne  
Lawrence MA, Brjakovic S                                                                   | Alternatives for elevating the omega 3 LCPUFA status of the population  
Portolesi R, Powell BC, Gibson RA                                                       | Salt and blood pressure: relationship with obesity, weight loss and direct effects on vascular function  
Keogh JB, Torpy DJ, Brinkworth GD, Clifton PM                                              |
| 1630-1645| Screening food-based libraries to identify antihypertensive bioactives  
Rogers PF, Patten GS, Bennett LE, Abeywardena MY                                               | A valid and reproducible food frequency questionnaire to estimate long chain omega-3 polyunsaturated fatty acid intakes  
Sullivan B, Brown J, Williams P, Meyer BJ                                                 | Predicting weight loss in overweight and obese people using a very low energy diet  
Delbridge EA, Prendergast LA, Pritchard JE, Proietto J                                        |
| 1645-1700| An economic evaluation of the re-introduction of a school milk program  
Dalton A, Bass S, Lawrence A                                                          | Effects of omega-3 polyunsaturated fatty acids on cardiovascular risk, exercise performance and recovery in Australian Football League (AFL) players  
Buckley JD, Burgess S, Murphy KJ, Howe PRC                                                   | A prospective study of the effect of a 12-week very low calorie diet on changes in health status, liver size and abdominal adipose tissue in the severely obese  
Colles SL, Dixon JB, O’Brien PE                                                               |
| 1700-1715| Short-term milk supplementation is inadequate to promote optimum peak bone mass for Chinese children  
Zhang Q, Greenfield H, Ma GS, Zhu K, Foo LH, Hu XQ, Cowell CT, Fraser DR                  | Combined effects of omega-3 supplementation and regular exercise on body composition and cardiovascular risk factors  
Hill AM, Buckley JD, Murphy KJ, Saint DA, Morris AM, Howe PRC                              | Using cognitive behaviour therapy to promote behaviour change in overweight and obese adolescents  
Brennan L, Wilks R, Walkley J, Fraser S                                                     |
<p>| 1715-1730|                                                                                     |                                                                                      |                                                                                       |</p>
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| 1900-2130 | **Public Forum**  
  **Ballroom**  
  Prof Michael Zemel, The University of Tennessee, TN USA  
  Prof John Foreyt, Behavioural Medical Research Center, Houston, USA  
  Prof Seppo Salminen, Prof Seppo Salmien, University of Turku, Functional Food Forum, FINLAND |

**FRIDAY 2 DECEMBER 2005**

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| 0830-1030 | **Invited Speaker Plenary 3 : Gene-Nutrient Interactions**  
  *Dietary regulation of skeletal muscle metabolic genes*  
  Dr David Cameron-Smith, Deakin University, VIC |
| 0830  | *Characterisation of a novel selective PPARγ modulator (SPPARγM) with insulin sensitizing and glucose lowering properties*  
  Dr George Muscat, University of Queensland, QLD |
| 0920  | *The influence of postnatal nutrition on metabolic and cardiovascular risk: insights from animal studies*  
  Dr Margaret Morris, University of Melbourne, VIC |
| 0945  | *Delivering nutritional and health benefits through genetically modified plant-based foods*  
  Dr Allan Green, CSIRO Plant Industries, ACT |
<p>| 1005  | Panel questions                                                      |</p>
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<td>1100–1230</td>
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Pan MX, Xu RJ  
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Aspin KE, Bevan BA, McGowan CM, Pollitt CC, Silkence MN  
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Noble GK, Munn KJ, Brockwell YM, Austin HE, Harris PA, Davidson HPB, Zhang D, Li X, Cao M, Byrden WL, Silkence MN  
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Sialic acid supplementation improves learning and memory in piglets  
| 1115–1130    | Increased protein intake from lean red meat replacing carbohydrate-rich foods lowers blood pressure in hypertensive individuals  
Hodgson JM, Burke V, Beilin LJ, Pudday IB  
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Moran LJ, Luscombe-Marsh N, Noakes M, Wittert GA, Keoghb JB, Clifton PM |
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Khosousi A, Pal S, Binns CW, Dhaliwal SS  
Does moderate red wine consumption protect DNA and lipid systems from oxidative damage: in vivo measurements in young and old humans?  
Micallef M, Lewandowski P  
Effects of dietary protein type on energy intake and appetite regulatory hormones  
Bowen J, Noakes M, Clifton P  
The relationship of nutrient intake to blood pressure in females  
Nowson CA, Conn J, Lucas M, Wark JD |
| 1145–1200    | The effect of lupin kernel flour bread on satiety, blood glucose and insulin response  
Lee YP, Hodgson JM, Puddey IB, Hall RS, Mori TA, Sipsas  
Whey proteins- GMP, body fat reduction and altered insulin status in rats  
McIntosh GH, Royle PJ, Clifton P  
Does oleoanthal, a pungent principal in olive oil, contribute to the health benefits of a Mediterranean Diet?  
Beauchamp GK, Keast RSJ, Morel D, Lin J, Pika J, Han Q, Lee C, Smith AB, Breslin PAS  
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Whey protein supplementation and resistance training to enhance muscle growth in young and older adults  
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<td>Balasundram N, Sundram K, Samman S</td>
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<td>Removal of microcystin from water using potential probiotic lactic acid bacteria</td>
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<td>Systemic and airway levels of glutathione and α-tocopherol in asthma</td>
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<td>Green tea supplementation alters liver fat oxidation and synthesis gene expression in rats fed high fat diets</td>
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<td>0855</td>
<td>Calcium and dairy modulation of adipose tissue metabolism and obesity risk</td>
<td>Prof Michael Zemel, The University of Tennessee, USA</td>
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<tr>
<td>0920</td>
<td>Use of the pig and obese minipig in nutritional and obesity research</td>
<td>Prof Frank Dunshea, DPI, VIC</td>
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<tr>
<td>0945</td>
<td>Can the obesity epidemic be stopped?</td>
<td>Prof Joe Proietto, Repatriation Hospital Heidelberg, VIC</td>
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<tr>
<td>1005</td>
<td>Predictors of weight gain in childhood and adolescence</td>
<td>Prof Louise Baur, University of Sydney, NSW</td>
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<tr>
<td>1030</td>
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| 1100-1130 | Morning Tea | sponsored by National Foods |


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<td>1130</td>
<td><em>Strategies for &quot;fat loading&quot; in endurance athletes</em></td>
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<td>Prof Louise Burke, Australian Institute of Sports, ACT</td>
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<td>1155</td>
<td><em>Interaction of exercise and diet to maximise the training adaptation</em></td>
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<td></td>
<td>Prof John Hawley, RMIT University, VIC</td>
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<tr>
<td>1220</td>
<td><em>Role of dietary fatty acids and exercise in insulin resistance</em></td>
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<td>Assoc Prof Mark Febbraio, RMIT University, VIC</td>
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Invited Speaker Plenary 1: Functional Foods

**Functional foods in Europe: state of the art and future perspectives**

S Salminen

*University of Turku, Functional Food Forum, Finland*

**Background** - Diet and health as research priorities have taken a major role in the European Union in the 1990’s. Focus areas have included diet and cardiovascular disease, bone health, physical performance, body weight regulation, diet-related cancer, mental state and performance, and gut health and immunity. These areas have significantly progressed and developed within European Community funded research programmes during the 1990-2005 with intensive collaboration e.g. with Australian researchers. During the same period, European Community has supported two major collaboration projects named Functional Food Science in Europe (1) and PASSCLAIM (2). These have enabled the European researchers to work closely together and to involve industry, scientists and regulators in the process to first develop guidelines and priorities for functional foods and then agree upon methodology to assess the substantiation of effects. The target has been to set the basis for a clear and consumer oriented legislative development in terms of functional foods health claims.

**The objective** - To develop regulations for functional foods using high standards and extensive processes for the assessment of scientific support for claims on foods.

**Outcomes** - The process has completed European consensus on defining functional foods as foods that have scientifically documented health effects beyond normal nutrition. The collaboration of academic scientists, industrial scientist and regulators from all European Union countries has created a unique and special background. By providing consensus agreements and scientific assessment framework that can be used throughout Europe the process has improved the credibility of potential claims for consumers and provided background documentation for those making and regulating health claims. Currently, both health claims related to the generally accepted role of nutrients and other substances as well as health claims related to diseases risk reduction have been proposed in Europe. The process has been discussed in the Parliament and proceeds towards finalizing the rules. At the same time, the European Food Safety Authority is preparing guidelines for practical demonstration of health claims and nutrient content claims. The process has been ongoing for ten years and has also facilitated the introduction of several new food products with scientifically demonstrated health effects. Focusing on food and health research by the industry has resulted in benefits for all consumers.

**References**

Invited Speaker Plenary 1: Functional Foods

**Functional foods—an industry dream?**
P Clifton

*CSIRO Human Nutrition, Health Sciences & Nutrition, Adelaide, South Australia*

Compared with the supplement industry the food industry is very restricted in the vitamins/minerals and bioactives that can be added to food and the claims that can be made about them. Under the new health claims legislation it is very likely the burden of proof will be considerable and very few foods/ingredients will have sufficient supporting data to enable a claim. Even a very well documented safe and effective ingredient such as plant sterols may not be allowed to be extended into a wider range of foods because of concerns by the states over a medicalised food supply, potential side effects of over consumption, cost effectiveness etc. This review will examine the status of plant sterols and blood cholesterol, dairy calcium and weight, dairy peptides and blood pressure, dairy conjugated linoleic acid and cancer.

**Plant Sterols**
Plant sterols in Australia are available only in margarines but in Europe they are available in milk, yoghurt, dressings, soy drinks and cheese-type products. In Australia applications under the novel food regulations for use in milk, bread and cereals have yet to pass the Ministerial Council. Concerns have been raised about the lowering of beta carotene with plant sterols, given the association with plasma beta carotene levels with protection from cancer, heart disease and diabetes and the fact that the lowering of LDL cholesterol with sterols in bread and cereals is less than the 10% usually seen with margarine.

**Calcium and Weight Management**
Dairy Australia says: “Exciting new research is emerging showing the benefits of dairy in weight management. A number of scientific trials demonstrate that including three daily serves of low-fat dairy in a reduced-calorie eating plan can accelerate weight and fat loss. Participants in the research also lost more centimetres from around their waists. So whether you want to lose weight, burn fat or simply stay lean and trim, make sure you consume three serves of dairy, every day”. These conclusions were based on data from Zemel in the USA (Zemel 2004) and have not been confirmed by other researchers in either humans or animals. The US Dairy council is being sued over their weight loss claim. A lot more data is required from many different researchers.

**Dairy Peptides and Blood pressure**
Milk fermented by Lactobacillus Helveticus contained tripeptides isoleucine-proline-proline (IPP) and valine-proline-proline (VPP), which have been shown to possess angiotensin converting enzyme (ACE) inhibitory activity in vitro and this is marketed in Japan by Calpis and in a different formulation by Valio in Europe. Two papers have been published from these groups both showing dramatic blood pressure lowering in humans which was not statistically different from the placebo when all data was used. Two independent studies showed a modest effect of fermented milk of about 2 mm systolic which was not significantly different from placebo.

**Conjugated Linoleic acid**
Conjugated linoleic acid (mostly cis 9, trans 11 form) is produced by ruminants and humans eat about 50-150mg/day. Animal studies show that at a human equivalent of about 3g/day it reduces mammary and prostrate cancers. The only downside is that at this dose level in humans it produces insulin resistance. More work is required before this can be marketed as a safe and effective functional ingredient.

**Conclusions**
Although diet is related to disease incidence, the data in relation to functional foods, with one notable exception, is at present not very compelling.

**References**
Invited Speaker Plenary 1: Functional Foods

**Enhancing health active compounds in milk through cow management**

PT Doyle¹, FR Dunshea¹, GH McIntosh²

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**Background** - Milk and dairy products provide a range of essential nutrients and also contain health active compounds. The concentrations of some of these compounds in dairy products can be enhanced by fortification, through cow genetics or by nutritional management of the herd. Consumers in some markets prefer ‘natural’ as opposed to fortified products. Successful on-farm manipulation of the concentrations of physiologically functional compounds requires systems that produce consistent concentrations in milk. Opportunities to increase the concentrations of protein bound organic selenium (Se), calcium (Ca) and conjugated linoleic acids (CLA) through cow management are discussed.

**Review** - A growing body of evidence suggests that protein bound organic Se is protective against some cancers. For example, McIntosh et al. (2004) reported reductions in colonic tumour incidence and burden in rats consuming selenised casein (1 ppm) relative to control and equivalent Se yeast treatments. This has increased interest in delivering Se in organic forms in enriched dairy products, to provide base nutritional requirements in countries where Se intake is low, and to provide intakes above recommended daily intakes for health benefits to people at risk of colon or other cancers. For the later purpose, concentrations in food or supplements need to be consistent and specified to avoid toxicity. Feeding supplemental Se-yeast complexes can increase concentrations in milk from around 10 µg/kg to in excess of 100 µg/kg with peak concentrations occurring within 1 week of feeding the supplement (McIntosh and Royle 2002; Heard et al., 2004). More recently, Heard et al., (unpublished data) have defined the effects of Se concentration in grain supplements on responses in milk Se concentration to organic Se supplements, and it is possible to produce protein products with 2 to 6 ppm Se. Epidemiological studies have shown an association between both milk and Ca intake and a reduced risk for colon cancer. In rats, a high Ca WPC80 (diet Ca content 0.8%) was more efficacious in decreasing AOM induced tumours than a low Ca WPC80 (diet Ca content 0.2%) (McIntosh and Royle, unpublished). Also, Ca from dairy sources appears to be more efficacious than Ca from other sources. On-farms, Ca supplementation has greater effects on the Ca concentration in milk than stage of lactation at key times of the year (G Walker unpubl. data). The predominance of Holstein-Friesian genetics and associated declines in the Jersey and crossbred proportions in the Australian dairy herd may have contributed to a decline in Ca concentration in milk. Effective supplementation strategies may lead not only to higher Ca in milk and the potential for producing functional dairy proteins, but could have benefits for cow health and longevity. CLA and trans vaccenic acid (TVA) occur naturally in milk fats and have been found to be protective against cancers in animal and in vitro models, with some supporting epidemiological evidence in humans. CLA and TVA concentrations in milk fat are higher in cows consuming pasture and are affected by pasture and supplement intakes (Dunshea et al. 2005). Improvements in understanding of rumen and mammary metabolism mean that it is theoretically possible to supplement the unsaturated fats consumed in pasture with those from oil seeds and fish oil to produce milks with high CLA and TVA. These approaches may also be used to enhance omega 3 fatty acids in dairy products.

**Conclusions** - Strategies exist to enhance concentrations of physiologically functional compounds in milk through cow nutrition. They need to be tested under commercial conditions and are only likely to be implemented where payment systems reward farmers for the increased value of the raw material.

**References**

Flavonoids in functional foods: potential to improve vascular function and cardiovascular health

JM Hodgson

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Background - Flavonoids are a class of compounds that occur in a wide variety of plant foods. A limited number of foods are particularly rich in flavonoids and can provide a significant contribution to flavonoid intake. These include tea, soy, red wine (derived from red grape skin and grape seeds), chocolate and several fruits. Isolated flavonoids derived from these flavonoid-rich plant foods can also be added to a food to produce a functional food. Flavonoids have been linked to better cardiovascular health. Accumulating data from population studies, studies using animal models, human intervention studies and in vitro studies suggest that a higher flavonoid intake can reduce the risk of cardiovascular disease. A major mechanism proposed involves effects to improve vascular function and lower blood pressure.

Population studies - Many prospective epidemiological studies have found an inverse relationship between flavonoid intake and risk of cardiovascular disease. Some studies have failed to show a benefit, which may be explained by either a uniformly low or high flavonoid intake within the populations studied. Overall, results of these studies suggest that flavonoids may provide modest protection against cardiovascular disease, but they do not establish a causal link.

Animal models of atherosclerosis - A causal link is supported by results of studies in animal models of atherosclerosis. Several studies have now shown that flavonoids, mainly from red grapes, can reduce the progression of atherosclerosis.

Human intervention studies - Results of human intervention trials provide further evidence for a causal link via effects on pathogenic pathways and risk factors for cardiovascular disease. The effects of flavonoids on a range of cardiovascular disease-related endpoints have been assessed in human intervention trials. Endpoints considered have included blood lipid and lipoprotein concentrations, endothelial function, arterial compliance and blood pressure, oxidative stress, platelet function and body fatness. For many of these, the data are inconsistent and/or limited.

Vascular function and blood pressure - Mostly consistent data from controlled trials does suggest that flavonoids can improve endothelial function and arterial compliance, and could reduce blood pressure in humans. The effects of flavonoids on endothelium-dependent flow-mediated dilatation in humans have been investigated in more than 10 randomised controlled trials in humans. Most of these trials have shown some improvement in endothelial function with flavonoids from sources including tea, red wine, red grape juice, and chocolate. Improvements in arterial compliance have also been observed with dietary flavonoids. Improved endothelial function and reduced arterial stiffness could play a role in blood pressure reduction. Studies on the effects of flavonoids on blood pressure provide varied results. Falls in blood pressure have been observed with increased flavonoid intake in some, but not all intervention studies. Results of cross-sectional population studies also support a relationship between higher flavonoid intake, particularly from tea, and lower blood pressure.

Conclusions - Overall, the evidence linking flavonoids with cardiovascular health is mounting, but is not yet conclusive. Effects of flavonoids to improve vascular function and reduce blood pressure could be at least partly responsible for any reduction in risk of cardiovascular disease. Further studies are needed to strengthen the evidence for these effects.
Invited Speaker Plenary 1: Functional Foods

Role of whey and whey components in regulating adipose tissue and skeletal muscle metabolism
MB Zemel

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Background - Thermodynamics and energy balance are clearly core factors involved in the obesity epidemic, with small increases in energy intake coupled with declining physical activity resulting in net positive energy balance and progressive weight and fat gain. Consequently, the obesity epidemic is often reduced to a simple question of energy balance, and proposed strategies accordingly focus upon best approaches to induce negative energy balance. However, obesity is a complex genetic trait, with multiple genes interacting to confer relative resistance or susceptibility to positive energy balance. Similarly, dietary components and patterns may affect the same metabolic pathways affected by genetic susceptibility and thereby alter energy portioning and obesity risk. A growing body of evidence, discussed in this review, suggests that dairy whey contains compounds that exert such effects and thereby contribute to healthy weight management.

Review - We have found dairy-rich diets to attenuate body fat accumulation and weight gain during periods of over-consumption of an energy dense diet and to increase fat breakdown and oxidation while preserving lean tissue during energy restriction. The underlying theory is that the calcitriol released in response to sub-optimal calcium intakes stimulates lipogenic gene expression and lipogenesis and inhibits lipolysis and fat oxidation, resulting in increased adipocyte triglyceride storage and excess adiposity, while the higher levels of calcium contained in dairy suppress calcitriol and exert the opposite effect. In addition, calcitriol inhibits adipocyte mitochondrial uncoupling and apoptosis, resulting in increased efficiency of energy storage on low calcium diets, while greater adipocyte uncoupling, energy dissipation and apoptosis occurs on dairy-rich diets. While these effects are attributable, in part, to calcium suppression of calcitriol, dairy is more than twice as effective as calcium per se in inhibiting adiposity, and this additional bioactivity resides in the whey fraction. Moreover, calcium is without effect on preserving lean mass during energy restriction, while whey confers significant protection. The angiotensin converting enzyme (ACE) inhibitory activity of whey contains a portion of this additional activity, as it attenuates autocrine angiotensin II-induced adipocyte lipogenesis. However, combining calcium and whey-derived ACE inhibitors produces an effect that is significantly less potent than that of intact whey, indicating the presence of other anti-obesity factors in whey; the identity of these factors is presently under investigation. Moreover, this combination does not retain the ability of intact whey to protect lean mass. Instead, the branched chain amino acid (BCAA) content of whey appears to contribute significantly to preservation of lean mass during energy restriction and expansion of lean mass in the absence of energy restriction; this effect is likely due to leucine stimulation of muscle protein synthesis and may also contribute to reduced adiposity as a result of the additional energetic cost of muscle protein synthesis. However, whey-free diets containing BCAA confer less lean mass protection than intact whey.

Conclusions - Whey components have the potential to play a significant role in weight management and protection of lean mass during dieting. While the calcium content of whey accounts for a portion of this effect (~50%), there are clearly other bioactive whey components which also contribute. However, although both ACE-inhibitory peptides and BCAA contribute to this additional bioactivity, they cannot fully account for the anti-obesity and muscle-protective properties of whey, indicating that there are other, as of yet unidentified, whey components which contribute to these effects.
Richard Read Memorial Plenary

Nutrient reference values for Australia and New Zealand: process and outcomes

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Background - In 2002, under the auspices of the Australian and New Zealand government departments of health, the NHMRC established a Working Party to develop a set of Nutrient Reference Values for Australia and New Zealand. The working party’s brief was to ensure that the recommendations were based on best available scientific evidence. Given the limited resources available for de novo assessment, the development of the reference values was to be based on the processes and recommendations that the United States:Canadian Governments used to develop their Dietary Reference Intakes. However, the Working Party was to take into account any unique aspects of the populations in Australia and New Zealand including environmental, geographical, physiological, ethnic and cultural factors of both countries; to consider new scientific evidence and other recent recommendations from countries such as the UK, the European Union countries or FAO:WHO and to follow processes and standards acceptable to the Australian and New Zealand governments.

Review - The first step in establishing the Nutrient Reference Values was to elicit expert reviews from specialist reviewers in Australia and New Zealand for each of the nutrients that had been identified in earlier joint meetings of Australian and New Zealand researchers and practitioners, as being of importance. These reviews were then assessed by the Working Party resulting in draft Nutrient Reference Values for all ages and lifestages being set for 35 nutrients. For infants an additional two recommendations were set for total fat and total carbohydrate. A further six nutrients were considered but no recommendations were made for any age of lifestage group as essentiality could not be clearly established. As well as establishing a set of reference values for nutrients which were adequate for physiological needs and which would prevent deficiency states (Estimated Average Requirements; Recommended Dietary Intakes or Adequate Intakes) or prevent toxicity (Upper Level of Intake), additional ranges (Acceptable Macronutrient Distribution Ranges) or targets (Suggested Dietary Targets) were set for some nutrients implicated in chronic disease etiology at levels that might prevent or alleviate the chronic disease burden. After setting the draft Reference Values a modelling process was undertaken to ensure that the recommendations were feasible. The draft Nutrient Reference Values were then sent out for public consultation in both Australia and New Zealand for a period of three months with just over 60 submissions being made. Issues which received the greatest prominence in submissions related to the feasibility of attaining intakes in various population groups in line with some of the recommendations (eg sodium, folate) and the need for updating population intake data, as well as nutrient and food intake guidelines to account for proposed changes. These submissions were then considered by the Working Party, the document and recommendations amended as necessary and sent for final process review. They were considered by the Health Advisory Committee of the NHMRC and then the Council itself for approval as well as to the Australian and New Zealand Government Departments of Health.

Conclusions - The NRV review process highlighted the limited data available for many nutrients and the need for ongoing research in this area. The data are often scant or drawn from studies that have substantial limitations. Apart from studies of frank deficiency disease, there are few studies that address the effects of inadequate intake on specific health indicators. The process also highlighted the need for current information on population intake data particularly in setting Adequate Intake figures which in the absence of reliable experimental data are based on median population intakes. The new reference values will require food and dietary guidelines as well as food labelling requirements in Australia and New Zealand to be updated.

References
Invited Speaker Plenary 2: Vitamin D & Bone Health

The significance of vitamin D to health in Australia
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Background - The main source of vitamin D is not derived from dietary sources, but from sunlight, however dietary supplements have been used to treat and prevent vitamin D deficiency for many years. The main affects of a vitamin D deficiency are seen on bone, characterized by rickets in infants and children and by osteomalacia in adults. Vitamin D deficiency in children was identified as a significant public health problem in industrialized nations in the northern hemisphere. When it was found in 1920s, that cod liver oil could cure rickets this led to widespread fortification of the milk supply, which was effective in eliminating rickets. There is now increasing evidence for possible benefits of living closer to the equator, increased sun exposure and/or maintaining higher levels of serum 25-dihydroxyvitamin D (25OHD) in prevention of a number of other diseases including breast, prostate and colorectal cancer, non-Hodgkin lymphoma, multiple sclerosis and Type 1 diabetes.

Review - In the Australian population there are a number of groups that are at high risk of developing vitamin D deficiency and these include the elderly, particularly in residential care, babies of vitamin D deficient mothers, those with skin conditions where avoidance or sunlight is advised, dark skinned people, particularly if veiled and patients with malabsorption. Mild vitamin D deficiency (serum 25OHD levels between 25-50nmol/L) are associated with increased parathyroid hormone secretion, and levels between 12.5-25 nmol/L is associated with reduced bone density, high bone turnover and increased risk of hip fracture in the elderly. We have recently found in elderly residential care residents, within the range mild deficiency to adequate vitamin D levels (range 25OHD 25 – 90 nmol/L), a reduction in the incidence of falls with vitamin D supplementation (10,000 IU weekly or 1,000 IU daily), together with calcium (600mg daily). Among those taking at least 50% of study medication, the incident rate ratio for falling was 0.63 (95% CI 0.48-0.82). In another Australian study conducted in men aged over 50 years with higher levels of serum vitamin D (mean serum 25OHD of 77 ± 23 nmol/L), daily supplementation with calcium-vitamin D fortified milk (1000 mg calcium and 800 IU of vitamin D3) over 2 years was effective in suppressing PTH and slowing bone loss (unpublished). A number of vitamin D supplementation studies have been performed overseas assessing the effect on fractures, and overall the data are consistent with a dose dependent reduction in fractures with vitamin D deficiency. However it there is little evidence that vitamin D supplementation has a role in fracture prevention in those with serum 25OHD levels above 50nmol/L.

Conclusions - A number of Australians, from specific groups, are at high risk of developing severe vitamin D deficiency. There is evidence that a number of people living in the community have circulating vitamin D levels in the range of mild vitamin D deficiency, but how this impacts on health is not known. The only group with mild deficiency to demonstrate a positive effect on a functional health index with vitamin D supplementation is the elderly in residential care, with a reduction in the rate of falls. Although mild vitamin D deficiency has been associated with biochemical abnormalities, we have no good evidence that increasing circulating 25OH levels improve health outcomes in other groups with mild vitamin D deficiency. We need more studies to determine the prevalence of vitamin D deficiency across all latitudes of Australia and intervention studies to assess the functional health outcomes of increasing vitamin D levels in those with mild deficiency.

References
Invited Speaker Plenary 2: Vitamin D & Bone Health

Vitamin D to prevent falls in older people in residential care

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The incidence of falls is high amongst older women in residential care. As a consequence of their high falls incidence and also because of their bone fragility, women in residential care account for one third of all hip fractures in Australia. In nursing homes in France, calcium and vitamin D supplementation has been demonstrated to reduce fracture incidence. It has been postulated that vitamin D and calcium supplementation could reduce the risk of fracture through a reduction in the incidence of falls. Falling may be consequent upon impaired neuromuscular function previously reported in those with low vitamin D levels.

We had previously demonstrated vitamin D deficiency in about one fifth of Australian hostel and one half of nursing home residents (defined as a serum 25-hydroxyvitamin D (25D) less than 25nM), and associations between the level of serum 25D and falling in these residents both retrospectively, and prospectively. However, until recently there was little trial evidence to determine whether administration of vitamin D could reduce the incidence of falls in these residents. We considered it unethical to randomise residents with vitamin D deficiency and thus chose to study residents whose vitamin 25D level was in the lower half of the laboratory reference range but were not classically deficient.

Older people resident in 60 hostels and 89 nursing homes in urban and rural centres across three states of Australia were approached. Subjects whose 25D level was greater than 25 nmol/l and less than 90 nmol/l were randomized to receive either vitamin D supplementation or placebo, either 10,000 IU ergocalciferol orally once weekly or 1000 IU daily. Institutional staff and study staff were blinded to treatment allocation. All subjects were prescribed 600 mg of elemental calcium in the form of calcium carbonate. Each subject was followed for 2 years. Residential care staff recorded falls and fractures prospectively. Compliance with vitamin D therapy was monitored by pill counts. Logistic regression and negative binomial models were used to examine the effect of vitamin D supplementation on falls and fractures, both before, and after, exclusion of subjects with less than 50% compliance with vitamin D.

There were 665 falls observed in 486 person years in the vitamin D supplement group compared with 890 falls observed in 478 person years in the placebo group. Using the negative binomial model that accounts for all falls, the incident rate ratio (95% CI) for the vitamin D supplement group compared to the control group was 0.73 (0.57, 0.95). There was also a trend favoring vitamin D supplementation for the odds of ever sustaining a fall, Odds Ratio (OR) 0.82 (0.59, 1.12) and fracture OR 0.69 (0.40, 1.18). Excluding 85 subjects whose vitamin D compliance was not greater than 50%, revealed a moderate reduction in the incident rate ratio for falls with vitamin D treatment, 0.63 (0.48, 0.82), and a moderately lower risk of sustaining a fall OR, 0.70 (0.50, 0.99). All estimates were almost identical after further adjustment for baseline serum 25D level, removing those subjects who had poor compliance with the calcium supplements or who were non-ambulant. Number-needed-to-treat analyses, suggest that 12 people needed to be treated to prevent one of those people falling during the time of the study, or that 8 people needed to be treated for one year to prevent a fall occurring.

This was the first long term trial of vitamin D supplementation that has demonstrated a significant reduction in the rate of falls. Our conclusions from previous studies, and our own, is that vitamin D supplementation has the greatest effect in decreasing falls in those older people who are frail, and have low or suboptimal pre-existing vitamin D levels, and that additional calcium supplementation may be necessary to maximise this effect. The precise pre-existing 25D level at which vitamin D supplementation is beneficial requires further investigation, but it now seems clear that it is well above the level of frank vitamin D deficiency (25nmol/L). Based on these findings, all older people in residential care should be considered for vitamin D supplementation.

The researchers gratefully acknowledge the contribution of the residents, their families and nursing and personal care staff from many facilities across Australia. Funding for this study was provided by NHMRC and VHPF.
Invited Speaker Plenary 2: Vitamin D & Bone Health

**Vitamin D: new insights into an old secosteroid**

RS Mason

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**Background** - Adequate vitamin D is well known to be important for bone health, primarily due to its ability to increase calcium and phosphate absorption from the diet, as well as promote good muscle function, but there is an increasing body of evidence which indicates that vitamin D may be important in a number of other conditions. Vitamin D is formed in skin when UV light opens up the B-ring of 7-dehydrocholesterol to form pre-vitamin D, which, at body temperature, converts into vitamin D. Thus vitamin D is not strictly a vitamin and is better termed a seco-steroid – a steroid with one of its rings disrupted. Some vitamin D is obtained from the diet but there are not many rich sources. Fortification with vitamin D is limited in Australia. Once made in skin, vitamin D is converted into 25-hydroxyvitamin D (25OHD) in the liver, with a near linear relationship between vitamin D and 25OHD. Vitamin D status is assessed by measuring 25OHD. In kidney and other tissues, 25OHD is converted into the hormonal form, 1,25-dihydroxyvitamin D, also called calcitriol.

**Adequate vitamin D** - Accumulating evidence indicates that adequate 25OHD concentrations are higher than the lower limit of most “normal” ranges, which is around 30nmol/L. Calcium absorption increases with increasing 25OHD concentrations up to 80nmol/L and then plateaus. Inadequate calcium absorption results in secondary hyperparathyroidism. Parathyroid hormone levels could be suppressed by high dose calcium and vitamin D in subjects with 25OHD concentrations below 50nmol/L but not those with higher 25OHD concentrations. Evidence of impaired lower extremity muscle function has been demonstrated in subjects whose 25OHD was below 40-60nmol/L. Thus in relation to bone and muscle, adequate vitamin D levels are at least 50nmol/L.

**Vitamin D and calcium** - While vitamin D is clearly important for calcium absorption, less well known is that adequate calcium is probably important to help conserve vitamin D. Low calcium intakes accelerate degradation of vitamin D compounds, probably due to secondary hyperparathyroidism. Supplemental calcium alone has been reported to increase 25OHD concentrations.

**Vitamin D and cancer** - Negative correlations have been reported between sunlight exposure/vitamin D intakes (in USA)/25OHD concentrations and the prevalence of or mortality from certain cancers including breast, prostate, colon, ovary and even melanoma. Whilst this association does not indicate any causative relationship, there are numerous studies which demonstrate decreased development of neoplasia or increased survival of animals with implanted tumours if animals are also treated with D compounds. There are a number of mechanisms possibly involved in these protective effects, including local production of calcitriol by tumour cells or invading macrophages, enhanced differentiation and reduced proliferation of tumour cells, a pro-apoptotic effect of active D compounds on tumour cells and reduced angiogenesis. When added topically to mouse skin, calcitriol or analogs decrease UV-induced DNA damage, sunburn cells and immune suppression.

**Other disorders** - Decreased development of type I diabetes has been reported in populations supplemented after birth with vitamin D. There is a clear latitude gradient for multiple sclerosis. In each case, animal models confirm the effects. Calcitriol has been shown to enhance the antimicrobial activity of cells through induction of genes coding for antimicrobial proteins.

**References**

Invited Speaker Plenary 2: Vitamin D & Bone Health

Do calcium and vitamin D in pregnancy influence offspring health?
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There has been much interest in the observed association between size at birth and risk of cardiovascular disease in adult life, but from a public health perspective we need to study factors that are potentially modifiable, rather than fetal growth or birth size.

**Calcium** - Adult offspring of rat dams with experimental calcium deficiency had higher blood pressure than offspring of control dams.1 In a cross-fostering study, spontaneously hypertensive rat pups suckled by calcium deficient mothers had higher mean arterial pressure, regardless of maternal calcium intake during pregnancy.2 In humans a negative association between maternal calcium intake and infant blood pressure was noted in two observational studies3,4 and in an experimental study, where systolic blood pressure in children of women given calcium supplements in pregnancy was lower than in children of controls.5 This association was significantly stronger with increasing BMI (P = 0.0001 for interaction) and strongest in children with BMI >17.5.

In 147 twin pairs in Tasmania, we tested the hypothesis that maternal calcium supplementation might also influence other risk factors for cardiovascular disease in their offspring. Children of supplemented mothers had lower geometric mean triacylglycerol, total cholesterol (T-C) and LDL-cholesterol (LDL-C) than other children. After adjustment for potential confounding factors, geometric mean ratios [95% CI] of 0.86 [0.75, 0.98], 0.94, [0.90, 0.99] and 0.90, [0.83, 0.98] respectively. The association with T-C and LDL-C was seen only among children with BMI >17.5: estimated ratios 0.85 [95% CI 0.79, 0.92] T-C and 0.79 (0.70, 0.90) for LDL-C (p for interaction 0.001 and 0.009 respectively).6 There was no significant association between maternal calcium supplementation and child size at birth and follow up, blood pressure, fasting glucose or insulin or HDL cholesterol. These findings are of potential significance for public health, and need to be replicated in other cohorts.

**Vitamin D** - Vitamin D is a potent steroid hormone that plays an important role in bone health, but is also involved in the regulation of cell proliferation and differentiation, so is potentially of great importance during gestation. In animal studies offspring of vitamin D deficient mothers have higher offspring blood pressure and altered brain and kidney development (Black, unpublished). In humans data from randomised controlled trials of vitamin D supplementation during pregnancy have yielded somewhat inconsistent results regarding birth size of their offspring, a summary measure of fetal growth, though most have been conducted in populations with low vitamin D concentrations.

In an observational study in Geelong, comprising largely Caucasian women, we examined the relationship between maternal 25-hydroxyvitamin D level (25-OHD) and parathyroid hormone (PTH) concentrations at 28-32 weeks of gestation and infant birth size measures, including knee-heel length measured accurately by knemometry. Gestation length was 0.7 weeks [95% CI -1.3, -0.1] shorter and knee-heel length 4.3 mm smaller [-7.3, -1.3] in infants of 27 mothers with low 25-OHD (<28 nmol/L) at 28-32 weeks. There was little evidence that low maternal 25-OHD was associated with other birth measures, and no evidence of linear association with maternal 25-OHD concentration. Maternal PTH concentration at 28-32 weeks was positively related to knee-heel length, birth weight and mid-upper arm and calf circumferences. These associations were independent of 25-OHD concentration.

**Conclusion** - Maternal calcium supplementation and vitamin D adequacy during gestation may be important for offspring health. Our findings regarding maternal PTH and offspring birth size require further study.

**References**
Invited Speaker Plenary 3: Gene-Nutrient Interactions

Dietary regulation of skeletal muscle metabolic genes
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Background - Skeletal muscle is the largest component of fat-free mass in humans. Skeletal muscle is also a dynamic tissue which undergoes marked metabolic and structural adaptation in response to altered nutrient availability and exercise patterns. A significant component of this cellular adaptation is the coordinated expression of mRNA species that encode the desired proteins. However, relatively little is known of the gene responses that take place within human skeletal muscle following either altered macronutrient availability or the interaction between macronutrient supply and exercise. The major macronutrients, carbohydrates and lipids, are the predominant oxidative substrates used by muscle. In addition to being a source of energy, both glucose and fatty acids (FA) communicate directly to the nucleus or via a range of transcription factors which regulate the expression of coordinated groups of genes. Our laboratory has focused on the regulation of genes essential for the oxidative metabolism of fatty acids, as an impaired capacity to oxidize lipids is a hallmark of insulin resistant states, including obesity, diabetes and advanced age.

Aims - Our experimental studies aim to evaluate the impact of FA and exercise on the control of genes that regulate lipid metabolism within human skeletal muscle.

Human clinical trials - Initial studies demonstrated that short periods of high fat feeding (48 hours to 4 days) increased the expression a range of genes important in FA metabolism, including; the FA transporter, Fatty acid translocase (FAT/CD36), the β-oxidative enzyme, β-hydroxyacyl-CoA dehydrogenase (β-HAD) and the negative regulator of glucose oxidation, pyruvate dehydrogenase kinase 4 (PDK4). Similar responses in gene expression were demonstrated with endurance exercise training, a condition in which oxidative capacity is enhanced.

To determine whether these effects are mediated rapidly via changes in fatty acid supply or sustained alterations in hormonal status, 7 healthy male subjects were infused with a sterile intravenous lipid emulsion (Intralipid) for 5 hours. Plasma FA concentrations and oxidation were increased. In response to this rapid perturbation in FA supply, expression of PDK4 was increased 15 fold. This same gene was shown to be increased by short-term fasting, with increased expression evident after 15 and 40 hours without food, consistent with an increased use of FA as the predominant fuel source of the muscle. Thus, these studies provide evidence that the PDK4 gene is sensitive to FA supply. Endurance exercise also results in increased plasma FA concentrations. To separate out the actions of muscular contraction, per se, rather than the increased plasma FA supply on the gene expression of PDK4, endurance cycling exercise was performed in the presence or absence of the lipolysis inhibitor, Acipimox. In this study, exercise increased PDK4 gene abundance, irrespective of the changes in plasma FA. Thus exercise and FA-supply may operate via independent pathways to elicit the expression of some genes.

Human muscle cell culture - Whether these gene changes are influenced by the type of FA studies have been undertaken using primary cultured human muscle cells. The exposure of muscle cells with the saturated FA, palmitate and the monounsaturated FA, oleate, both at a concentration of 250 µM increased PDK4 gene expression markedly. This action was dampened by the addition of a long chain omega-3 polyunsaturated FA, eicosapentaenoic acid (EPA). These data suggest that the actions of FA on gene expression differ depending upon the species of FA, with EPA, antagonizing the actions of other FA.

Conclusions - Fatty acids are potent regulators of skeletal muscle gene expression. These actions are mediated rapidly in response to increased FA supply. Thus muscle genes are regulated by the supply and type of FA present in the blood supply. On-going analysis is aimed at determine if the ability of FA to activate skeletal muscle genes is preserved or abnormally regulated in obese and diabetic states.
Invited Speaker Plenary 3: Gene-Nutrient Interactions

**Characterisation of a novel selective PPARγ modulator (SPPARγM) with insulin sensitizing and glucose lowering properties**

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**Background** - PPARγ is a member of the Nuclear Hormone Receptor (NR) superfamily, and the NR1C subgroup that includes PPARα and PPARδ. Inherited mutations in the PPARγ gene lead to dysfunctional lipid and glucose homeostasis. The NR1C subgroup functions as fatty acid (FA) sensors, and couples fluxes in low affinity dietary lipids/FAs to the transcriptional regulation of genes in lipid and glucose homeostasis. For example, the mono and polyunsaturated (but not saturated) FAs modulate PPARγ in the μM range. The total concentration of nonesterified FAs in human serum can exceed 1mM, and the more prevalent FAs can account for up to 20-40% of this total. The pathophysiological significance is underscored by many reports that diets rich in unsaturated FAs lower cholesterol and triglycerides levels, and elevate HDL cholesterol levels in animals and humans. Furthermore, the dietary polyunsaturated to saturated fat ratio differentially affects the body mass index in populations with common variants of the PPARγ gene, highlighting the importance of PPARγ (gene)-nutrient interactions.

Halofenate, a phenoxyacetic acid [(2-acetoamidoethyl (p-chloro-phenyl) (m-trifluoromethylphenoxy) acetate)] was tested clinically in the 1970’s as a hypouricemic, and hypolipidemic drug. Halofenate was shown to be very effective in lowering plasma triglycerides, cholesterol, uric acid and bilirubin levels in patients with a variety of hyperlipoproteinemias. Interestingly, hypoglycemic and hypoinsulinemic effects were serendipitously observed in dyslipidemic type II diabetic (NIDDM) patients after halofenate monotherapy, and in combination with oral hypoglycemic drugs. The therapeutic (and time course of the hypoglycemic) effects of halofenate mirrored some aspects of the TZD class of insulin sensitizers that are potent synthetic activators of PPARγ.

**Objectives** - We hypothesized that halofenate might act as an insulin sensitizer and we present data to show that halofenate is a selective PPARγ modulator (SPPARγM) with therapeutic utility.

**Outcomes** - We show that halofenic acid: (i) selectively activates PPARγ in a dose dependent manner (~EC₅₀ 30 μM); (ii) binds directly to human PPARγ (Ki of ~18-30 μM); and (iii) is a partial PPARγ agonist with ~ 20% the activity of the full agonist rosiglitazone. The partial agonism of halofenic acid reflects a unique footprint in the context of interactions with transcriptional cofactors. For example, the differential displacement of corepressors (N-CoR and SMRT) and the defective recruitment of the coactivators (p300, CBP and TRAP220). Specifically, halofenic acid displaced the co-repressors N-CoR and SMRT from PPARγ in a dose dependent manner yet did not induce recruitment of the co-activators p300, CBP or TRAP 220, relative to the potent PPARγ agonist, rosiglitazone. In addition, halofenic acid selectively modulated specific PPARγ responsive genes in differentiated 3T3-L1 adipocytes. In contrast to the potent agonist, rosiglitazone, halofenic acid did not induce genes involved in fatty acid storage and transport. Moreover, halofenic acid did not induce differentiation of primary human pre-adipocytes, and neutralized rosiglitazone-mediated adipogenesis. In vivo studies demonstrated that halofenate displays vigorous insulin sensitizing and glucose lowering properties in ob/ob mice.

**Conclusions** - These results demonstrate that halofenate is a novel selective PPARγ modulator that induces differential cofactor displacement and recruitment. Moreover, it demonstrates therapeutic anti-diabetic properties in the absence of adipogenic properties that lead to deleterious weight gain with TZD treatment in type II diabetic patients.
Invited Speaker Plenary 3: Gene-Nutrient Interactions

The influence of postnatal nutrition on metabolic and cardiovascular risk: insights from animal studies

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Background - Population studies suggest that nutrition in early life can influence subsequent risk of obesity and high blood pressure. Childhood obesity is increasing throughout the world, and demographic data suggest that environmental influences operating early in life are involved. Importantly, childhood obesity is associated with subsequent hyperlipidemia, glucose intolerance and hypertension. Managing childhood obesity and its consequences requires an understanding of the pathophysiological changes induced by early onset overnutrition. We are investigating the impact of early over- or under-nutrition in rodents on subsequent body weight, adiposity, hormone profile, blood pressure and brain neurotransmitters implicated in feeding.

Methods - To examine the impact of early postnatal overnutrition on blood pressure and adipose-derived mediators, we adjusted rat litters to 3 or 12 male pups (overnutrition and control respectively) on day one of life. This intervention provides pre-weaning overnourishment, which to date has been little examined. We have also examined the impact of continuous over-nutrition from birth, induced by small litter size followed by a high fat (30% calories as fat) diet.

Results - Small litter animals were significantly (25%) heavier than normal litter animals by day 14, and consumed approximately 25% more milk than normal litter rats. At weaning (day 24) plasma leptin concentrations were more than doubled, and remained significantly increased at 8 weeks of age, regardless of the post-weaning diet.1 By maturity (16 weeks) there was no significant effect of being raised in a small litter on plasma leptin, although consuming a high fat diet led to a doubling of leptin compared to low fat diet.1 At this time the white adipose expression of 11 beta hydroxysteroid dehydrogenase 1, the enzyme that converts inactive cortisone into cortisol, was significantly increased in small litter rats, across dietary groups. This suggests long-term effects of early onset overnutrition, possibly representing a programming effect. While body weight was not significantly elevated 16 weeks after overnourishment during the pre-weaning phase, we consistently observe a 5% higher body weight in rats raised in small litters, and on a population basis, relatively small changes such as these may be relevant to disease burden. Increases in blood pressure were more likely to be associated with high fat feeding, and these appeared delayed relative to the increases in body weight and plasma leptin. Similar 10-15 mm Hg increases in blood pressure were observed in rats subjected to high fat feeding as adults.2

Conclusions - Adjustment of litter size, thereby influencing early feeding patterns, can influence adult blood pressure. Rats overfed from an early age developed increases in body weight, along with changes in mediators involved in the both the regulation of feeding and blood pressure. An important question under investigation presently is the site of fat deposition as in humans central obesity was recently shown to be associated with greater sympathetic activation relative to peripheral obesity, possibly linked to greater cardiovascular risk.3

References
Plants are the mainstay of human diets, either through their direct consumption, or as the primary source of nutrients for marine and terrestrial animal production. The plant kingdom is comprised of an enormous species diversity that exhibits a vast array of chemical compositions in both vegetative and fruiting tissues. This diversity results partly from different plant species implementing different adaptive responses to the various environmental challenges they faced during evolution, and also partly from purely random variations that have no consequences for plant fitness but are maintained in species because of their selective neutrality. Thus, plants did not evolve their specific chemical compositions in order to meet the particular nutritional requirements of humans, but in response to their own survival imperatives. Humans have simply chosen from within this abundant variety, a limited array of plant foods that are primarily safe to eat, provide sufficient essential nutrients for life and reproductive fitness, and that are desirable to our tastes. Most of these plants foods have been taken into cultivation since the advent of agriculture and have been selectively bred to further improve their yield, performance, consumer appeal and, in some cases, nutritive value.

Through advances in human nutritional research we have an increasing understanding of the relationship between the chemical composition of our food and the status of our health and well-being. We now recognise the role of a wide range of nutrients, vitamins and minerals in our general health and the impact that deficiencies in these can have in bringing about specific illnesses. In recent years, much has also been learnt about the role of particular “bioactive” compounds in alleviating or controlling a range of degenerative diseases that are increasing in prevalence in the now long-lived populations of the developed world. The roles of specific fatty acids, sterols, antioxidants, and other metabolites in reducing risk of cancers, cardiovascular disease, inflammatory conditions, and neurological disorders are being widely acknowledged and the mechanisms of these effects are being unraveled. Not surprisingly, it is being revealed that many traditional foods selected in much earlier times for safety, culinary appeal and basic nutrition by humans having a significantly shorter life span, are either lacking or deficient in many of these bioactive compounds that have favourable impacts on the degenerative diseases of older populations. For example, land plants lack any of the long-chain polyunsaturated fatty acids (LC-PUFA) that are present in marine microalgae and fish and which have been shown to have valuable health benefits in prevention and control of a range of diseases. Similarly, phytosterols having significant LDL-cholesterol lowering properties occur naturally in our food oils at concentrations that are too low to have significant health benefits at normal dietary intake levels. Although such shortcomings in our diets might be able to be alleviated at least in part through changing the spectrum of foods that we eat, this is not always feasible or practical, and has proved a frustratingly difficult strategy to implement in both developed and undeveloped cultures. In recent years, an alternative strategy has been adopted by the food industry through the fortification of foods during processing with nutritionally desirable bioactives extracted from enriched sources. These so-called “functional foods” attempt to provide nutritionally effective levels of bioactives in mainstream foods that are already well-accepted by consumers. Although this may be an effective strategy, it can also be a costly one, particularly where the source of the bioactive is relatively rare or the costs associated with its development as an ingredient are high. For instance, the high costs of phytoesterol extracts contribute substantially to the large price premium for cholesterol-lowering spreads containing phytosterol esters compared to conventional spreads. Large premium prices can restrict the widespread adoption of these beneficial products, thereby limiting the extent of public health benefits achieved and also raising issues of nutritional equity.

An alternative strategy for delivering nutrition and health benefits associated with specific bioactives is to genetically enhance (bio-fortify) the levels of these compounds in food raw materials through the use of plant biotechnology. The presence of a bioactive compound in an organism is simply the result of it having specific genes that encode the enzymes responsible for the synthesis of that compound. The appropriate genes from a source rich in the bioactive can now be cloned and transferred to mainstream food plants to equip them with the ability to synthesise nutritionally effective levels of the bioactive. Using this approach, Golden Rice was recently developed to contain sufficient β-carotene to avoid vitamin A deficiency in populations consuming rice as their staple food. Similarly, plants are now being developed to contain the essential LC-PUFA such as EPA and DHA, to overcome our reliance on dwindling fish supplies for these important nutrients. The bio-fortification approach has potential to be applied to a range of other nutrients and bioactives that are now being revealed to have significant benefits to human health and well-being, and in many situations may be more attractive than the current approach of ingredient fortification.
Consequences of growth retardation early in the life of cattle

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**Background** - The beef industry in Australia is subject to variable pasture availability and quality. This results in numerous growth path possibilities that may influence growth potential and body and carcass composition of cattle and eating quality of beef. Studies of cattle within pasture-based nutritional systems have failed to demonstrate substantial long-term differences in body or carcass characteristics due to prenatal nutrition and growth1 or nutrition and growth from birth to weaning.1 However, severe nutritional restriction from birth to weaning followed by concentrate (high energy) feeding from weaning resulted in increased fatness at the same live and carcass weights compared to cattle well-nourished to weaning.1 Furthermore, the extent to which growth early in life interacts with genotype to influence long-term outcomes for growth, carcass and beef quality characteristics of cattle has not been investigated.

**Objective** - To determine the extent to which prenatal and pre-weaning growth influence subsequent growth, composition and meat eating quality of cattle sired by bulls with high muscle (Piedmontese breed) or high intramuscular fat (Wagyu breed) growth capacity.

**Design** - Piedmontese × Hereford (n = 120) and Wagyu × Hereford (n = 120) calves of low (28.6 kg, n = 120) or high (38.8 kg, n = 120) birth weight were nourished to grow slowly (554 g/d, n = 119) or rapidly (875 g/d, n = 121) to weaning at 7 months of age (total n = 240). They were grown from weaning to feedlot entry at 26 months of age on improved, temperate pasture, then lot-fed a grain-based diet until conclusion of the study at 30 months of age.

**Outcomes** - Low birth weight calves grew more slowly to weaning and in the feedlot, were 56 kg smaller on average at conclusion of the study, and had similar composition and eating quality characteristics compared to those of high birth weight. Cattle grown slowly to weaning weighed 70 kg less at weaning, grew more rapidly post-weaning but remained 40 kg lighter at conclusion of the study, and were leaner and had similar meat eating quality at 30 months of age compared to those grown rapidly to weaning. **Genotype × early-life nutrition interactions** were not evident.

**Conclusions** - Fetal growth retardation resulted in slower subsequent growth and reduced size of cattle, but had little effect on composition and meat eating quality at 30 months of age. In cattle grown slowly to weaning, compensation in weight was incomplete and cattle were leaner with similar meat eating quality at 30 months of age. These findings on consequences of low birth weight for body or carcass composition are consistent with previous research in cattle,1 but in contrast to findings in sheep grown to 20 kg or 35 kg live weight in which increased fatness was evident following severe foetal growth retardation that resulted in low birth weight. However, our findings are consistent with previous studies in sheep6,7 that showed no adverse effects on eating quality due to restricted nutrition during pregnancy, and with previous research in cattle in which nutrition and growth early in life did not adversely affect beef eating quality characteristics.3

**References**

Invited Speaker Plenary 4: Animal Nutrition-CRCs

The impact of selection for muscling on carbohydrate metabolism
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Background - An adequate level of muscle glycogen at the time of slaughter is essential for ensuring the production of premium quality meat, and minimising the incidence of dark cutting in cattle and sheep. Muscle glycogen status is likely to reflect the rate of turnover, principally driven by the sensitivity of muscle to insulin/nutrition, and adrenalin/stress. Breed indices for sheep and cattle are focused towards selection for muscling, potentially impacting on muscle glycogen metabolism and thus dark cutting.

Objective - Determine the impact of selection for muscling on insulin and adrenalin sensitivity in cattle and sheep.

Design - 12 steers from either Piedmontese (heavy muscling genotype), or Angus sires, and 20 5-month old lambs with sires selected for extremes (high v low) in Muscling Estimated Breeding Value (EBV) were maintained on a pelleted concentrate ration and challenged with adrenalin at 0.1, 0.2, 0.4, 0.6, 0.9, 1.2, and 1.6 µg/kg liveweight via indwelling jugular catheters. In cattle these challenges were undertaken at 15 and 36 months. Blood samples were taken prior to, and up to 120 min following administration of challenges for the determination of plasma lactate concentration – an indicator of muscle response. Peak plasma lactate response was analysed for either difference between breeds (Angus or Piedmontese) or impact of Muscling EBV (sheep analysis) using a linear mixed effects model, with level of adrenalin challenge and basal lactate concentration as covariates, and animal as a random term.

Outcomes - Increasing adrenalin challenge lead to a linear (lambs) and curvilinear (cattle) increase in plasma lactate peak response (P <0.05; Fig. 1a & b). The slope of this increase for the low muscle EBV lambs (ie EBV = -2) was more than twice (P <0.05) that of the high, suggesting that high muscle EBV lambs are less sensitive to adrenaline at the level of the muscle. In cattle there was no difference between breeds at 15 months, but both breeds demonstrated increased adrenalin sensitivity at 36 months (P <0.05). In the Angus sired cattle, the increase in sensitivity (ie slope) was almost twice that of the more heavily muscled Piedmontese (P <0.05). Thus, as was the case in lambs, the more heavily muscled genotypes are less sensitive to adrenaline at the level of the muscle.

Conclusions - Selection for muscling will reduce stress sensitivity in muscle tissue potentially resulting in more muscle glycogen at slaughter, and less dark cutting in sheep and cattle.

Figure 1. Plasma lactate peak response versus increasing adrenalin challenge for a) sheep with high and low muscling EBV and b) Angus, and Piedmontese sired cattle at 15 and 36 months of age. Values are least square means ± sem.

References
Invited Speaker Plenary 4: Animal Nutrition-CRCs

An integrated approach to understanding gut function and gut health of chickens
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The gastrointestinal tract performs a selective barrier function between the tissue of the host animal and its luminal environment. On the one hand, the mucosa must allow efficient transport of water and nutrients, but on the other, it must resist the passage of potentially harmful microorganisms, and toxins produced either by gut microorganisms or ingested in the feed. The integrity of the barrier can be disrupted when pathogenic microorganisms and toxins damage cells lining the lumen, or alter tight junction integrity. The barrier comprises physical, chemical, immunological, and microbiological components. Mucus coating the villi, tight junctions between enterocytes on the villi and commensal bacteria attached to the mucosa block the approach and entry of potentially harmful agents such as pathogenic bacteria, viruses, fungi, parasites, toxins, undigested feed and antigens in feed, and, of course, digestive enzymes. Mucins secreted by goblet cells in the intestinal villi also provide a chemical defence by binding to bacteria. The intestine is also an immunologic organ of considerable significance; capable of mounting innate and specific challenges to antigens associated with microorganisms and ingested feed. Development of the commensal microflora in the chicken gut plays an important role in intestinal maturation, physiology and immunity. Commensal bacteria, such as members of the Lactobacillus genus, which are naturally present in the chicken gut at high numbers throughout the production period, are likely to play an important role in gut health.

Metabolic stresses associated with diet, environment and management can negatively affect the delicate balance among the physical, chemical, immunological, and microbiological components of the chicken gut and severely impair efficient growth and feed conversion. To maintain productivity, vaccination and in-feed antibiotic growth promotants have been the mainstays of industry to control a range of economically important diseases. Currently, there is keen interest in developing improved nutrient formulations to increase protein accretion and hence enhance growth rates. Little attention has been given to the use of nutraceuticals such as ω3 PUFA as dietary supplements to reduce stress, and indigestible carbohydrates to favourably modify the gut microflora, and improve intestinal health and immune responsiveness.

In a recent comprehensive review of dietary regulation of intestinal gene expression, Sanderson and Naik concluded, “Understanding how nutrition can alter intestinal gene expression is an early step in the realization of its therapeutic implications for the future”. They pointed out that the diet is a potent mechanism for altering the environment of enterocytes and described how various nutritional factors such as complex carbohydrates and metabolic products of gut microflora can influence gene expression. More recently, Sibjen et al. described changes in cytokine gene expression in chickens after challenge with S. typhimurium lipopolysaccharide and modulation by dietary omega-3 polyunsaturated fatty acids. Kelly and King concluded “Unravelling the cellular and molecular basis of bacterial colonization, host recognition and the modulatory effects of bacteria in intestinal cell signalling and gene expression will provide the platform for the development of safer therapeutics to prevent disease and promote intestinal health”.

The Australian Poultry CRC seeks to establish the respective roles of these dietary supplements in sustainable poultry production without reliance on antibiotics. We hypothesise that impairment of intestinal barrier integrity and stress-induced inflammatory responses in intensively housed birds will be attenuated by ω3 PUFA modulating cell membrane structure/function and inflammatory mechanisms, and by indigestible carbohydrates favouring the development of a healthy gut microflora in general and lactobacilli in particular.

References
Invited Speaker Plenary 4: Animal Nutrition-CRCs

Can sheep thrive on salty diets?
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1,2,3,4 CRC for Plant-Based Management of Dryland Salinity

Background - In southern Australia up to 2 million hectares of land in the high rainfall and mixed farming zones is affected by dryland salinity. Despite our best efforts to counter this problem through the strategic management of recharge areas, over the next 20 years more land will become saline, leaving some individual farmers with up to 30% of their property affected. Much of this land may never be returned to its former condition. However, it has been suggested that approximately 50% of salt affected land is suitable for improvement by planting halophyte-based (salt tolerant) pastures. This has significant implications for animal production, as only the grazing industry has the existing infrastructure and markets to make productive use of such land on this scale. Accordingly, a key aim of the CRC is to understand the consequences, opportunities and risks associated with feeding ruminants high salt diets, as well as other secondary compounds known to accumulate in halophytic plants.

Objectives - To determine the physiological and functional implications of feeding high salt diets to grazing ruminants, so that risks and benefits can be identified, and production systems optimized, to make the best use of saline land.

Design - A program of research has been designed to investigate numerous aspects of salt tolerance in ruminants, from the level of the farm production system, through studies on the individual animal, down to the molecular level of cellular responses. Comparative studies using cattle, and various breeds of sheep selected for meat or wool production, will help to identify the existing species and breeds that are best suited to grazing salty pastures. Physiological responses of sheep to high salt diets are being measured, in terms of diet selection, feed intake, digestibility, growth rate, feed conversion efficiency, and water requirement. The effect of a salt load on fetal development has been investigated in pregnant sheep and their lambs. Endocrine markers of the response to NaCl are being sought, with a view to developing rapid screening, selection and toxicity tests. The way in which salt affects rumen microorganisms is being investigated at the molecular level, and physiological responses are being measured in both plants and sheep after grazing saltbush, to identify and characterize the effects of secondary compounds in a halophyte diet.

Outcomes - Dietary NaCl decreases feed intake and digestibility in ruminants in a concentration-dependant manner, and beyond a concentration of approximately 12% NaCl, growth in sheep is depressed significantly. Nevertheless, sheep will select a high energy/high protein feed that is also high in salt, in preference to a feed that is low in salt, protein and energy, and will combine high and low salt feeds to improve the overall quality of their diet. At low levels of NaCl (up to 8% dry matter) cattle appear to tolerate salty diets better than expected, and do not show the same depression in feed intake observed in sheep. Furthermore, at high salt concentrations (20% dry matter), feed efficiency is improved markedly in cattle (and to a lesser extent in sheep), such that body weight is maintained for up to 6 wk, despite a 50% reduction in organic matter intake. When a salt load of 15% NaCl was administered to ewes throughout pregnancy, no detrimental effects were observed on blood pressure, lambing rate, or lactation, with some evidence that the pattern of water consumption and urine output in their lambs is altered following an acute salt challenge. Both insulin and leptin concentrations are altered by feeding salty diets, but further work is needed to isolate the direct effects of NaCl from those mediated by associated changes in feed intake. Only a small proportion of the rumen microbial population is able to tolerate high concentrations of NaCl added to rumen fluid in vitro. Finally, growth performance declines markedly when sheep graze on saltbush for more than 28 d, and the causative factor is being investigated.

Conclusion - Much remains to be learned about the way ruminants manage salty diets, but based on the degree of tolerance and adaptation that has been shown in studies to date, there is great potential for cattle and sheep graziers to make productive use of saline land. Compounds other than NaCl that accumulate in halophytic plants need further investigation, however, to safeguard these animals and to inform strategic plant breeding initiatives.
Invited Speaker Plenary 5: Obesity/Diabetes/Metabolic Syndrome

Trends in the long-term management of obesity

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Obesity is the number one public health problem in the world today. Its prevalence is increasing alarmingly in both developed and developing nations. Unchecked, it will continue to drain the health care resources of all countries. In the United States, for example, its prevalence has increased dramatically in recent years and now accounts for almost one-third of the adult population. Obesity is a complex multifactorial chronic disease that results from an interaction of one’s genes and environment. It is a chronic, incurable condition, with significant health, economic, and personal costs. It requires long-term management similar to type 2 diabetes and hypertension. The purpose of this presentation is to evaluate the published evidence for new trends in the clinical and environmental long-term management of obesity. Currently, lifestyle and psychosocial treatments form the basis for clinical management of obesity. These approaches have their roots in behavior modification and include a multitude of techniques and strategies that focus on changing behaviours that are believed to contribute to or maintain obesity. Most of the various lifestyle approaches have several factors in common, including the use of self-monitoring and goal-setting, stimulus control and modification of eating styles and habits, use of reinforcement for healthy behaviours, nutritional education and counseling, physical activity, and cognitive-behaviour therapy interventions that focus on problem solving and improving coping skills. These interventions produce moderate weight losses and have minimal side effects. They are most helpful as a primary or adjunctive form of treatment for patients with BMIs less than 40. Newer trends in the clinical management of obesity include combining lifestyle intervention with portion-controlled meal replacements, prepackaged low-calorie products and meals, planned snacking and structured eating; the use of the Internet and related delivery systems; combining lifestyle changes with long-term use of pharmacotherapy; and the use of lifestyle approaches plus bariatric surgery. Earlier interventions with high-risk populations and an emphasis on prevention in our children are urgently needed. Because obesity is influenced by numerous biopsychosocial factors and is partially the result of a mismatch between our modern lifestyle and the environment in which humans evolved, simple solutions are inadequate to address this complicated issue. Despite the interest and progress in genetic research, major public health advances only will occur when we take the environment seriously. Research on the long-term management of obesity, including the environmental interactions that play a role in its development and maintenance, should have the highest priority. Only by addressing and modifying our obesogenic environment will we be able to stem the tide. Until we do this, we will not make substantial progress in addressing the public health epidemic of obesity.
Invited Speaker Plenary 5: Obesity/Diabetes/Metabolic Syndrome

Calcium and Dairy Modulation of Adipose Tissue Metabolism and Obesity Risk
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Background - A substantial body of data has emerged over the last five years to indicate that dietary calcium and dairy foods modulate adipocyte lipid metabolism and energy partitioning between adipose tissue and lean body mass, resulting in a significant “anti-obesity” effect. This effect is supported by a clear mechanistic framework, prospective and retrospective epidemiological reports and observational studies, secondary analyses of past clinical trials originally conducted with other primary endpoints (i.e., skeletal, cardiovascular) and prospective clinical trials. Further, these findings are evident in populations of multiple ages and ethnicities, suggestive of a generally robust effect, as discussed in this review.

Review - Dietary calcium appears to play a pivotal role in the regulation of energy metabolism and obesity risk. High calcium diets attenuate body fat accumulation and weight gain during periods of over-consumption of an energy-dense diet and increase fat breakdown and preserve metabolism during caloric restriction, thereby markedly accelerating weight and fat loss. This effect is mediated primarily by circulating calcitriol, which regulates adipocyte intracellular Ca\(^{2+}\). Studies of human adipocyte metabolism demonstrate a key role for intracellular Ca\(^{2+}\) in regulating lipid metabolism and triglyceride storage, with increased intracellular Ca\(^{2+}\) resulting in stimulation of lipogenic gene expression and lipogenesis and suppression of lipolysis, resulting in adipocyte lipid filling and increased adiposity. Moreover, the increased calcitriol produced in response to low calcium diets stimulates adipocyte Ca\(^{2+}\) influx and, consequently, promotes adiposity, while higher calcium diets inhibit lipogenesis, promote lipolysis, lipid oxidation and thermogenesis and inhibit diet-induced obesity in mice. Notably, dairy sources of calcium exert markedly greater effects in attenuating weight and fat gain and accelerating fat loss. This augmented effect of dairy products versus supplemental calcium has been localized, in part, to the whey fraction of dairy and is likely due to additional bioactive compounds, such as angiotensin converting enzyme (ACE) inhibitors in dairy, as well as the rich concentration of branched chain amino acids, which act synergistically with calcium to attenuate adiposity; however, these compounds do not fully account for the observed effects, as whey has significantly greater bioactivity than found in these compounds. These concepts are confirmed by epidemiological data as well as recent clinical trials which demonstrate that diets which include at least three daily servings of dairy products result in significant reductions in body fat mass in obese humans in the absence of caloric restriction, markedly accelerate the weight and body fat loss secondary to caloric restriction and attenuate regain of body weight and fat in individuals who have successfully lost weight.

Conclusions - It is important to interpret these findings within the context of overall energy balance, and these data should not be interpreted to suggest that increasing dairy intake will facilitate weight loss independent of energy balance considerations. Nonetheless, these data provide the framework for the development of strategies to utilize dairy products and dairy ingredients for the prevention of overweight and obesity and, in conjunction with controlling energy balance, for effective weight management.

References
Use of the pig and obese minipig in nutritional and obesity research
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Background - To develop preventative and treatment strategies to control obesity and resultant metabolic syndrome it is necessary to have animal models to study the aetiology of the metabolic syndrome. Obese minipigs are thought to be a good model for studying metabolic syndrome as they display insulin resistance and exhibit impaired glucose and amino acid utilisation. In this paper data supporting the use of the pig as a model for nutritional and obesity studies will be presented as will studies investigating some interventions, such as high protein diets.

Review - The pig is considered to be very similar to the human with respect to many aspects of intermediary metabolism allowing us to study how dietary factors may reduce the risk factors for a number of diseases. More recently, our attention has turned to obesity and the possibility that high protein diets, particularly those of dairy origin, may be beneficial in satiety and weight control. The major proteins present in milk include β-lactalbumin, α-lactoglobulin, immunoglobulin, bovine serum albumin, and the caseins: κ-casein, β-casein, and the α-caseins. In addition, whey contains glycomacropeptide (GMP) that is cleaved from κ-casein during casein precipitation. Some whey protein isolates (WPI) are relatively high in GMP, which is thought to have intrinsic satiating effects. In a study conducted to demonstrate the relative differences in insulin sensitivity between lean and obese pigs 8 obese mini (141 kg, 50% body fat) and 8 conventional lean (111 kg, 27% body fat) female pigs were offered diets containing two sources of protein (WPI vs soy protein isolate (SPI)) formulated to provide 100% of CP requirements for at least 10 wk. The WPI contained 46, 30, and 8% β-lactalbumin, GMP and α-lactoglobulin, respectively. Pigs were infused i.v. with insulin at 0.6 and 6.0 mU/(kg.min) and blood glucose and amino acids clamped at pre-infusion values by i.v. infusion of dextrose and amino acids. Pigs were also injected with epinephrine (3.0 µg/kg) and the metabolic responses measured. Dextrose (11.8 vs 9.2 mg/(kg.min), P = 0.08) and amino acids (1.42 vs 0.80 mg/(kg.min), P = <0.001) required to maintain glycemia and plasma lysine were higher in lean pigs. Also, the plasma NEFA response to epinephrine was muted in the minipigs (0.48 vs –0.28 mM.min, P<0.001). Next, to test whether dietary protein could influence metabolism, 16 obese adult female minipigs (133 kg, 50% body fat) were allocated to a 2x2 factorial design with the respective factors being source of protein (WPI vs SPI) or level of dietary protein (11 (LP) vs 22% (HP) CP). After consuming their respective diets ad libitum for 10 weeks insulin infusions as outlined above were conducted. Feed intake was lower in pigs fed the HP diet (2070 v. 2352 g/d, P <0.001), particularly in pigs fed WPC (1951 v. 2408 g/d) as indicated by an interaction (P = 0.027) between source and level. Pigs consuming the HP diet deposited less weight (231 v. 382 g/d, P = 0.045) and had a lower ratio of fat:lean in the ham (0.70 vs 0.76, P = 0.026) at 8 weeks than those fed the LP diet. Protein source had no effect on the amount of dextrose infused to maintain euglycemia (108 v. 115 mL/h P = 0.59) but the amount infused was lower in the minipigs fed the LP diet (101 v. 125 mL/h, P = 0.048). Protein source had no effect on the amino acid infusion rate required to maintain plasma lysine concentrations (50 v. 50 mL/h, P = 0.98) but the amount infused was lower in pigs fed the LP diet (45 v. 55 mL/h, P = 0.030).

Conclusions - Obese minipigs exhibit insulin and epinephrine resistance. A HP diet reduces feed intake, weight gain and fat deposition and reduced insulin resistance in obese minipigs. The HP diet containing WPI that was enriched in GMP had the greatest effect upon feed intake and weight gain.

References
Invited Speaker Plenary 5: Obesity/Diabetes/Metabolic Syndrome

Can the obesity epidemic be stopped?

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Australia, together with many other parts of the world, is experiencing an epidemic of obesity. Recent surveys have shown that 52% of adult women and 67% of adult men are either overweight or obese (BMI > 25 kg/m$^2$). Of these, 20% of both men and women are obese (BMI > 30 kg/m$^2$). This increase in the weight of the population is causing grave concern in the community since obesity either causes or aggravates a long list of disorders including type 2 diabetes, dyslipidaemia, hypertension, sleep apnoea, arthritis, polycystic ovary disease and more. Not surprisingly with a condition that afflicts over half of the population, there is much debate about the public health measures that should be taken to stem the tide. Will public health measures work?

The Minnesota Heart health study was a comprehensive 5-city study designed to reduce cardiovascular risk. There were 3 intervention and 2 control communities. It was shown that in one of these communities, Mankato, after 2 years of participation, the inhabitants were significantly more exposed to activities promoting cardiovascular disease prevention compared to control cities most designed to lose weight, eat healthy foods and be active. Surprisingly the end result was that while some cardiovascular risk factors improved, there was no difference in the rate of weight gain between the intervention and study communities. Why? The authors blamed competing unhealthy messages that were airing at the same time such as advertisements for junk food, coke? Is it possible to put out healthy messages and at the same time reduce unhealthy ones. I will argue that this scenario is at present impossible in capitalist democracies, that the required changes in society such as the banning of television junk food advertisements to children, reduction in use of cars, etc cannot be legislated without heavy political fallout. In addition, positive changes such as the building of bicycle paths, school exercise programs, workplace activity programs will not work since they do not reproduce the obligatory activity that was a feature of life before the technological revolution we are living through now.

Apart from the social, political and cultural barriers to a successful reversal of the obesity epidemic, there are also biological impediments that need to be overcome. Firstly there is evidence that body weight is homeostatically regulated and that individuals who lose weight will put in place mechanisms to return to their previous weight. Secondly, the evidence that body weight is genetically regulated is overwhelming. Several genes that can cause severe obesity have already been identified these include the genes for leptin, the leptin receptor, and more commonly the melanocortin 4 receptor. Those opposed to the idea of a genetic basis of body weight regulation ask how can the obesity epidemic be genetically based when the prevalence of obesity has risen from 7.1% to 18.4% between 1980 and 2000? The answer may lie in animal data suggesting a true gene-environment interaction in which exposure to fatty foods in youth will cause (only in genetically susceptible animals) the development of obesity that, once established, is defended. These genetically obesity-prone rats do not become obese if fed a low fat chow diet from birth.

It is concluded that the challenges facing us in stemming the obesity epidemic are such, that any public health measure proposed should be first investigated before general implementation.

References

Overweight and obesity in childhood and adolescence are increasingly prevalent in westernised countries, and in countries undergoing economic transition. An improved understanding of the factors promoting, or protecting against, the development of obesity is important for effective public health and clinical interventions. There is a strong familial association with obesity, a major part of this association being via a shared genetic predisposition. However, the increased prevalence of obesity in recent decades in genetically stable populations highlights the central role of environmental trends in the development of the obesity epidemic. Obesity has a strong association with socioeconomic status (SES), with higher prevalence levels among children in lower SES strata in westernised countries.

There is an association between birth weight and later in children or young adults (sometimes a linear relation, occasionally U-shaped or J-shaped). Early infant feeding is important, with breast-feeding having a small but protective effect against the development of later overweight. Other early factors predicting excess weight gain in childhood include rapid catch-up growth by age 2 years and an earlier adiposity rebound.

The association between television viewing and obesity in childhood and adolescence has been demonstrated in both cross-sectional and longitudinal studies including a prospective study in western Sydney, the Nepean Cohort. Several possible mechanisms may explain this association, including: increased exposure of children to food marketing; increased snacking of energy-dense foods; displacement of time spent in more physical activities; and reinforcement of sedentary behaviours.

The increased prevalence of obesity in recent decades has resulted, at least in part, from changes in dietary intake, such as an increase in the consumption of energy-dense, micronutrient-poor foods or in sugar-sweetened drinks. Consumption of soft drinks at baseline is associated with increased weight gain in young adolescents in the US, data recently confirmed in the Nepean Cohort followed over a 5 year period until 12/13 years. The relative contributions of dietary fat (versus energy) intake, glycaemic index, portion sizes and specific eating patterns to the development of obesity remain unclear, although all may play an important role.

A review of physical activity and obesity in childhood has shown that lower physical activity levels and sedentary behaviours are associated with a higher prevalence of obesity in children. Prospective studies in early childhood suggest that physical activity may have a protective effect on the development of excess weight gain in mid-childhood. And in the Nepean Cohort, decreased “vigorous activity” at 7/8 years was associated with increased weight gain in young adolescents in the US, data recently confirmed in the Nepean Cohort followed over a 5 year period until 12/13 years.

The association between parental and child obesity is well-known, a finding also confirmed in the Nepean Cohort Study, where maternal obesity was the strongest predictor of excess weight gain at age 12/13 years, probably reflecting both shared genetic and (obesogenic) lifestyle factors. These data are in keeping with the concept that both sides of the energy balance equation (energy intake and energy expenditure) are important in the development of obesity in young people.

References
Invited Speaker Plenary 6: Sports Nutrition

Strategies for “fat loading” in endurance athletes

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Recent studies have examined the metabolic and performance outcomes of a dietary periodisation strategy that aims to simultaneously optimise endogenous carbohydrate (CHO) stores while maximising the capacity for fat oxidation during prolonged submaximal exercise. Such "nutritional periodisation" typically encompasses 5-7 d of a high-fat diet followed by 1-2 d of high carbohydrate (CHO) intake (i.e. CHO restoration). Despite the brevity of the adaptation period, ingestion of a high-fat diet by endurance-trained athletes results in increases in the basal gene expression of the fatty acid (FA) translocase (FAT/CD36) and enzymes of FA metabolism, including β-hydroxyacyl-CoA. This results in substantially higher rates of fat oxidation and concomitant muscle glycogen “sparking”, when subjects commence sub-maximal exercise with similar muscle glycogen content (i.e. 700-800 mmol/kg d.m.). Higher rates of fat oxidation during exercise persist despite conditions in which CHO availability is increased, either by having athletes consume a high-CHO meal prior to exercise and/or ingest glucose solutions during exercise. Surprisingly, despite metabolic perturbations that, in theory, should enhance endurance capacity, there are no clear benefits to the performance of prolonged exercise. Several theories are proposed to explain the lack of performance transfers. A possible reason for this "paradox" is a diet-induced reduction in the activity of pyruvate dehydrogenase (PDHa), which would act to impair rates of glycogenolysis at a time (i.e. during periods of exercise in which high intensity workrates are required) when muscle CHO requirements are high.
Invited Speaker Plenary 6: Sports Nutrition

Interaction of exercise and diet to maximise the training adaptation
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Training and nutrition are highly interrelated in that optimal adaptation to the demands of repeated training sessions typically requires a diet that can sustain muscle energy reserves. Nutrient stores (i.e. muscle and liver glycogen) play a predominant role in the capacity to undertake both prolonged submaximal endurance exercise as well as intense, intermittent activities. Nutrient availability is vital in the replenishment of energy reserves for subsequent training sessions. Accordingly, the extent to which acutely altering substrate availability might modify the training response/adaptation has been a key research area among exercise physiologists and sport nutritionists for several decades. With regard to training adaptation, it has been proposed that AMPK-PGC-1α signalling mediates endurance training-like responses, while up-regulation of the Akt-TSC2-mTOR pathway underlies the increased protein synthesis observed following resistance exercise. However, the precise molecular signalling mechanisms that transduce the effects of contractile activity to modify skeletal muscle phenotype and function are incompletely understood, as is the effect of training/nutrient interaction on many of these signalling cascades. Here several nutritional interventions that modify the acute responses to exercise (and thus have the potential to impact on subsequent training adaptation) will be examined. Specifically, the molecular and cellular events that occur in skeletal muscle during exercise and subsequent recovery, and the potential for nutrient supplementation (e.g. carbohydrate, fat, protein or combinations) to serve as a potent modulators of many of the adaptive responses to training will be discussed.
Invited Speaker Plenary 6: Sports Nutrition

**Role of dietary fatty acids in exercise and insulin resistance**

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Consumption of a Western diet rich in animal fats is associated with obesity and insulin resistance and skeletal muscle fatty acid accumulation is observed in some insulin resistant phenotypes. Paradoxically, intramuscular fat stores are often increased in endurance trained athletes. Our group has been focussing on the effects of dietary fatty acid subtype on 1) insulin sensitivity 2) skeletal muscle lipid accumulation and 3) lipid use during exercise. We have employed a high fat feeding model in rodents, whereby animals are fed a control chow diet (CON) or a diet rich in either saturated (SAFA) or polyunsaturated (PUFA) fats. We have been able to show that consumption of a diet rich in SAFA induces insulin resistance, whereas a diet high in PUFA induces insulin sensitivity, as assessed by plasma glucose and insulin responses after an oral glucose tolerance test. Although the PUFA diet results in a small increase in diacylglycerol (DAG) content, the excess fatty acids were directed more towards triacylglycerol (TAG) storage, a lipid subtype thought to be relatively inert. In contrast, the SAFA diet resulted in a marked increase in muscle DAG but a concomitant small increase in TAG, consistent with our insulin sensitivity data. Acute, prolonged exercise results in reductions in both DAG (20%) and ceramide (47%) content in high-fat fed rats, irrespective of dietary fatty acid subtype. Our results indicate that increasing saturated fatty acids induces insulin resistance in association with increased diacylglycerol content. Polyunsaturated fatty acids appear to prevent insulin resistance by directing fat into triacylglycerol, rather than other lipid metabolites.
Concurrent Session 1

Understanding consumers’ motivations to increase selenium intakes

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Background - There is evidence that increasing Selenium (Se) intakes may reduce the risk of some diseases.

Objectives - To understand consumers’ knowledge of antioxidants, minerals and specifically Se and their putative relationship to disease risk reduction. To understand consumers’ preferences for options to increase Se intakes and their motivations to consume Se enriched foods to reduce the risk of some cancers.

Design - Two questionnaires: 1) “knowledge” (n = 63) and 2) “preferences and motivations” (n = 212) were administered. Socio-demographic characteristics were matched ($\chi^2$, $P > 0.05$). With a gender ratio of ~1:1, half were tertiary educated and had professional occupations (high socio-economic status, SES).

Outcomes - Knowledge of antioxidants and minerals and their role in disease prevention was low, Se unknown but associations were made between antioxidants and fruits and vegetables, tea and wine. It is likely that respondents to Questionnaire 2 had similar low knowledge and therefore primarily responded to a text description presentation of Se, cancer and options for increasing intakes. There was general favourability of Se enrichment of foods, with a preference for biofortification (Se enrichment of soils) above enrichment during manufacturing. Using multiple regression analysis of variables within Protection Motivation Theory the “importance of consuming Se enriched foods” was predicted by product efficacy ($\beta 0.35$); severity/fear of cancer ($\beta 0.19$); self efficacy ($\beta 0.16$) and vulnerability to cancer ($\beta 0.15$; all $P <0.01$; $R^2 0.35$). However when the dependent variable was product specific (e.g. Se enriched bread, etc) the dominant predictor was self efficacy ($\beta 0.70 – 0.86$; $P <0.001$; $R^2 0.55 – 0.76$) with vulnerability an additional significant but minor predictor for some products.

Conclusions - Knowledge of nutrient-disease risk reduction was low (even amongst high SES) and consumers tend to be food (not nutrient) orientated. However, once informed, respondents were generally favourable towards Se enrichment of foods using biofortification. Food specific self efficacy suggests that consumers are aware of their own food choice behaviours as being crucial to the uptake of nutrient enrichment for disease risk reduction.

Why do women of low socioeconomic status have poorer diets than women of higher socioeconomic status?

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Background - In developed countries, persons of low socioeconomic status (SES) are less likely to consume diets consistent with dietary guidelines. For example, lower SES individuals are more likely to consume diets high in fat, low in micronutrient density, and to have lower intakes of fruit and vegetables. As a result, studies repeatedly find that people of low SES possess nutrient intakes and dietary patterns that increase the risk of diet-related disease and overall health inequalities. However, little is known about the mechanisms that influence SES differences in diet. In particular, few studies have focused on the environmental contributors to SES variations in food choice, and where they have, there have been conflicting findings.

Objective - The aim of the study was to investigate SES variations in the role of perceived food availability, accessibility and affordability among women.

Design - In 2004, a sample of 1580 women aged 18-65 years randomly selected from the Australian electoral roll, completed a mailed survey. Women were selected from low, mid and high SES areas in Melbourne (15 neighbourhoods from each). The survey measured considerations underlying food choices and perceptions of the influence of availability, access and cost on these food choices. Individual-level details such as education, occupation and income were also obtained.

Outcomes - Women of low SES were more likely to report not being able to afford healthy foods and considered the cost of food as a more important barrier than those of high SES. There were few significant SES differences in perceptions of availability, access and/or quality of healthy foods locally, although high SES women did report greater access to public and private transport.

Conclusion - Public health strategies aimed at reducing SES inequalities in diet might focus on promoting healthy diets that are low cost. Future research should confirm these findings by assessing objectively whether the availability, access and cost of healthy foods differ in areas of varying SES.
Concurrent Session 1

Municipal dimensions and opportunities for improving food security in an urban area
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Background - Long term food security issues have been identified in the inner urban area of the City of Port Phillip (CoPP). Creative strategies are required to enable more people within the City to secure, regular, adequate, nutritious and culturally acceptable food and improved food security.

Objective - To scope the dimensions and opportunities for improving food security in the CoPP.

Design - A generic outline and checklist to support whole of population and sustainable food security through the local food system and the Municipal Public Health Planning Framework was trialed and modified through stakeholder interviews and search of secondary data sources.

Outcomes - In the stakeholder interviews, gentrification, transport barriers and inequitable local food access were considered to be three of the main reasons affecting community food security. The groups most at risk of food security problems are the most vulnerable (families in poverty, younger people, older people, Kooris, ethnic groups, people with disability, homeless people, alcohol and drug users, and street sex workers). As a large collective group (estimated to be 32% of the total population of CoPP), their physical and mental health needs for user friendly neighbourhood food supplies, public and community transport and infrastructure requires serious consideration. The Municipal Public Health Planning Framework checklist, with food security overlay for the food chain system provided a method of identifying the natural, built, economic, socio-cultural and health dimensions, and in turn generated municipal opportunities for improving food security.

Conclusion - Application of this method for scoping food security (community, household, individual) in an inner city urban environment has identified multiple opportunities for improving food security, many of which are low cost. Further trial of the method in a variety of other local government locations is indicated.

References

How well do Australian preschool children’s food preferences match consumption recommendations?
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Background - Children’s food choices are often directed primarily by their liking or disliking for a given food. Accordingly, a better understanding of how children’s food preferences match or differ from dietary recommendations may assist in the development of strategies to improve the nutrient quality of children’s food consumption.

Objective - To examine to what extent Australian children’s food preferences comply with dietary recommendations, and the impact of socio-demographic factors on this association.

Design - Cross sectional survey. Four hundred and five parents of children aged 2-5 years, recruited from three socio-economic groups in Melbourne and Adelaide completed a survey on their child’s liking for 176 foods and drinks on a 5-point Likert scale in addition to demographic descriptors. Preferences were compared to aspects of the Dietary Guidelines for Children and Adolescents in Australia and the Australian Guide to Healthy Eating.

Outcomes - Foods in the Extra Foods group of the Australian Guide to Healthy Eating were liked the most (mean ± SD = 4.02), closely followed by the Cereals group (mean ± SD = 4.01). Foods in the Vegetables group were liked the least (mean ± SD = 3.01). A large percentage of foods in the Cereals group was liked (64%) in contrast to the other food groups, especially Vegetables (7%). Two-tailed Spearman’s Rho correlations showed that children liked foods that were more energy dense (rho=0.40, P<0.01), and higher in saturated fat (rho=0.28, P<0.01) but not those higher in sugar (rho=0.18, P=0.02), fat (rho=0.12, P=0.12) or sodium (rho=0.14, P=0.07). Relationships between demographic variables (e.g. SES, parental education, child’s gender, breast/bottle feeding) and food preferences were generally weak.

Conclusions - Interventions designed to help preschool children improve compliance with dietary guidelines may be enhanced by addressing children’s low preferences for Vegetables and high preferences for Extra Foods, and foods higher in saturated fat and energy density.
Concurrent Session 1

Choosing breakfast: convenience, cost or quality?
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Background - Consumption of a nutritious cereal at breakfast is an important dietary pattern to establish, particularly in children. How to choose that nutritious cereal is problematic due to the large diversity of products, the emergence of new, convenience products and specific marketing to different consumer groups.

Objective - To survey breakfast cereals, bars and drinks available in a large supermarket in Melbourne.

Design - Standardised entry sheets were used to collect data from the labels of all breakfast cereals, bars and drinks presented for sale in a large Melbourne supermarket. Data was entered into a spreadsheet and analysed for nutrient content, cost, energy density, fortification and nutrition, health and related claims.

Results - One hundred and eighty two cereals, 27 bars and 10 drinks were identified. Eleven cereals, specifically targeted at children were lower in protein, fat and fibre and higher in sugars and sodium per serve than other cereals. Breakfast bars were higher in protein, fat and sugar and drinks provided more protein, carbohydrate, sugar and sodium than the cereals. In many products the stated energy content was less than calculated using Atwater factors from macronutrient contents detailed on the label. This was particularly prevalent (>80%) in the 11 children’s cereals. In cereals, bars and drinks, energy density was negatively related to energy cost ($A per 100kJ), r = -0.413, P <0.001; r = -0.611, P <0.001; r = -0.624, P <0.05, respectively. Many cereals were fortified and claims relating to nutrients were common. The most prevalent claims related to dietary fibre, carbohydrate or iron content. Of 1289 claims identified, 13% were not regulated by current codes.

Conclusion - The high availability of sweetened, low cost, high energy density cereals strongly marketed at children and the emergence of convenience breakfast foods (bars and drinks) has nutritional implications in relation to the growing epidemic of obesity in Australia.

Breakfast and obesity - a matter of sex
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Background - The prevalence of obesity and diabetes have been increasing at a rapid rate over the last 20 years. Furthermore, coronary heart disease is still the leading cause of death in Australia despite declines in mortality. The reasons for these changes still remain relatively unclear and to date there is limited information to help clarify this. Furthermore, longitudinal data on predictors of obesity change are scarce. The Sydney Adventist Hospital, situated in a high socioeconomic area in Northern Sydney has a unique 30 year data set on biomedical, lifestyle and dietary factors related to heart health. To our knowledge no other data set in Australia contains such extensive information in such a long time series that is relevant to non communicable disease.

Objective - To examine the relationship between food consumption and BMI. In particular, as breakfast has often been claimed to be of influence on biomedical indices, this paper aims to investigate its possible influence on obesity.

Design - Self-reported questionnaires detailing demographic, lifestyle and dietary habits were completed by about 1000 individuals per year from 1976. Of these, a randomly selected sample of at least 300 questionnaires was taken for every alternate year for this study. Analyses included simple descriptive statistics, reliability analysis and univariate analysis of variance.

Outcomes - To date results are available for BMI from 1976 and 1986. Breakfast was found to be very important in the maintenance of body weight for males (P <0.001, 1976; P = 0.001, 1986) but not for females (P = 0.869, 1976; P = 0.772, 1986) for both years.

Conclusions - These results indicate that breakfast appear to be differentially related to BMI depending on sex. It remains to be seen if the relationship holds in later years.
Concurrent Session 2

Vitamin D status and its relationship with bone mass in healthy adolescent girls in China

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Background - There is little known about the influence of vitamin D status on the growth of bone mass in Chinese children and adolescents.

Objectives - To investigate the relationship between vitamin D status and bone mass in 301 apparently healthy Chinese adolescent girls aged 15 ± 0.4 years in Beijing, China (40°N).

Design - Serum 25 hydroxyvitamin D [25(OH)D] was determined by radioimmunoassay during late winter, 2004, and bone mineral content (BMC) and bone area (BA) for the whole body and the distal and proximal forearm were measured by dual energy X-ray absorptiometry (DXA).

Outcomes - Mean body weight and height were 55.1 ± 9.9 kg and 1.6 ± 0.1 m, respectively, and 98% of the subjects were in late pubertal Tanner stages IV and V. Mean serum 25(OH)D concentration was 34.0 nmol/L [95% CI: 32.1 – 35.9]. Approximately 49.2% and 39.9% of the subjects, respectively, had either vitamin D deficiency (serum 25(OH)D <25 nmol/L) or vitamin D insufficiency (serum 25(OH)D between 25 and 50 nmol/L). Only about 11.0% of the subjects had adequate vitamin D status (>50 nmol/L). Partial correlation analysis showed a significant positive association between log serum 25(OH)D concentration and bone mineral content (BMC) and also between vitamin D status and the areal bone mineral density (aBMD) for the total body, and the distal and proximal forearm, after adjusting for potential confounders. When these bone measurements were compared with vitamin D status it was found that those girls with adequate status had significantly higher BMC in the whole body (P <0.001), distal forearm (P <0.001) and proximal forearm (P <0.01) than those with poorer vitamin D status, after adjusting for body weight, height, handgrip strength, physical activity and dietary intake of calcium and vitamin D. No association was found between body mass index and vitamin D status (P >0.05).

Conclusions - The adolescent girls with adequate vitamin D status had significantly higher BMC for the whole body, distal forearm and proximal forearm compared with those with poor vitamin D status although there was no difference in bone size. This finding suggests that good vitamin D status during adolescence is important for bone mass and may contribute to attaining an optimal peak bone mass.

Low fat milk fortified with calcium and vitamin D₃ prevents bone loss in older men

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Background - Osteoporosis and its related problems are now recognised as an increasing public health problem in men. This highlights the importance of identifying lifestyle interventions that are effective at maintaining bone mass in men.

Objective - The aim of this study was to examine the effect of milk fortified with additional calcium and vitamin D₃ on bone mineral density [BMD] in ambulatory community living men aged 50 to 87 years.

Design - This was a two year randomized controlled study in which 167 men [mean age ± SD; 61.9 ± 7.7 years] were assigned to receive either 400 mls per day [2 x 200 ml tetra packs] of reduced fat [~1%] UHT milk containing 1000 mg of calcium plus 800 IU of vitamin D₃ or to a control group receiving no additional milk. Primary endpoints were changes in BMD, serum vitamin D [25(OH)D] and parathyroid hormone [PTH] concentrations.

Outcomes - A total of 149 men completed the study [milk compliance averaged 88%]. Baseline characteristics between the groups were no different; mean dietary calcium and serum 25(OH)D levels were 941 ± 387 mg per day and 77 ± 23 nmol/L, respectively. After two years, the mean percent change in BMD at the femoral neck, total hip and ultra-distal radius was 0.9 to 1.6% less in the milk compared to control group [P<0.05 to <0.001]. No differences were detected for lumbar spine BMD after two years. Serum 25(OH)D levels increased and PTH decreased in the milk relative to control group after one year [P <0.001], and these differences remained after two years. Body weight remained unchanged in both groups.

Conclusion - In conclusion, supplementing the diet of men aged over 50 years with reduced fat, calcium and vitamin D₃ enriched milk may represent a simple, nutritionally sound and cost effective strategy to reduce age-related bone loss at several skeletal sites at risk of fracture.
Concurrent Session 2

**Vitamin E increases blood pressure in type 2 diabetic subjects, independent of vascular function and oxidative stress**

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**Background** - Oxidative stress is thought to play a role in the development of diabetes, hypertension and endothelial dysfunction. Vitamin E, a major lipid-soluble dietary antioxidant, occurs in a number of structurally related forms. Although many studies have examined α-tocopherol, another major dietary form, γ-tocopherol has largely been overlooked.

**Objective** - To investigate the effect of α-tocopherol and γ-tocopherol supplementation on blood pressure (BP), vascular function and oxidative stress in people with type 2 diabetes.

**Design** - 55 individuals were randomised in a double blind, placebo-controlled trial. Participants received either 500 mg/d α-tocopherol, 500 mg/d mixed tocopherols (60% γ-tocopherol), or placebo, for 6-weeks. At baseline and post-intervention, 24hr ambulatory BP, endothelium dependent and independent vasodilation and plasma and urinary F₂-isoprostanes were measured.

**Outcomes** - Treatment with α-tocopherol significantly increased systolic BP (7.0 ± 0.9 mmHg, *P* <0.0001), diastolic BP (5.3 ± 0.6 mm Hg, *P* <0.0001), pulse pressure (1.79 ± 0.61 mm Hg, *P* <0.005) and heart rate (2.0 ± 0.7 bpm, *P* <0.005) versus placebo. Treatment with γ-tocopherol significantly increased systolic BP (6.8±1.0 mm Hg, *P* <0.0001), diastolic BP (3.6±0.7 mm Hg, *P* <0.0001), pulse pressure (3.20 ± 0.63 mm Hg, *P* <0.0001) and heart rate (1.8±0.7 bpm, *P* <0.01) versus placebo. Treatment with α-tocopherol or γ-tocopherol significantly reduced plasma F₂-isoprostanes versus placebo, but had no effect on urinary F₂-isoprostanes. Endothelium-dependent and independent vasodilation were not significantly altered.

**Conclusion** - Treatment with either α- or γ-tocopherol significantly increases BP, pulse pressure and HR in type 2 diabetes, independent of changes in vascular function or oxidative stress.

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**Iodine status in Dunedin mothers and their breastfed infants**

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**Background** - Iodine needs increase greatly during pregnancy and lactation. Recent evidence, based on low urinary iodine levels, suggests that New Zealand women are not meeting these requirements. The iodine content of breast milk, which depends upon the iodine intake of the lactating mother, is the only source of iodine for the breastfeeding infant. Newborn infants require iodine for normal growth, cognition and hearing acuity, so it is crucial that their iodine intakes are met. To our knowledge, no studies have investigated the levels of iodine in breast milk over the course of lactation.

**Objectives** - Firstly, to determine, over the first six months post-partum, the median urinary iodine concentrations (MUIC) of breast-fed infants and their mothers, and the breast milk iodine concentration of the mothers. Secondly, to assess the efficacy of two levels of iodine supplementation on increasing breast milk iodine concentration in comparison to a placebo.

**Design** - In a six-month, randomised, double-blind controlled intervention trial, conducted from May 2004 to October 2005, lactating mothers (n=109) from Dunedin were given 75 µg iodine/day, 150 µg iodine/day, or a placebo. At one, two, four, eight, 12, 16, 20 and 24 weeks post-partum, breast milk iodine concentration and maternal and infant urinary iodine concentration were measured.

**Outcomes** - The mothers in this study were predominantly Caucasian (92%) with a mean (± SD) age of 32 years (± 4.8). The average birth weight (± SD) of their infants was 3.7 kg (± 0.5). Preliminary analyses showed that the MUIC of a sub-sample (n=57) of this study population was 43 µg/L (inter-quartile range=23,62) prior to giving birth, which is indicative of moderate iodine deficiency.

**Conclusions** - This suggests that both infants and mothers will be at risk of sub-optimal iodine status in the placebo group. The impact of moderate maternal iodine deficiency on breast milk iodine levels and infant iodine status over a six month period of breastfeeding, in comparison to two different levels of supplementation, will be reported at the conference.
Concurrent Session 2

Methodologies to assess human UV exposures for estimates of synthesis of pre-vitamin D in human skin

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Background - Most of the population receive their nutritional Vitamin D requirements through exposure to solar UV, with cutaneous synthesis providing 80 to 100% of the Vitamin D requirements to the body, yet little is understood about the basic photobiology and photochemistry of Vitamin D production in humans. Low Vitamin D has been linked to the development of a surprisingly wide range of diseases. Epidemiological data and animal studies indicate that low Vitamin D is linked to rickets, bone mass loss, multiple sclerosis, hypertension, breast cancer, prostate cancer, colorectal cancer, insulin dependent diabetes and schizophrenia. Recent research has found that adults living in South East Queensland, Australia, have surprisingly high rates of Vitamin D deficiency and insufficiency (8% and 23% respectively).

Objective - This work aims to understand human UV exposures and determine the correct method for assessment of exposure for pre-Vitamin D synthesis.

Design - We describe the techniques that can be used to assess UV exposure of humans ranging from the photo activation of thin cast polymer films to mathematical modelling of exposure patterns.

Outcomes - The results presented show the important considerations research must take into account when estimating human UV exposure and the potential to synthesize pre-Vitamin D in skin. We found that the UV exposure to various sites over the human body varies not only with anatomical location, but also time of day and cloud cover. For example, the exposure to the facial region was found to be 25% to 30% lower on cloudy days compared to sunny days. However, we found that the distribution of UV over the face during this period also changed where the UV exposure to the nose during cloudy conditions increased by 15% when normalized to the vertex of the head. These results indicate that exposures to the human body are lower that the data measured by ambient UV detectors and correlations between ambient exposures and human UV exposures are complex. Significant errors in assessment of UV exposures for Vitamin D synthesis can occur and may impact on validity of sun exposure estimates if not taken into account in project planning and design.

Conclusions - This research highlights the need for further research into the interactions between the solar UV environment and humans. To take a simplistic approach to assessment of UV exposures is dangerous and may lead to results that are not valid. Data and methodologies presented in this presentation will aid researcher when undertaking Vitamin D research and UV exposure estimates.

Thyroglobulin as an index of mild iodine deficiency

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Background –The most commonly used indices to assess iodine status are urinary iodine concentration (UIC), thyroid volume (TV), and thyroid stimulating hormone (TSH). However, the measurement of TV requires trained personnel and access to an ultrasound machine, while changes in TSH, although metabolically significant, fall within normal ranges in mild iodine deficiency (IDD). Thyroglobulin (Tg) is the most abundant protein of the thyroid gland and shows promise as a sensitive index of mild IDD.

Objective – To determine the relationship between Tg and other indices of iodine status of iodine status using data from the New Zealand (NZ) National Children’s Nutrition Survey (CNS02) conducted in 2002.

Design - The CNS02 was a cross-sectional survey of 3275 school children aged 5-14 years. Blood drawn from an antecubital vein and a casual morning urine sample was obtained from 1154 children. UIC, serum TSH and Tg concentration, and plasma free tri-iodothyronine (fT3) and free thyroxine (fT4) concentration were determined.

Outcomes - The median UIC of the children was 67 µg/L, and 28% of the children had a UIC <50 µg/L, indicative of mild IDD. The concentrations (mean ± SEM) of TSH (1.72 ± 1.70 mU/L), fT3 (6.0 ± 0.0 pmol/L), and fT4 (14.9 ± 0.2 pmol/L) were similar to values published for children in other countries. The median Tg concentration was 12.8 ng/mL and fell within the range of 10-20 ng/mL; also indicative of mild IDD. Furthermore, children who had an UIC<50 µg/L had a significantly higher (P=0.000) serum Tg concentration than children with a UIC above this level, suggesting hyperplasia of the thyroid gland in children with lower UIC.

Conclusions - These data suggest that Tg is a sensitive index of mild IDD in NZ children.
Concurrent Session 3

The effect of a low glycemic load, high protein diet on hormonal markers of acne

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Background - Acne vulgaris is a common endocrine condition affecting adolescents in Western civilizations. Acne typically manifests during puberty when there is a transient decrease in insulin sensitivity. It has been suggested that high glycemic nutrition during puberty induces hyperinsulinemia which increases the bioavailability of androgens and certain growth factors. These changes may induce follicular epithelial growth and increased sebum production – two factors responsible for acne proliferation.

Objective - To determine the effect of a low glycemic load diet, comprised of high levels of protein and low glycemic index (GI) foods, on hormonal markers of acne vulgaris.

Design - Male acne sufferers [n=43, age=18.3±0.4 (mean ± SEM)] were randomly assigned to either the dietary intervention (n=23) or control groups (n=20). The intervention diet consisted of 25% energy from protein and 45% energy from low glycemic index carbohydrates. The control group received no information about diet nor were they given dietary instruction. Venous blood was collected at baseline and 12-weeks for an assessment of testosterone, sex hormone binding globulin (SHBG), free androgen index (FAI), dehydroepiandrosterone – sulfate (DHEA-S), insulin-like growth factor (IGF)-I and IGF-binding proteins –I and -3.

Outcomes - Dietary intervention resulted in a significant reduction in FAI (-9.1 ± 4.5, P<0.05) and DHEA-S (-0.72 ± 0.33 umol/L, P<0.05) and an increase in IGFBP-1 (5.3 ± 1.6 ng/mL, P<0.01). No significant changes were observed in levels of IGF-I, IGFBP-3, testosterone or SHBG following dietary intervention. The control group showed no change in any of the blood parameters measured.

Conclusion - These data suggest that a low glycemic load diet may reduce androgenic activity (as indicated by a reduction in FAI and DHEA-S) and may oppose the growth promoting effects of IGF-I by increasing levels of its binding protein, IGFBP-1. This implies that a low glycemic load diet may reduce hormonal influences involved in acne pathogenesis.

The Greek migrant morbidity mortality paradox: low levels of hypertriglyceridaemia and insulin resistance despite central obesity

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Background - Greek migrants to Australia continue to have one of the lowest all-cause mortality rates of any birthplace group in Australia despite having an adverse coronary heart disease (CHD) risk factor profile, including higher rates of diabetes, and the high self-reported CHD morbidity.

Objective - To examine a broad range of CHD risk factors and dietary and lifestyle factors that may help explain the relative protection of Greek migrants from premature CHD mortality.

Design - Cross-sectional study of 432 Greek and Australian-born people with and without diabetes, recruited from the Melbourne Collaborative Cohort Study. Body composition was measured by standard anthropometric techniques and DEXA. Analysis of lipids and glycaemic variables was performed on fasting blood samples using standard laboratory techniques. Food intake was measured by food frequency questionnaire.

Outcomes - Greek men and women were significantly more obese (P = 0.008 men and women) but had lower levels of hypertriglyceridaemia (P =0.036 men; P = 0.001 women), and lower IR (P=0.027 men; P <0.001women) compared with Australian-born men and women. Diabetes was associated with a greater adverse effect on fasting insulin, IR and plasma homocysteine in the Australian-born people compared with the Greeks.

Conclusions – Dietary factors such as consumption of a Mediterranean-style diet with a high intake of plant derived antioxidants, olive oil and red wine could be protecting Greek migrants from premature CHD mortality even in the presence of diabetes.
Concurrent Session 3

Clustering of risk factors, metabolic syndrome, and coronary heart disease risk in hypertensive patients
FRB Geronimo on behalf of the FORT-HPN Group (RF Abarquez Jr, FER Punzalan, EI Cabral)
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Background - Hypertension and cardiovascular risk factors increase the risk of developing coronary heart disease. This study investigates the risk factors and metabolic syndrome present in hypertensive individuals.

Objective - To determine the common clustering of risk factors, prevalence of metabolic syndrome, and coronary heart disease risk among hypertensive individuals.

Design - This is a descriptive cross-sectional pilot study done in Internal Medicine and Cardiology clinics of UP-Philippine General Hospital. Adult hypertensive patients and household members were recruited and screened for hypertension, diabetes, dyslipidemia, obesity, smoking, sedentarism, and metabolic syndrome (MetS: based on NCEP III criteria with IAS modification for Asians). Outcomes included proportion of individuals with combination of risk factors, prevalence of metabolic syndrome, and estimated coronary heart disease (CHD) risks using the Framingham risk prediction algorithm.

Outcomes - A total of 134 hypertensive individuals (100 patients and 34 household members) were included (age 56±11 years, BMI 25±14.4 kg/m²). Dyslipidemia was most prevalent risk factor followed by sedentarism, obesity, diabetes, and active smoking. Reduced HDL level was most common form of dyslipidemia. In hypertensive patients, having at least three risk factors was most common. Hypertension and dyslipidemia plus one other risk factor was most frequently encountered. Hypertension, dyslipidemia, and sedentarism were the most common clustering. The prevalence of MetS was 66%. Among hypertensive patients with MetS, the average estimated CHD risk in the next 10 years is 18% and at least half are at high risk for CHD events. Among those without MetS, the average CHD risk is 10% and majority (73%) are at low risk.

Conclusions - Hypertensive individuals can have multiple risk factors and metabolic syndrome. Those with metabolic syndrome are at high risk to have CHD events in the next 10 years, similar to CHD risk equivalents. Emphasis should be given on early identification, intervention, and prevention of coronary heart disease in hypertensive individuals, especially those with metabolic syndrome.

Effect of dairy foods on coronary heart disease: a systematic review of prospective cohort studies
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Background - Dairy foods may increase the risk of coronary heart disease.

Objective - To assess the effect of dairy foods on coronary heart disease using prospective cohort studies.

Design - We searched for prospective cohort studies where intake of dairy foods was measured and these intakes were related to heart disease and death end points. Electronic databases including MEDLINE, EMBASE, CENTRAL, CINAHL, citation index (Web of Science) and the Australian and International dissertation libraries were searched. Eligible studies were assessed for quality and data extracted. Primary outcomes were death, death from coronary heart disease (CHD), ischaemic heart disease (IHD), or episode of myocardial infarct. Two reviewers assessed study quality and extracted data with discrepancies resolved by consensus.

Outcomes - We identified eleven studies for inclusion assessing >215,000 subjects. Most studies had close to or greater than 80% follow-up rate, made adjustment for three or more confounders in the statistical analysis and used standard criteria to determine CHD/IHD end points. About half the studies used validated food frequency questionnaires (FFQ), administered the FFQ more than once, or had a follow-up duration of 20 years or more. Less than half the studies involved subjects with characteristics representative of the general population. Seven of eleven studies reported no association between dairy intake and CHD/IHD. Four of eleven studies suggested some association between some aspect of dairy intake and CHD/IHD.

Conclusions - This assessment of eleven prospective cohort studies indicates that there is no clear evidence in support of the concept that dairy intake is consistently associated with higher CHD/IHD risk.

Interest statement - This was an independent scientific review commissioned by Dairy Australia.
Concurrent Session 3

The effect of a low glycaemic index (GI) ingredient substituted for a high GI ingredient in two complete meals on blood glucose and insulin levels, satiety and energy intake in healthy lean women

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Background - While there is great interest in the effects of low GI food on the development of diabetes, heart disease and obesity, the impact on food intake is unclear.

Objective - To examine the effect of a low GI ingredient, BarleyMax™, (barley cultivar, Hordeum Vulgare var. Himalaya 292; GI 49) incorporated into breakfast and lunch compared with otherwise identical meals containing a high GI ingredient (wheat starch GI 75).

Design - Randomized single blinded cross-over study in 14 healthy women. The test breakfast was consumed at 7.00AM. Insulin and glucose levels, appetite ratings using a visual analogue scale (VAS) and energy expenditure (EE) were measured before and after lunch which was eaten at 1.30PM. VAS and food intake were recorded for the next 10hr.

Outcomes - Area under the curve for insulin and glucose were lower after the low GI lunch compared with the high GI lunch (-35.5%, \( P < 0.001 \) and -6.9%, \( P < 0.05 \), respectively). There was a significant increase in post-prandial RQ above baseline (0.80) independent of treatment (0.88 and 0.90 for low and high GI respectively, \( P < 0.001 \)). Both test meals increased EE by 5%. Meal type did not affect any variable measured by the VAS. Ad libitum intake over the next 10hr was reduced by 23% (9.6 vs. 11.0mJ) after the high GI meals compared to the low GI meals.

Conclusions - Low GI foods containing BarleyMax™ have a role in improving glucose and insulin homeostasis. However this study does not support the role of low GI foods in regulating food intake.

Dietary and clinical risk profiles of a sample of healthy overweight adults provide targets for dietary advice in an intervention trial

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Background - Lifestyle intervention trials demonstrate the benefits of dietary intervention for reducing metabolic risk in overweight adults. For effective advice strategies dietary and clinical risk profiles need to be established.

Objective - To examine clinical and dietary profiles of healthy subjects in an intervention trial for the management of overweight.

Design - Volunteers were 35 adults (24 female, 11 male) overweight or obese (BMI=25-35) but otherwise healthy. Preliminary data from fasting blood samples and diet history interviews (using FoodWorks software, Xyris, Bris) were analysed and compared to reference levels (in brackets): 2,3

Outcomes - Mean ± SD: blood glucose 5.48 ± 1.02mmol/L (3.0-5.4) 2, cholesterol 5.61 ± 1.67mmol/L (2.30-5.50) 2, LDL-C 3.38 ± 1.17mmol/L (0.0-3.50) 2, HDL-C 1.34 ± 0.40 (1.00-3.00) 2 and triglycerides 1.96±1.73mmol/L (0.00-2.00). Total dietary fat 31.59 ± 9.98%E (<35%E), saturated fat 11.24 ± 3.60 (<10%E), monounsaturated fat 12.07 ± 4.30, polyunsaturated fat 5.28 ± 2.22 (~10%E). Fasting glucose and total cholesterol levels were above the normal ranges. Total fat intake was within the recommended range, but intakes of SFA and PUFA were above and below recommended levels, respectively.

Conclusion - These results expose the nature of risk factors in a healthy overweight sample and demonstrate the need to target the type of fat in an intervention trial to test the efficacy of current guidelines.

References
Concurrent Session 4

Behavioural effect of prenatal iron supplementation in children: long term follow up of a randomised controlled trial
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Background - Iron deficiency is a relatively common problem in pregnancy. Although poor iron nutrition during pregnancy has been consistently shown to affect the behaviour of offspring in rats, the effect of iron nutrition in pregnancy on behaviour of children has not been explored.

Objective - To determine if improved maternal iron nutrition through iron supplementation in pregnancy affects behaviour of the children.

Design - 4 year follow up of children whose mothers participated in a double blinded randomised controlled trial of iron supplementation in pregnancy. Behaviour of the children, a secondary outcome of the 4-year follow up, was assessed using the “Strength and Difficulties Questionnaire”. A total score of greater or equal to 17 is classified as abnormal. The primary outcome of the follow up was IQ of the children, which was also assessed using the Stanford – Binet Intelligence Test.

Outcomes - Seventy percent (300/430) of the children from the original trial completed the behaviour assessment. There were no significant differences between children of iron supplemented mothers and children of control mothers in behavioural scores. However, the percentage of children with abnormal total behavioural scores was higher in the iron group compared with the control group (24/151, 16% vs. 12/149, 8%, RR: 2.0, P=0.037). Childhood IQ did not differ between the groups. Children with abnormal behavioural scores had lower mean IQ compared with children whose behavioural scores were in the normal range (104 ± 11 vs. 110 ± 11, P=0.001).

Conclusions - Routine iron supplementation in pregnancy was associated with a higher risk of abnormal behaviour score in this well-nourished population. Further research is needed to substantiate this finding.

Reference:

Characterising the nutritional intake of preterm infants <33 weeks gestation
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Background - There are difficulties in providing sufficient nutrition to preterm infants <33 weeks gestation to meet their needs for long term growth and development.

Objectives - To characterise nutritional intake for preterm infants <33 weeks gestation and to compare actual nutritional intake with recommended intakes.

Design - Intake data were collected from infants enrolled in the pilot phase of the DINO trial (a randomised controlled trial evaluating the effect of meeting the calculated docosahexaenoic acid requirement of very preterm infants. Actual protein and energy intake were compared with current recommendations (Protein 3 – 4 g/kg/day; Energy 120 – 135 Kcal/kg/day).

Outcomes - Data were collected on 137 infants (mean gestational age 29 weeks, SD 2; birth weight 1.33 kg, SD 0.44). Most infants failed to meet protein requirements on day 3 and 7. On day 14, 20% and day 21, 16% still received less than the recommended level. Mean energy intakes were well below the conservative recommended intake of 120 kcal/kg/day on day 3, 7, and 10; by day 21, 15% continued to have intakes below this level.

Conclusion - The conservative estimate of protein (3g/kg/day) and energy (120 kcal/kg/day) requirements are not being met in early life. By day 14, intakes had improved but a significant proportion of infants continue to have intakes below recommendations and have accrued a substantial protein and energy deficit.
Concurrent Session 4

**BMI and waist circumference at 7/8 yr and metabolic profile in adolescence**

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**Background** - Estimates of the prevalence of overweight and obesity in young people are typically based on body mass index (BMI). However, BMI may not indicate the level of central adiposity. Waist circumference (WC) has therefore been recommended to identify young people at risk of morbidity associated with central adiposity.

**Objective** - To determine whether sex and age specific WC cut points at 7/8 yr are more effective at predicting elevated metabolic risk (metabolic syndrome) in adolescence compared to recognised BMI cut points.

**Design** - Anthropometric measurements were taken on 342 children in 1996/97. Seven years later blood pressure (BP) and metabolic risk (metabolic syndrome) in adolescence compared to recognised BMI cut points were measured in 270 children and fasting blood samples obtained from 174 of the children for measurement of lipids, glucose and insulin. Metabolic syndrome was defined as the presence of three or more of the following: overweight, high systolic BP, high triglycerides, low HDL cholesterol, high insulin and impaired fasting glucose.

**Outcomes** - The prevalence of the metabolic syndrome was 17.7%. Being overweight defined by WC (OR 3.6[95% CI: 1.7,8.0], $P=0.002$) at 7/8 yr was more strongly associated with the metabolic syndrome in adolescence compared to BMI (3.0[1.3,7.0], $P=0.007$). Being overweight, as defined by both BMI and WC at 7/8 yr, was also associated with high SBP in adolescence (2.1[1.1,4.2], $P=0.048$ and 2.0[1.1,3.7], $P=0.031$, respectively) but not with triglycerides, glucose or insulin concentrations.

**Conclusions** - Results from this study demonstrate the value of both WC and BMI at 7/8 yr in predicting an elevated metabolic risk in adolescence. Identifying predictors of risk factor clusters is important; clusters may track more than the individual risk factors.

**References**

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**Resting energy expenditure in 18-20 year old males and females: Validation of indirect calorimetry and Harris-Benedict prediction equation**

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**Background** - The accurate measurement of Resting Energy Expenditure (REE) is a cornerstone of nutritional assessment. The purpose of this study was to compare two indirect calorimetry methods for measuring REE and theREE estimation obtained by using the Harris-Benedict prediction equation (HBE). The indirect calorimetry methods used were the well validated but expensive metabolic cart, Vmax Spectra (SensorMedics, Yorba Linda, CA) and a commercially available and inexpensive hand-held indirect calorimeter, MedGem (HealthTech Inc. Golden, CO).

**Objective** - To compare REE measurements obtained from the Vmax Spectra and the MedGem and estimations of REE calculated using the Harris-Benedict Equation.

**Design** - A convenience sample of seventy six adults (45 women, 31 men)(mean ± SD), age 19.3 ± 0.1 years, body mass index 22 ± 0.27(kg/m2) completed duplicate REE measurements using both the MedGem and Vmax Spectra. Subjects were instructed to avoid food and beverage (excluding water), vigorous physical activity and medications for 12 hours prior to measurements. All Vmax measurements were collected in a reclining position following a 30 minute rest period; MedGem measurements were collected in a seated position according to manufacturers’ instructions.

**Outcomes** - Paired t-test results between REE measured using the MedGem hand-held indirect calorimeter showed no significant difference ($P>0.05$) from the REE measurement using Vmax Spectra metabolic cart. Pearson’s correlations were significant between HBE and the two methods of REE measurement ($P<0.01$). Paired t-test values were significant between the Vmax Spectra results and the HBE prediction equation ($P>0.05$). The HBE prediction results were statistically similar to REE measured using the MedGem ($P>0.05$). Compared to the Vmax Spectra results accuracy is lower (38% within ± 5% range) than predicted REE using the HBE (88%).

**Conclusions** - At the group level there is agreement between measured REE using the Vmax Spectra metabolic cart and the MedGem hand-held indirect calorimeter. However, for an individual clinically significant difference in resting energy expenditure would be obtained by the three different methods. Awareness of the limitations of the HBE and portable hand-held indirect calorimeter is invaluable and will help clinicians choose the best method for determining resting energy expenditure for the sampled population. More studies are needed on different groups living under different environmental, economical, and social conditions.
Concurrent Session 5

Effects of gamma-tocopherol supplementation on thrombotic risk factors and measures of oxidative stress

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Background - The antioxidant activity of vitamin E is derived primarily from alpha-tocopherol (α-T) and gamma-tocopherol (γ-T). Gamma tocopherol has been found to be more effective in protecting against certain specific types of oxidative damage and reducing platelet activity.

Objective - This study sought to evaluate whether five weeks of supplementation with 100 mg/d or 200 mg/d γ-T would modulate lipid profile and platelet reactivity thus reducing oxidative and thrombotic markers in vivo.

Design - Fourteen healthy subjects consumed 100 mg/d γ-T and 13 subjects consumed 200 mg/d γ-T (Tama Biochemical Co. Ltd, Japan) while 12 were on placebo (soybean capsules with less than 5 mg/d γ-T) in a double blind parallel arm study. Fasting pre- and post-dose blood was analysed for lipid profile, platelet function tests, C-reactive protein (CRP) and antioxidant status.

Outcomes - Blood γ-T levels increased significantly (P < 0.05) relative to dose during the intervention period. The group taking 200 mg γ-T had significantly reduced total cholesterol and LDL (P < 0.05) and higher HDL (P < 0.05) than did the placebo group. Both active groups showed lower P-selectin expression for platelet activation post supplementation though the changes were not significant. No effect of γ-T was observed on total antioxidant status, triacylglycerols, CRP, platelet numbers and volume.

Conclusion - Five weeks supplementation with 100 and 200 mg γ-T significantly increased blood γ-T levels and in the case of the higher dose improved plasma lipid profile.

Interest statement: This project was funded by The RMIT Virtual Research Institute (VRI) Grants Scheme 2004

Calcium supplementation for improving bone density in children: a systematic review

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Background - Trials of calcium supplementation in children have given inconsistent results particularly as to whether any benefit persists after supplementation is ceased.

Objectives - To determine the effectiveness of calcium supplementation for improving bone mineral density (BMD) in children and if any effect persists after cessation of supplementation.

Design - We performed a systematic review of randomised placebo-controlled trials of calcium supplementation in healthy children with bone mass at any site as an outcome. We searched multiple databases including Medline and Embase and used hand-searching to identify 234 potential studies. Assessment by 2 independent reviewers yielded 36 references to 19 studies. Of these, 18 provided data which could be used in meta-analysis.

Outcomes - Calcium supplementation has little effect on BMD at the hip or lumbar spine (see table). Total body bone mineral content (BMC) increases during supplementation but the effect does not persist. Upper limb BMD increases with supplementation and this persists after cessation. There was no significant heterogeneity at any site.

<table>
<thead>
<tr>
<th>Site</th>
<th>Effect at end of trial¹</th>
<th>Effect at longest point after cessation of supplementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spine BMD</td>
<td>+ 0.10 (- 0.02, + 0.22) (n = 1079)</td>
<td>- 0.01 (- 0.16, + 0.15) (n = 617)</td>
</tr>
<tr>
<td>Hip BMD</td>
<td>+ 0.07 (- 0.05, + 0.20) (n = 988)</td>
<td>+ 0.02 (- 0.14, + 0.18) (n = 617)</td>
</tr>
<tr>
<td>Total body BMC</td>
<td>+ 0.14 (+ 0.01, + 0.27) (n = 953)</td>
<td>0.00 (- 0.40, + 0.40)² (n = 96)</td>
</tr>
<tr>
<td>Arm BMD</td>
<td>+ 0.21 (+ 0.11, + 0.31) (n = 1503)</td>
<td>+ 0.18 (+ 0.05, + 0.32) (n = 840)</td>
</tr>
</tbody>
</table>

¹standardised mean difference (SMD) (95% CI); an SMD of 0.3 is regarded as small. Bold denotes statistical significance. N = number of participants included in each analysis; ² single study only

Conclusions - Taken as a whole, this overview suggests calcium supplementation in childhood as a measure for improving long-term bone density is of marginal benefit at best.
Concurrent Session 5

**Folate, vitamin B12, plasma thiols and cognitive function in an elderly population sample**

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**Background** - The plasma thiols, especially homocysteine (HCY), folate and vitamin B12 (VitB12) have been implicated in the aetiology of cognitive impairment, anxiety and depression in the elderly.

**Objective** - The aim of the study was to determine whether there was a relationship between plasma thiols, folate and VitB12 and the prevalence of cognitive impairment, anxiety and depression in a sample of 120 elderly subjects (67 females and 53 males), 65 years old and over, living in a NSW Central Coast retirement village.

**Design** - Cognitive impairment was assessed using the Mini-Mental State Examination (MMSE) test and anxiety and depression using the Hospital Anxiety and Depression Scale (HADS). The plasma thiols HCY, cysteine (CYS), cysteinyl-glycine (CYS-GLY) and glutathione (GSH) were measured by high pressure liquid chromatography (HPLC). Serum folate and VitB12 and red cell folate were measured using automated specific binding assays.

**Outcomes** - The severity of anxiety (Pearson’s $r = -0.290, P=0.035$) and depression (Pearson’s $r = -0.365, P=0.007$) was inversely related to the concentration of plasma CYS-GLY in males but not in females. In contrast, anxiety was inversely related to the concentration of serum VitB12 in females (Spearman’s $r_s = -0.269, P=0.028$) but not in males. There was no relationship between the other thiols (including HCY) and folate with anxiety and depression ($P>0.05$). Cognitive impairment was not related to any of the thiols or vitamins probably because cognitive impairment (MMSE score ≤24) was very low in this cohort (3 of the 120 subjects).

**Conclusions** - The observed HCY-independent association of CYS-GLY and VitB12 with anxiety and depression in this cohort is a novel finding which may help shed some light on the development of these disorders in the elderly.
Changes to diet and physical activity have the potential to treat the metabolic syndrome in female Pakistani immigrants

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Background - The Metabolic Syndrome is a multifactor disorder which includes obesity insulin resistance hypertension, alteration in glucose and lipid metabolism. The disorder has been identified as an area requiring vigorous lifestyle intervention. It has been established that weight loss significantly improves all aspects of the Metabolic Syndrome. South Asians in Britain have been shown to be a high-risk population for coronary heart disease and other insulin resistance related conditions. It is believed that other migrant South Asians are high risk populations but there is limited data to show this.

Objectives - To describe the current risk factor status with respect to the Metabolic Syndrome for a group of female Pakistani migrants in Australia. This is important baseline data will be used to develop a culturally appropriate intervention for this population.

Design - A pilot sample of Pakistani female volunteers (n=15, age=37.6±4.3 years [all data is ± SEM]) was recruited from urban Melbourne via snowballing techniques. Volunteers were screened for the presence of two or more components of the Metabolic Syndrome, according to the ATPIII criteria.

Baseline data was collected with participants completing a questionnaire on their state of health, dietary pattern in Australia and physical activity. The intervention was built around a food and exercise manual. In addition anthropometric measurements, blood pressure, blood lipid profile, blood glucose and insulin levels were collected.

Results - Results indicated that this group of female Pakistani migrants were obese (BMI 31.5±1.4), hypertensive (systolic 145±6±4.1 mmHg, diastolic 88±6±1.3 mmHg), hypertriglyceridaemic (1.3±0.3 mmol/L) and three were diabetic. In addition all were inactive taking less than 4000 steps per day measured by pedometer.

Conclusion - The results suggest that this group of female Pakistani migrants suffer from the Metabolic Syndrome and that a culturally sensitive programme of dietary modification and increased physical activity has great potential to treat their condition.

References


Effects of dietary weight loss on sympathetic activity and cardiac risk factors associated with the metabolic syndrome

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Background - Weight reduction, the first-line treatment for the metabolic syndrome, improves insulin sensitivity and associated metabolic and cardiovascular abnormalities but there is a paucity of data regarding its effects on sympathetic nervous system (SNS) activity in this clinical setting.

Objectives - 1. To test the hypothesis that dietary weight loss attenuates both insulin resistance and SNS activity 2. To examine the relationships between SNS activity, metabolic and cardiovascular parameters.

Design - Twenty-three metabolic syndrome subjects (ATP III criteria, age 58 ± 2 yr, body mass index 33.3 ± 0.8 kg/m², mean ± SEM) participated in a 3-month dietary weight loss program, using a modified DASH diet (26% fat, 22% protein, 51% carbohydrate, 100 mmol/day sodium). Before and following treatment participants underwent measurements of postganglionic muscle sympathetic nerve activity (MSNA, microneurography at a peroneal nerve), whole-body plasma norepinephrine spillover, spontaneous cardiac baroreflex function, oral glucose tolerance and insulin sensitivity.

Outcomes - A mean weight loss of 6.3 ± 0.7 kg or 7% of initial body weight resulted in significant improvements of all metabolic syndrome components. These changes were accompanied by significant decreases in norepinephrine spillover rate (by 43%, P= 0.005) and MSNA (from 40.6 ± 2.1 to 34.6 ± 2.4 bursts/min, P= 0.01) and an improvement in cardiac baroreflex sensitivity (from 7.4 ± 0.6 to 9.0 ± 1.0 ms/mmHg, P= 0.02). The decrease in norepinephrine spillover correlated positively and independently with change in plasma leptin concentrations (r =0.49, P=0.03). Subgroup analyses showed that only those subjects who were insulin resistant at baseline (HOMA ≥ 2.5) experienced a significant reduction in norepinephrine spillover, despite similar weight loss in insulin resistant and insulin sensitive subjects.

Conclusions - Weight loss by a hypocaloric diet with moderate sodium restriction diminishes sympathetic activity in metabolic syndrome subjects. This may be due to the consequences of decreased leptin concentrations, enhanced insulin sensitivity or improvements in cardiac baroreflex function.
Concurrent Session 6

Comparison of 4 *ad libitum* weight loss diets of varying glycemic load on cardiovascular risk factors

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**Background** - Compared with conventional low fat diets, high-protein and low-glycemic index (GI) diets have been associated with greater rate of weight loss. While both methods reduce dietary glycemic load (GL), the effects on cardiovascular risk may differ.

**Objective** - To evaluate the effects of 4 diets varying in GL, GI and protein on lipid and glucose metabolism.

**Design** - A 12-week randomised trial of 4 *ad libitum* diets: diet 1 was a high carbohydrate, high GI diet (HGI), diet 2 was similarly high in carbohydrate but low GI (LGI), diets 3 and 4 replaced some of the carbohydrate with protein, specifically from lean red meat, and included carbohydrate from either high or low GI foods (HP/HGI and HP/LGI respectively). The diets were similar in fat (30% energy) and type of fat. All key foods and some pre-prepared meals were provided on a weekly basis to assist compliance. Fasting blood samples were taken 0, 6 and 13 weeks.

**Outcomes** - In total, 129 subjects were recruited and 116 completed the intervention. Changes in weight and body composition were reported previously.¹ In the primary intention-to-treat analysis, total cholesterol and LDL-cholesterol changes showed significant differences among the 4 diets (*P* = 0.04 and 0.019 respectively). Despite similar weight loss, total and LDL-cholesterol rose by +5% and +8% respectively on the HP/HGI diet and fell by -4% and -6% respectively on the LGI diet (*P* = 0.033 and 0.013 for total and LDL-cholesterol respectively). Overall, there was a significant effect of GI, but not protein content, on change in total cholesterol (*P* = 0.019) and LDL cholesterol (*P* = 0.009). HDL-cholesterol rose and triglyceride concentrations fell in all groups with no differences among the four diets.

**Conclusions** - Reduced GL diets have varying effects on cardiovascular risk factors. Low GI carbohydrate foods may be more important in high protein diets because of their capacity to attenuate undesirable changes in lipid metabolism.

**References**


Relationships between clinical data and baseline eating behaviours in a sample of overweight volunteers for a dietary intervention trial

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**Background** - Dietary risk factors for heart disease may be associated with specific eating behaviours. The Dutch Eating Behavior Questionnaire (DEBQ) divides eating behaviour into three categories – emotional, external and restrained.¹ The DEBQ has been previously validated in obese and healthy weight subjects.²

**Objective** - To identify relationships between clinical indicators of the Metabolic Syndrome and eating behaviour scores.

**Design** - Volunteers were 17 adults determined as overweight or obese (BMI=25-35) but otherwise healthy (no disease diagnosis or on medication). Individuals were instructed on completing the DEBQ at the first clinic visit. Fasting blood samples were collected by trained professionals. Bloods were analysed for blood glucose, insulin, and blood lipid levels. Spearman’s correlation coefficients were used to determine relationships using preliminary data.

**Outcomes and conclusion** - Strong correlations were found between emotional eating and values (mean ± SD) for key clinical indicators of the Metabolic Syndrome: BMI 31.84 ± 3.39 kg/m² (0.48), glucose 5.62 ± 0.48mmol/L (0.51, *P* ≤ 0.05), total cholesterol 5.75 ± 1.75mmol/L (0.56, *P* ≤ 0.05), and insulin 9.42 ± 2.88mU/L (0.57, *P* ≤ 0.05). These results suggest emotional eating may be a pattern of eating that increases risk and should be targeted in intervention strategies.

**References**

Concurrent Session 7

General practitioners’ perception of their role in dietary counselling
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Background - Proven effective methods of dietary change are not being applied to patients who have experienced a cardiovascular event. Key investigators have reported that a high proportion of these cardiac patients have poor nutrition, are overweight and/or obese with diets high in saturated fat and cholesterol. The overall aim is to facilitate the improvement of the nutritional health of cardiac patients aged 65-75 years.

Objective - The aim of this qualitative study was to elicit the opinions of a range of Victorian general practitioners regarding the value of dietary counselling for the older cardiac patient.

Design - An Exploratory qualitative interview study was conducted with 30 general practitioners in Melbourne, Australia. Each interview lasted 30 minutes. The texts were then analysed using the computer software program NUD*IST database.

Outcomes - The general practitioners described their roles as either: coordinators of care and having holistic roles or as having no role in dietary counselling. The frequency and duration of dietary counselling was not clearly evident in interviews but counselling appeared to range from the provision of no advice to bouts of advice from once to perhaps four times a year.

Conclusions - General practitioners who provided dietary counselling made up the smallest proportion of general practitioners in this study. The context in which dietary counselling in provided needs to be understood if we are to attempt to address the issues which influence general practitioners’ provision of dietary counselling. Findings from this study will be incorporated into prevalence studies of general practitioners, dietitians and cardiologists.

Implementation of the folate–neural tube defect health claim in Melbourne
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Background - In late 1998 the then Australia New Zealand Food Authority (ANZFA) commenced a trial permitting a health claim on certain folate-rich foods, both fortified and non-fortified, as part of a folate–neural tube defect (NTD) Health Claim Pilot. The pilot created a precedent for health claim implementation in Australia and New Zealand.

Objective - To survey the implementation of the folate–NTD health claim and the availability of folate fortified food products in Melbourne supermarkets in 2004.

Design - During 2004 the 128 permitted food products listed in the transitional standard for health claims were sought in 5 large supermarkets in suburban Melbourne. Found products were examined for folate fortification, use of the folate–NTD health claim and an ANZFA folate approved logo.

Outcomes - Eighty seven of the 128 permitted food products were found. Two of the 87 found food products were implementing the folate–NTD health claim on their label and one of these products was implementing the ANZFA folate approved logo. Twenty eight of the listed food products were fortified with folate.

Conclusions - Six years after commencement, the Health Claim Pilot was being poorly implemented in Melbourne. The findings raise questions about the choice of health claim for the pilot, the efficacy of the health claim to support the voluntary folate fortification public health intervention and the capacity of the pilot’s verification system to monitor the implementation of the folate–NTD health claim.
Concurrent Session 7

**Screening food-based libraries to identify antihypertensive bioactives**

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¹&²CSIRO Preventative Health National Research Flagship

**Background** - Development of functional foods and nutraceuticals targeted to promote cardiovascular benefits is an active area of research at present. Supporting evidence exists for several such bioactives including plant sterols, n-3 polyunsaturated fatty acids, polyphenols and peptides from various sources.

**Objective** - To develop and validate suitable assay systems to allow rapid screening of different food based peptide libraries in an attempt to identify potential bioactives that may possess antihypertensive properties.

**Design** - A rapid spectrophotometric assay to identify inhibitors of angiotensin-converting enzyme (ACE) was developed based on the method of Cushman and Cheung.¹ Other potential target mechanisms identified include scavenging of free radicals and inhibition of the action of angiotensin II at its receptor.

**Outcomes** - A reproducible assay for ACE activity (CV 4.1%) was established and validated using the pharmacological inhibitor captopril, and Val-Ala-Pro, a known inhibitory tri-peptide, as standards. A selection of commercially available, vegetable derived protein hydrolysates demonstrated ACE inhibitory activity (wheat, 20-50%; soy, up to 20%; rice, 10-70% and pea, 10-60%). In some cases it was possible to enhance this activity by further fractionation.

**Conclusions** - The ability of some food-based fractions to inhibit ACE was demonstrated. By targeting different mechanisms of antihypertensive action, the potential exists to improve the efficacy of dietary interventions for lowering blood pressure.

**References**


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**An economic evaluation of the re-introduction of a school milk program**

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**Background** - Osteoporosis is a major cause of morbidity and mortality in Australia incurring an annual health care cost of approximately $1.9 billion.¹ Although osteoporosis is a disease of the elderly it has been predicted that increasing peak bone mass during growth will significantly delay the onset of osteoporosis during aging², thereby offering improved health outcomes and health care savings over time.

**Objective** - To determine the potential cost-effectiveness of school milk programs (SMP) compared to current practice.

**Design** - A semi-Markov model was developed to predict the impact of SMP upon health outcomes and health care costs over life-expectancy. The model allows for transitions between 10 health states comprising 8 different hip and vertebral fracture states, good health, and death. These probabilities were derived from published epidemiological literature, including Australian data wherever possible. The effect size was estimated as an average increase in peak BMD of 1.5%.

**Outcomes** - Cumulative life-years and quality-adjusted life-years (QALYs) are predicted for cohorts of current children and a hypothetical intervention respectively. Estimated incremental life-years were 0.0096 and 0.0016, and QALYs were 0.0476 and 0.0148 for females and males respectively. Health outcomes and costs are systematically compared to assess cost-effectiveness, that is, ‘value-for-money’ of SMP.

**Conclusions** - As expected, gender significantly affects the predicted impacts of SMP. The impacts upon life-expectancy are minimal and provide weak support for funding of SMP. Including morbidity impacts through evaluation of QALYs greatly strengthens the funding argument. At a cost per QALY of less than $25,000, SMP compares favourably with many other health care interventions receiving funding support.

**References**


Concurrent Session 7

**Short-term milk supplementation is inadequate to promote optimum peak bone mass for Chinese children**

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\(^2\)The Institute of Nutrition and Food Safety, Chinese Centre for Disease Control and Prevention, China
\(^3\)Institute of Endocrinology and Diabetes, the Children’s Hospital at Westmead, Australia

**Background** - Our two-year school milk intervention trial with Beijing Chinese girls aged 10 years showed that 330 ml milk supplement (fortified with vitamin D and/or calcium) on school days had resulted in greater increases in regional (pelvis, left leg and right leg) bone mineral content (BMC) and bone mineral density (BMD).

**Objectives** - To assess whether these effects were sustained 3 years after the supplement withdrawal.

**Design** - Regional BMC and BMD were reassessed in 274 of the 375 girls whose regional bone mineral data have been studied at the end of the intervention, with 87 from the group received calcium fortified milk (Ca milk), 82 from the group received calcium and vitamin D fortified milk (CaD milk), and 89 from the control group. The measurements were made at the same dual-energy X-ray absorptiometry (DEXA) machine by the same technicians.

**Outcomes** - Three years after the cessation of milk supplementation, there were no significant differences between the three groups in the changes of BMC and BMD of pelvis, left leg and right leg from baseline, after adjusted for age and corresponding baseline values.

Adjusted changes in BMC and BMC since baseline at follow-up*

<table>
<thead>
<tr>
<th></th>
<th>BMC (g)</th>
<th>BMD (g/cm(^2))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ca Milk group</td>
<td>CaD Milk group</td>
</tr>
<tr>
<td>Pelvis</td>
<td>132.77</td>
<td>130.55</td>
</tr>
<tr>
<td>Right leg</td>
<td>172.34</td>
<td>168.82</td>
</tr>
<tr>
<td>Left leg</td>
<td>170.30</td>
<td>167.54</td>
</tr>
</tbody>
</table>

* adjusted for age and corresponding baseline value, all \(P > 0.05\)

**Conclusion** - The benefit of milk supplementation on regional bone mass accretion had disappeared three years after the cessation of milk supplementation. Two years milk supplementation in Chinese pubertal girls is unlikely to have long-lasting effects on their bone mineral accretion. Short-term milk supplementation is not adequate to promote optimum peak bone mass for Chinese children.
Concurrent Session 8

The effect of CLA on body composition in humans: systematic review and meta-analysis
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Background - It is suggested conjugated linoleic acid (CLA) can alter body composition in humans in favour of improved cardiovascular health.

Objective - To evaluate the efficacy of CLA on altering body composition in humans by reviewing all available randomised controlled trials. Body composition measures were body weight, body fat mass (BFM) and lean body mass (LBM).

Design - Eligible trials were identified from a search of electronic databases MEDLINE, EMBASE, CENTRAL, CINAHL, citation index (Web of Science) and the Australian and International dissertation libraries. No language restrictions were applied. Date of last search: July 2005. Study quality was assessed based on concealment allocation, use of a placebo/control, blinding, and attrition rate.

Outcome - Thirteen trials met inclusion criteria. In general, trials had low sample size, short intervention period and were considered of medium to low quality. No trials reported a significant reduction in body weight with CLA. Three of eleven trials reported a significant reduction in BFM with CLA. Four trials measured LBM but none reported a reduction with CLA. Pooled data, calculated according to a fixed effects model, showed CLA reduced weight (WMD: -0.67kg, 95% CI: -0.97, -0.38, P <0.001, n=504, from 8 trials), reduced body fat mass (WMD: -1.13kg, 95% CI: -1.50, -0.76, P <0.001, n=372, from 5 trials), but had no effect on lean body mass (WMD: 0.12kg, 95% CI: -0.14, 0.39, P =0.36, n=454, from 7 trials).

Conclusion - CLA had a small effect in reducing body weight (0.67kg) and body fat mass (1.13kg) in humans. However, the design and methods of the thirteen trials differed considerably. Therefore, this result should be interpreted with caution, and may not be clinically relevant. We suggest long-term trials of high quality are needed to adequately determine the effectiveness, and safety, of CLA on body composition in humans.

Anti-inflammatory activity of lipid-rich extract in Chinese mussels
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Background – Lyprinol, a lipid-rich extract of New Zealand green-lipped mussel has shown an anti-inflammatory activity. However, there are no data on whether Chinese mussel extracts have anti-inflammatory activity.

Objective – The aim of this study was to investigate the anti-inflammatory activity in Chinese mussels.

Design – Chinese blue mussel (Mytilus edulis, ME), green mussel (Perna canaliculus, PC) and black mussel (Mytilus galloprovincialis, MG) were collected in May 2004, by the Department of Science and Technology, Shensi County, Zhejiang, China. The lipids were extracted by chloroform-methanol (2:1, v/v) containing 10mg/L of butylated-hydroxytoluene (BHT). The anti-inflammatory activities of the lipid-rich extracts of Chinese Mussels were assayed by the infiltration method and compared to Lyprinol (NZPC) and a control (vegetable oil), in Sprague-Dawley rats.

Outcomes – The figure shows the result of anti-inflammatory activity of lipid-rich extracts of the different mussels.

Conclusions – Present result showed that Chinese blue, inflammatory activity as potent as Lyprinol in this assay. green and black mussel extracts have similar anti-

References
Concurrent Session 8

Alternatives for elevating the omega 3 LCPUFA status of the population
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Background - Health authorities have recognised the importance of omega 3 long chain polyunsaturated fatty acids (LCPUFAs) in maintaining health. It is generally accepted that we need to increase our dietary intake of these fatty acids, particularly eicosapentaeanoic acid (20:5n-3, EPA) and docosahexaenoic acid (22:6n-3, DHA) through an increased intake of fish, consumption of fish oil supplements or increasing our intake of omega 3 enriched foods. These recommendations represent significant changes in dietary habits and rely heavily on an already declining global fish supply. Are there alternatives to elevate the omega 3 LCPUFA status of the population? α-linolenic acid (18:3n-3, ALA) is a substrate for the fatty acid synthetic pathway and is converted to EPA and DHA. Increasing ALA intake from vegetable oils improves the EPA status in humans but has only a marginal effect on DHA status. Two fatty acids downstream of ALA, EPA and docosapentaeanoic acid (22:5n-3, DPA), are also substrates for the pathway and may be more readily converted to DHA.

Objective - To compare the accumulation of DHA in human hepatoma (HepG2) cells supplemented with ALA, EPA and DPA.

Methods - HepG2 cells were seeded and grown in DMEM plus 10% foetal calf serum. After three days, the medium was replaced with serum free medium supplemented with increasing concentrations of ALA, EPA or DPA bound to bovine serum albumin. After 48h, cells were harvested for fatty acids analysis by gas chromatography.

Outcomes - There was a dose-dependent increase in the level of ALA, EPA and DPA in HepG2 cell phospholipids following supplementation with each of these fatty acids. The accumulation of EPA following supplementation with ALA, EPA and DPA was also dose-dependent. Following supplementation with ALA, EPA or DPA, the level of DHA in cell phospholipids increased 1.7-, 2.4- and 2.8-fold, respectively. The accumulation of DHA was significantly (P<0.05) higher in cells supplemented with EPA and DPA compared to those supplemented with ALA.

Conclusions - Foods rich in fatty acids downstream of ALA in the fatty acid synthetic pathway, such as EPA and DPA, may provide an alternative means to elevate the omega 3 LCPUFA status of the population.

A valid and reproducible food frequency questionnaire to estimate long chain omega-3 polyunsaturated fatty acid intakes
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Background - A new food frequency questionnaire (FFQ) has been developed at the University of Wollongong to estimate dietary long chain omega-3 polyunsaturated fatty acid (LC n-3 PUFA) intakes.

Objectives - To validate the new FFQ upon comparison with another well known dietary analysis method and biomarkers of LC n-3 PUFA intake. To determine the reproducibility of the FFQ.

Design - Healthy subjects (n=53) gave a fasting blood sample and completed both the FFQ and a 3-day weighed food record (FR). Average daily LC n-3 PUFA intakes from the FFQ and FR were determined and compared for differences using Wilcoxon signed rank tests. Red blood cell (RBC) and plasma fatty acids were measured by gas chromatography. Spearman correlation co-efficients assessed the relationship between LC n-3 PUFA intakes from the FFQ and both RBC and plasma LCn-3 PUFA (expressed as a % of total fatty acids). In a separate study, 33 subjects completed the FFQ twice, four to six weeks apart. Spearman correlation co-efficients assessed the relationship between intake estimates from the repeat FFQs.

Outcomes - There were no significant differences between intakes from the FFQ and FR and Spearman correlation co-efficients were 0.81, 0.81, 0.70 and 0.70 for total LCn-3PUFA, EPA, DPA and DHA respectively (P<0.0001). Significant Spearman quotes correlation co-efficients were obtained between the FFQ intakes and RBC fatty acids for total LC n-3 PUFAs, EPA and DHA (0.50, 0.39 and 0.40 respectively) but not for DPA. Very similar results were obtained for plasma fatty acids. Significant Spearman correlation co-efficients for intakes of EPA, DPA, DHA and total LC n-3 PUFA from the repeat FFQs were 0.88, 0.90, 0.87 and 0.88 respectively.

Conclusion - The new FFQ is valid and reproducible.
Concurrent Session 8

Effects of omega-3 polyunsaturated fatty acids on cardiovascular risk, exercise performance and recovery in Australian Football League (AFL) players

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²Nutritional Physiology Research Centre, University of South Australia and University of Adelaide

Background - Long chain omega-3 polyunsaturated fatty acids (LCn-3) can improve cardiovascular (CV) function and reduce the risk of CV disease. Studies have investigated the potential for these CV benefits to improve athletic performance without success, but none have investigated effects on recovery.

Objectives - To examine the effect of LCn-3 on exercise performance, recovery, and CV risk in AFL players.

Design - Twenty-five AFL players completed a five week training program during which they were randomised, double-blind, to consume six g/day of fish oil (FO; n=12, HiDHA®, Numega Ingredients Pty Ltd) or sunflower oil (C; n=13). At baseline and after five weeks erythrocyte (RBC) membrane LCn-3 content and fasting serum triglyceride (TG) concentrations were assessed, and players performed two treadmill runs (R1 and R2) to exhaustion separated by five min of recovery. Heart rate (HR) was monitored throughout each treadmill run. R1 assessed running performance while R2 assessed recovery (expressed as % of R1).

Outcomes – After five weeks, RBC LCn-3 content had increased 47.4 ± 11.2% in FO (P <0.001) and TG had decreased significantly compared with C (FO, -25.4 ± 4.9%, C, 4.9 ± 7.0%; P =0.002). HR during steady-state submaximal exercise decreased significantly in FO compared with C (FO, -8 ± 2 bpm, C -2 ± 2 bpm; P =0.05). Time to exhaustion during R1 increased in both groups (P <0.001) but by similar amounts (FO, 10.2 ± 2.2%, C 17.3 ± 4.3%; P =0.18). Recovery did not change in either group (FO, -2.6 ± 10.9%, C -13.5 ± 6.0%; P =0.87).

Conclusion - Five weeks of supplementing AFL players with LCn-3 reduced HR during submaximal exercise and fasting TG, reflecting improved CV function and decreased CV risk, but did not enhance endurance exercise performance or recovery.

Combined effects of omega-3 supplementation and regular exercise on body composition and cardiovascular risk factors

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Background - Regular exercise and inclusion of n3 fatty acids in the diet can improve cardiovascular (CV) health.

Objectives - We examined whether the combination of both could reduce CV and metabolic risk factors more than either treatment alone.

Design - Volunteers with metabolic syndrome characteristics (mean BMI=34 kg/m²; TG=1.82 mM) were randomly assigned to take 6 g/day of HiDHA® tuna fish oil or sunflower oil (provided in blinded capsules by NuMega Ingredients) and to undertake regular exercise (walking for 45 min, 3 days/wk at 75% of age-predicted maximal heart rate) or remain relatively sedentary. Fasting plasma lipids, blood pressure and measures of arterial function and respiratory exchange ratio (RER) during exercise were assessed at baseline and after 6 and 12 weeks of intervention. Body composition was assessed by Dual Energy X-ray Absorptiometry at baseline and 12 weeks only.

Outcomes - Fish oil supplementation lowered plasma triglycerides, increased HDL cholesterol and tended to improve endothelium dependent vasodilation (P =0.06), while exercise independently improved arterial compliance (P <0.01). The combined treatment, however, caused a 5% loss of body fat (P <0.05) - a benefit not seen with either treatment alone. The loss of fat correlated with increased fat oxidation (RER) during exercise (P <0.01).

Conclusion - Fish oil and exercise appear to have a synergistic effect on body fat, indicating that omega-3 supplementation may be a useful adjunct to exercise programs aimed at improving body composition and CV risk.
Concurrent Session 9

**The evaluation of a brief pilot nutrition and exercise intervention for the prevention of weight gain in general practice patients**

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2 The Victorian Council on Fitness and General Health (VICFIT), Melbourne, Victoria, Australia

**Background** - The Active Script Program (ASP) is a brief physical activity intervention that is available for use by approximately 1200 General Practitioners (GPs) in Victoria. Twenty-six out of 31 divisions of general practice have reported using the ASP. However, more effective health promotion lifestyle advice could include both nutrition and physical activity recommendations.

**Objective** - To pilot test a brief written prescription (script) recommending lifestyle (nutrition and physical activity) changes delivered by GPs to their patients.

**Design** - The script included five nutrition messages and personalized exercise advice for a healthy lifestyle and/or the prevention of weight gain. GPs volunteered to participate from practices across metropolitan Melbourne. GPs were asked to administer 10 scripts over 4 weeks to 10 adult patients with a body mass index (BMI) of between 23 and 30 kg/m². Information recorded on the script consisted of patients’ weight, height, waist circumference, gender, date of birth, type and frequency of physical activity prescribed, and the nutrition messages selected by the GP. GPs also recorded reasons for administering the script. Interviews recorded GPs views on using the script.

**Outcomes** - Nineteen GPs (63% female) provided a median of nine scripts over four weeks. Scripts were administered to 145 patients (mean age: 54 ± 13.2 years; mean BMI: 31.7 ± 6.3 kg/m²; 57% female), 52% of whom were classified as obese (BMI ≥ 30 kg/m²). GPs cited ‘weight reduction’ as a reason for writing the script for 78% of patients. All interviewed GPs (90%, n=17) indicated that the messages were clear and simple to deliver.

**Conclusion** - GPs found the ANS provided clear nutrition messages that were simple to deliver. However, GPs administered the script to obese patients for weight loss rather than to prevent weight gain among the target group. This has important implications for future health promotion interventions designed for general practice.

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**The effect of weight loss on blood pressure response to acute mental stress**

SJ Torres, CA Nowson

School of Exercise and Nutrition Sciences, Deakin University, VIC 3125

**Background** - Blood pressure (BP) responses to stress have been associated with the development of hypertension.

**Objective** - To assess the effect of weight loss on BP responses to stress.

**Design** - Sixty-four men completed a baseline mental stress test (13 minutes resting, 7 minutes stress, 36 minutes recovery) and then either participated in a 12 week weight loss program incorporating diet and exercise (intervention group, n=33) or maintained weight (control group, n =31). Both groups underwent a final stress test after 10-12 weeks.

**Outcomes** - Fifty-five men completed the study [intervention (n =28), controls (n=27)]. At baseline there were no differences between the groups in mean ± SEM age (48.7 ± 1.7 versus 49.9 ± 2.1 years), Body Mass Index (30.0 ± 0.4 versus 28.8 ± 0.6 kg/m2) or resting BP (126.8 ± 1.5 / 83.0 ± 1.0 versus 125.4 ± 1.4/ 84.3 ± 1.5 mmHg). Weight fell by 4.3 ± 0.5 (mean ± SEM) kg (P <0.05) in the intervention group and was unchanged in the controls (+0.4 ± 0.3 kg). The intervention group had a greater fall in resting systolic BP (SBP) and diastolic BP (DBP) following weight loss when compared to controls (mean between group difference of change: SBP: -4.6 ± 1.8 mmHg, P <0.05; DBP:-3.2 ± 1.6 mmHg, P =0.05). Following weight loss, there were no differences in the stress induced change (stress minus resting values) in SBP, DBP and pulse rate between the groups. After weight loss, the intervention group returned to resting SBP levels in less time than the controls (15.2 ± 1.8 versus 20.9 ± 1.9 minutes, P<0.05) and SBP was significantly lower in the first 24 minutes post stress (P <0.05).

**Conclusion** - A 5% loss of weight can lead to a general reduction in BP during mental stress and importantly assists to reduce the length of time that SBP remains elevated after a stressful event. These favorable reductions in BP responses to stress are likely to reduce the time that BP is raised during the day and potentially improve cardiovascular risk, as impaired post-stress recovery has been found to predict longitudinal increases in blood pressure in middle-aged men and women.

**References**

Concurrent Session 9

Salt and blood pressure: relationship with obesity, weight loss and direct effects on vascular function

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¹CSIRO Human Nutrition and ²The Royal Adelaide Hospital, Adelaide SA

Background - The mechanisms underlying the link between obesity and hypertension are uncertain and there are few data on the effect of weight loss on the blood pressure response to salt loading.

Objective - To determine the effect of weight loss on the blood pressure response to salt loading

Design - 35 overweight and obese volunteers followed a 4 week protocol. They were randomised to take 12g of salt (250 mmol/d) for either the first or last 2 weeks and followed a low salt diet (<30 mmol/day) during the other two weeks. Salt and potassium intake was checked by a 24 h urine collection at the end of each 2 week period while blood pressure was measured with ambulatory monitors. Pulse wave velocity and augmentation index were also measured and flow mediated dilatation (FMD) was measured just prior to and immediately after weight loss. The salt loading protocol was repeated after a 12 week weight loss intervention which aimed to reduce weight by 6-12 kg.

Outcomes - Salt loading of 200mmol/d elevated day time blood pressure by 6/3 mm Hg which was not altered by a 7.7 kg weight loss. Resting fasting blood pressure during the low salt phase fell with weight loss by 6/3 mm Hg. Salt loading decreased FMD from to 6.7 to 4.1% (P <0.01) while augmentation index increased from 23 to 26%. Pulse wave velocity was unchanged. Following weight loss the blood pressure to salt was unchanged and none of the vascular measures improved.

Conclusions - Salt has direct vascular effects and its effects on blood pressure are not diminished by weight loss.

Predicting weight loss in overweight and obese people using a very low energy diet

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²Department of Mathematical and Statistical Science, La Trobe University, Bundoora, VIC 3086
³Department of Physiology, University of Melbourne, Parkville, VIC 3052

Background - Treatment of overweight and obesity with very low energy diets (VLEDs) is one of the most extensively used weight-loss method in the scientific literature.¹ Our clinical experience has been that there is a wide variation in tolerance, acceptability and weight loss success associated with the use of VLEDs.

Objectives - To explore predictors of weight loss in volunteers participating in a weight loss program using a VLED.

Design - 180 healthy overweight or obese men and women, age 43.0 years (SD=10.5); weight 112.5 kg (SD=24.2); BMI 39.1 kg/m² (SD=7.6) participated in a longitudinal study of 12-weeks using the commercially available VLED known as Optifast®.

Outcomes - 159 participants (88.3%) completed 12 weeks of the VLED. Weight loss ranged from 3.1% to 25.8% of baseline weight. Regression analysis revealed three baseline predictors were significant for the prediction of weight loss after 12 weeks. The significant predictors were weight (P =0.014), waist (P =0.025) and fat mass (P =0.005) and the model explained 49.2% of the variation in the response. Including weight loss at week 4 along with the baseline predictors resulted in a vastly better fitting model that explained 80.4% of the variation in weight loss at week 12. On its own, weight loss at week 4 explains 74.4% of the variation in the response. Residual analysis for all estimated models indicated that there were no major violations of the usual model assumptions. An individual’s age, sex and BMI at baseline did not predict their weight loss after 12 weeks of VLED treatment.

Conclusion - Parameters that predict successful outcomes from VLED treatment may assist in determining the degree of success of VLED treatment for overweight and obese individuals.

References
A prospective study of the effect of a 12-week very low calorie diet on changes in health status, liver size and abdominal adipose tissue in the severely obese

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Background - In morbidly obese individuals, very-low-calorie diets (VLCD) can achieve substantial, rapid weight loss, and are increasingly prescribed prior to obesity surgery to minimise surgical risk and complexity, by reducing liver size and abdominal adiposity. Despite their growing popularity, the safety, efficacy and optimal time frame of VLCD in this setting has received little attention.

Objective - To investigate a range of health outcomes of a 12-week VLCD in a severely obese population

Design - A prospective observational study of 32 subjects (19M, 13F, mean age 47.5 ± 8.3y, mean BMI 47.3 kg/m²) undertook a 12 week VLCD. Outcome measures included change in: liver volume (LV), visceral adipose tissue (VAT), subcutaneous adipose tissue (SAT), weight, the pattern of VL and VAT change, anthropometry, biochemical parameters, QoL, compliance, acceptability and side-effects. CT and MRI measured changes in LV, and VAT and SAT area at baseline, week 2, 4, 8, and 12. Paired samples t-tests, Pearson correlations, ANOVA and linear regression were performed using SPSS version 12.

Outcomes - All results listed below are significant at P<0.001.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Baseline¹</th>
<th>After 12 weeks¹</th>
<th>Mean % change²</th>
</tr>
</thead>
<tbody>
<tr>
<td>weight (kg)</td>
<td>139.8 ± 11.0</td>
<td>125.0 ± 11.7 (32)</td>
<td>-10.6 (-0.7 to -19.1)</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>140.8 ± 9.8</td>
<td>128.1 ± 10.0 (32)</td>
<td>-9.0 (0 to -19.2)</td>
</tr>
<tr>
<td>Liver volume (L)</td>
<td>2.8 ± 0.5</td>
<td>2.3 ± 4.5 (32)</td>
<td>-18.7 (+20 to -51.6)</td>
</tr>
<tr>
<td>VAT area (cm²)</td>
<td>346.3 ± 103.3</td>
<td>285.1 ± 89.3 (32)</td>
<td>-16.9 (-12 to -52.6)</td>
</tr>
<tr>
<td>SAT area (cm²) (n=18)</td>
<td>454.5 ± 114.8</td>
<td>375.7 ± 109.7 (18)</td>
<td>-17.7 (+2.9 to -40)</td>
</tr>
</tbody>
</table>

¹mean ± standard deviation; ²mean percentage change (range of percentage change); n=32

A linear relationship exists between initial liver size and the percentage change in liver volume (r = .43, P = .015). Eighty percent of lost LV occurred between week 0 and 2 (P < 0.001). VAT loss was more uniform. Three factors contributed 51% of the variability in predicting a baseline LV >3.0L: TAG (β = .528, P ≤ 0.001), DBP (β = .310, P = .021), and CRP (β = .297, P = .025) (P = .006). Significant decreases occurred in glucose control, LFT, and lipids, whilst QoL increased. Attrition was 14% due mainly to taste intolerance. Acceptability was adequate, but waned over time. Mild transitory side-effects occurred.

Conclusion - Pre-operative weight loss by VLCD is effective and acceptable. Given the early reduction in LV, we suggest the duration for VLCD be at least 2 weeks, extending to 4 to 6 weeks to achieve useful reductions in VAT and body weight, without compromising compliance and acceptability.

Using cognitive behaviour therapy to promote behaviour change in overweight and obese adolescents

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Background - Understandings of the mechanisms of weight regulation, and the dietary and physical activity changes required for weight loss have advanced considerably in recent times. However the effectiveness of this knowledge in the promotion of weight loss is compromised by a lack of compliance to recommendations. Despite demonstrated effectiveness in the management of difficult to treat disorders, psychological behaviour change strategies have been under-utilised in the treatment of overweight and obesity. Cognitive behaviour therapy (CBT), an approach to changing behaviour and the thoughts and emotions maintaining behaviour, has been shown to be at least as effective as drug therapy in the treatment of a range of disorders requiring long term behaviour change. CBT holds promise as an effective approach to promoting the behaviour changes required for weight loss and weight maintenance.

Objectives - To examine the effectiveness of CBT in the treatment of overweight and obese adolescents (12 to 18 years).

Design - A randomised controlled trial with 63 overweight or obese adolescents aged 11.7 to 18.9 years (M = 14.39, SD=1.85). The 12-session CBT program included strategies targeting eating habits and food choices, sedentary behaviour and physical activity, and the management of physical, social, cognitive and emotional factors interfering with long-term behaviour change. Dietary intake was measured using a 7–day weighed food diary completed at pre and post intervention.

Outcomes - Preliminary results reveal improvements in self-reported dietary habits. Those participants completing the program reported a statistically significant reduction in daily total energy intake (pre M = 7633kJ, post M = 6234 kJ, P < 0.001) and daily total fat intake (pre M = 67.02g, post M = 50.86g, P < 0.001). The daily total weight of food intake was not significantly different at pre and post intervention (pre M = 1776.21g, post M = 1587.82g, P > 0.05).

Conclusion - A CBT based program is effective in changing the food choices required for weight loss in overweight and obese adolescents. The use of CBT in the treatment of obesity warrants further in adolescents and in children and adults.
Alternate sources of dietary oil for Atlantic salmon (*Salmo salar*)

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**Background** - The supply of fish oil from wild fish stocks has reached a maximum sustainable level and if aquaculture production is to continue to expand alternate sources must be investigated and introduced. Vegetables oils, such as canola, linseed and sunflower, have been extensively investigated as alternate sources and it has been shown that they do not affect fish health or growth. However, these vegetable oils do not provide omega 3 long-chain polyunsaturated fatty acids (ω3 LC-PUFA), which provide the cardiovascular protective and other beneficial properties that are associated with eating salmon containing these ω3 LC-PUFA.

**Objective** - To determine the effect of novel lipid diets on health, growth and biochemistry of Atlantic salmon and how the fish use and store these lipids, including their regiospecific distribution.

**Design** - Two novel diets consisting of oil from: (i) a plant source *Echium plantagineum*, (Patterson’s Curse) which has moderate levels of stearidonic acid (SDA, 18:4ω3-14%) an ω3 LC-PUFA precursor, and (ii) a thraustochytrid (marine micro-organism) derived oil, that possesses high levels of ω3 LC-PUFA especially docosahexaenoic acid (DHA 22:6ω3), were assessed against vegetable and fish oil diets in two salmon feeding trials.

**Outcomes** - Significantly higher levels of ω3 LC-PUFA accumulated in the muscle tissue of salmon fed the SDA diet without any effect on the growth or health of fish. A 60% increase in ω3 LC-PUFA and a 40% increase in DHA occurred in the white muscle of fish fed a SDA oil diet compared with fish fed vegetable. Replacement thraustochytrid oil showed no effect on growth, feed conversion or displayed any negative effects on fish health compared to traditional fish oil diet.

**Conclusions** - SDA rich oil has potential for use in aquaculture and has shown acclimation of ω3 LC-PUFA in salmon tissues. This is the first trial that has shown in salmon an increase ω3 LC-PUFA, such as DHA, when it is not been fed in the diet. Thraustochytrids may be suitable for a finishing diet, but the current high production costs may limit its application for commercial aquafeeds.

**References**


Effects of gonadic hormone and phytoestrogen on fetal rat hippocampal neuron proliferation in vitro

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**Background** - Epidemiological data from retrospective and case-controlled studies have indicated that estrogen replacement therapy (ERT) reduces the risk of developing Alzheimer’s disease in aged women, and dietary phytoestrogen has been suggested as a potential alternative to ERT. There is, however, a lack of information on the mechanism of such treatment on central neuron function.

**Objective** - The present study aimed to determine the effects of gonadic hormone and phytoestrogens on the survival and proliferation of the hippocampal neurons, the neurons of importance in learning and memory function of the brain.

**Design** - The neuronal cell line (H19-7) derived from fetal rat hippocampus were cultured in DMEM medium with or without present of 10% fetal bovine serum (FBS) for 72 hours. Gonadic hormones, 17β-estrodiol and testosterone, and phytoestrogens, genesteine and daidsein, were added to the culture medium at various concentrations. Their proliferative and protective effects on the neuronal cell were determined by methylene blue and tetrazolum (MTT) assays, the former determines the total cell population and the latter determines the cellular viability. The effects of the hormone treatment on cellular production of brain-derived neurotrophic factor (BDNF) were also determined by ELISA.

**Outcome** - It was observed that 17β-estrodiol, testosterone, genesteine and daidsein at 20 nM or higher concentrations significantly increased the neuronal cell proliferation in the culture medium containing FBS. In culture medium containing no FBS, the gonadic hormone and the phytoestrogen at the similar concentration significantly improved the viability and survival of the neurons. The gonadic hormone also significantly increased the neuronal cell expression of BDNF when cultured in serum-free medium.

**Conclusion** - Gonadic hormones and phytoestrogens stimulate hippocampal neuron proliferation in vitro and improve the neuron viability in serum-free medium. The effects may be mediated partially through an increase of cellular BDNF expression.
Concurrent Session 10

**Glucose uptake in the equine hoof**
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**Background** - Laminitis is a crippling and potentially fatal condition of the equine hoof, associated with many causes, including carbohydrate overload, overfeeding, dietary oligofructans, metabolic syndrome, and Cushing’s Syndrome.¹ The mechanism of laminitis is unknown, but could be associated with impaired glucose uptake into the hoof.

**Objectives** - To characterise the physiological regulation of glucose transport in normal equine lamellae.

**Design** - Equine lamellar explants were incubated for up to 48 h in a cell culture medium. Glucose uptake was measured using 2-deoxy-D-[2,6-³¹H] glucose. Separation force was determined by tension testing. β-Adrenoceptors were measured by radioligand binding using [³¹H]-CGP-12177.

**Outcomes** - Lamellar explants incubated in the presence of glucose remained intact at forces of up to 916 g, whereas without glucose, explants became separated from the hoof wall at 416 ± 36 g. Insulin (300µU/mL) had no effect on glucose uptake, but Isoprenaline (40 nM) reduced glucose uptake to 60% of basal levels after 24 h and 48 h. Explants contained 90 ± 2.6% β₂-adrenoceptors and 10 ± 2.6% β₁-adrenoceptors.

**Conclusion** - Healthy lamellar tissue is dependent on glucose for structural integrity. Glucose uptake is impaired by catecholamines, which are associated with various stress conditions that can cause laminitis. Therefore, the data presented are consistent with the hypothesis that glucose uptake plays a role in certain types of laminitis.

**References**

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**Do commercial tryptophan pastes elevate plasma tryptophan concentrations in horses?**
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**Background** - Tryptophan (Trp) is an essential amino acid that is a precursor of serotonin, a neurotransmitter implicated in sedation, inhibition of aggression, fear and stress in various animal species and humans. Preparations containing Trp are marketed worldwide as calming agents to treat excitable horses, but there is no evidence of their efficacy. Coupled with this, it has been shown that high oral doses can be toxic. No work has been done to establish that commercial pastes actually increase Trp concentrations in the blood of horses, or how long this elevation lasts.

**Objectives** - To determine if a commercial Trp oral paste increases plasma Trp concentrations and to establish whether the pharmacokinetics of Trp are altered by different feeding regimens.

**Design** - Eleven mature geldings (BW 507 ± 12.9 kg) were fed a meal of 2.7 kg lucerne hay at 0900 h each day, supplemented in the afternoon with sufficient hay to meet maintenance energy requirements. At 0900 h the horses were also given either 3 doses of a commercial Trp oral paste (total 6.3 g L-Trp) or an equivalent volume of water in a crossover design. Blood samples were collected every 30 min for 6 h and analysed for total Trp using gas chromatography. The study was repeated after 3 weeks using the same horses fed a morning meal of 1.5 kg oats.

**Outcomes** - Baseline Trp concentrations measured 2 h after feeding were 71.8 ± 3.7µM and 36.7 ± 3.4 µM for horses fed lucerne hay or oats, respectively (P < 0.001). Peak Trp concentration in response to Trp paste was also higher in horses fed hay (167.6 ± 8.0 µM at 1130 h) versus oats (149.4 ± 13.7 µM at 1030 h; P <0.001), as was the area under a plot of Ty concentrations versus time (227.8 ± 8.7 µM.h versus 179.1 ± 14.9 µM.h; P<0.01). Tryptophan concentrations returned to baseline after 6 hours regardless of the ration fed.

**Conclusion** - No adverse signs were seen in this study although the effect of such doses fed over a more prolonged period is unknown. Tryptophan paste fed at this level does increase plasma Trp concentrations in horses. The amount and duration of this elevation is dependent on the type of diet fed. Further work is needed to determine if the Trp paste fed at lower doses has an effect and whether in fact an increase in Trp concentrations has any effect on equine behaviour.
Concurrent Session 10

Nutritive value of wet, dried and ensiled brewer’s grains
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Background - Brewer’s grains (BG) are the most important by-products of the brewing industry and they have long been used as livestock feed. The high moisture content of BG gives problems associated with their transportation and conservation. Two possible alternatives for conservation are ensiling and drying. However, little is known about the nutritive value of BG in Iran. Rumen degradability of a feed, is one of the most important indicators of nutritive value of feed.

Objective - To determine rumen degradability of dry matter and protein of wet (WB), dried (DB) and ensiled (EB) brewer’s grains and comparison to those of Soybean meal.

Design - Protein and dry matter degradability of DB, WB, EB and SBM were determined by the nylon bag technique with four rumen fistulated wethers.

Outcomes - The effective degradability of dry matter at rumen outflow rate of 0.08 were 39.3%, 42.6%, 52% and 48.8% for DB, WB, EB and SBM respectively. The effective degradability of protein at rumen outflow rate of 0.08 were 40.6%, 45.8%, 65% and 62% for DB, WB, EB and SBM respectively.

Conclusions - Our results on rumen degradability of BG are in the range of those reported in the literature. Drying reduced protein degradability in the rumen. Ensiling BG with added urea increased protein and dry matter degradability in the rumen.

Sialic acid supplementation improves learning and memory in piglets
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Background - Sialic acid (Sia) is a quantitatively important component of both human milk oligosaccharides and brain grey matter. An increase in brain protein sialylation state is associated with improved learning and memory in rats. We hypothesised that dietary Sia may be critical to brain development and a conditional nutrient during early life.

Objective - To examine the dose-response relationship between dietary Sia, learning speed and frontal cortex Sia concentration in 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 Sia using glycomacropeptide for 5 wks: 140 mg/L (control), 300 mg/L (group 2), 635 mg/L (group 3) and 830 mg/L (group 4). Learning and memory were assessed using an easy or difficult visual cue in an eight-arm radial maze between 23 and 35 days of age. On day 35, the piglets were euthanased and frontal cortex Sia was analysed.

Results - The supplemented groups learned the visual cue significantly faster than the control group (P=0.0014 for easy task and P=0.0177 for difficult task) with a significant dose-response relationship in the difficult task. In the memory test, supplemented groups performed better than the control group for the difficult task (P=0.036) but not the easy one. Sialylated-protein in brain frontal cortex was significantly higher in group 4 (P=0.002) and group 3 (P=0.002) compared with the control. Ganglioside-bound Sia was 8-13% higher in the supplemented groups, but the difference did not reach statistical significance.

Conclusion - A protein-bound source of Sia increases learning speed and frontal cortex Sia content in an animal model representing the human infant. The findings suggest that exogenous sources of Sia are needed for optimal brain development.
Concurrent Session 11

**Increased protein intake from lean red meat replacing carbohydrate-rich foods lowers blood pressure in hypertensive individuals**

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**Background** - Inverse associations between protein intake and blood pressure are reported in many population studies. In a randomised controlled trial we have previously shown that increased plant protein intake, in comparison to carbohydrate, can lower blood pressure, but effects of animal protein have yet to be investigated.

**Objective** - To determine if increased animal protein intake in the form of lean red meat, with a concomitant reduction in carbohydrate intake, alters blood pressure in hypertensive individuals.

**Design** - Hypertensive individuals (n=60) were recruited to a parallel-designed study of 8 weeks duration. Participants were randomized to maintain their usual diet (control) or increase net protein intake from lean red meat, replacing energy from carbohydrate-rich foods. Clinic and 24 hour ambulatory blood pressures were measured at baseline and at the end of intervention.

**Outcomes** - Relative to control, there was an increase in protein intake (5.3 (95%CI:3.7, 6.9) % of energy, P<0.001) and a corresponding decrease in carbohydrate intake (-5.3 (-7.9, -2.7) % of energy, P <0.001). Intakes of fat, alcohol and fibre were unchanged. There was a net reduction in clinic, 24 hour, awake and asleep systolic blood pressure with protein (-5.2 (-10.3, -0.1) mm Hg, -4.0 (-7.4, -0.6) mm Hg, -4.7 (-8.9, -0.5) mm Hg and -4.7 (-10.3, -0.1), respectively, P < 0.05). These differences were independent of age, gender, weight change, alcohol intake, and urinary sodium and potassium excretion. Diastolic blood pressure was not significantly altered.

**Conclusion** - The results suggest that modest replacement of carbohydrate-rich foods with protein in the form of lean red meat can lower blood pressure in hypertensive individuals.

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**The satiating effect of dietary protein is unrelated to post-prandial ghrelin secretion**

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**Background** - Increasing dietary protein relative to carbohydrate and fat enhances weight loss, at least in part by increasing satiety. The mechanism for this is unclear.

**Objective** - To compare the effect of isocaloric test meals with differing protein-to-fat ratios on fasting and post-prandial ghrelin, insulin, glucose, appetite and energy expenditure before and after weight loss on the respective dietary patterns.

**Design** - The design was a randomised parallel design of 12 weeks weight loss (6081 kJ/day) and 4 weeks weight maintenance (7346 kJ/day) with test meals administered at weeks 0 and 16. Our main outcome measures were weight loss, fasting and post-prandial ghrelin, insulin, glucose, appetite, energy expenditure and respiratory quotient before and after weight loss. Fifty-seven overweight (BMI 33.8 ±3.5 kg/m²) hyperinsulinaemic men (n=25) and women (n=32) were recruited. Diets and test meals were: High-protein/low-fat (HP-LF) (34% protein/29% fat) or standard-protein/high-fat (SP-HF) (18% protein/45% fat).

**Outcomes** - Weight loss (9.2 ± 0.7kg) and improvements in fasting and post-prandial insulin and glucose occurred independent of diet composition. At weeks 0 and 16, subjects desired less to eat after the HP-LF than the SP-HF meal (P = 0.02). Fasting ghrelin increased (15.5 ± 3.4 pmol/L, P <0.001) and the post-prandial ghrelin response improved (P = 0.043) with weight loss independent of diet composition. Post-prandial hunger decreased with weight loss (P = 0.018) and was predicted by changes in fasting and post-prandial ghrelin (r² = 0.246, P = 0.004). Lean mass was the best predictor of fasting (r²=0.182, P = 0.003) and post-prandial ghrelin (r²=0.096, P = 0.039).

**Conclusions** - We conclude that exchanging protein for fat produced similar weight loss and improvements in metabolic parameters and ghrelin homeostasis. The reduced appetite observed with increased dietary protein appears to not be mediated by ghrelin homeostasis.
Concurrent Session 11

The acute effects of a high fibre meal on postprandial blood lipids and satiety
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Background - Epidemiologic and clinical studies demonstrated a negative association between consumption of dietary fibre and prevalence of cardiovascular disease. The consumption of dietary fibre in Australians is generally lower than recommended levels, especially in overweight and obese people.

Objectives - This study examined the effects of the consumption of dietary fibre on serum lipids, blood glucose, hunger and satiety postprandially in overweight and obese men.

Design - Ten overweight and obese men consumed a mixed meal accompanied by either high fibre or low fibre supplement on 2 separate visits, in a random order, 1 week apart. Two breakfast meals with similar composition were consumed by 10 overweight/obese men (BMI 30.9 ± 0.8 kg/m² SEM). The meals contained either 3 g (low) or 15 g (high) of fibre (LFM and HFM, respectively). Blood samples were collected on an hourly interval for 10 hours throughout the day (One fasting and 7 postmeal blood samples) and analysed for plasma lipids, apolipoproteins, insulin and glucose. Analysis was carried out using Paired t-test and ANOVA.

Outcomes - Incremental changes in serum triglyceride levels during the first four hours of postprandial period were significantly lower after the consumption of high fibre meal than after the low fibre meal (P = 0.037). Both meals produced a similar increase in insulin levels. There were no significant changes in total cholesterol, LDL-cholesterol and HDL-cholesterol postprandially. Incremental changes in Apolipoprotein B48 levels after consumption of HFM were significantly lower than LFM during a 3 hours period (P = 0.045). There was no significant difference in the measurements of hunger and satiety perceptions between the two meals.

Conclusions - Collectively, a significant decrease in triglyceride and chylomicrons levels after the consumption of a high fibre meal suggests that the daily consumption of additional fibre, in the form of psyllium seed husk, may reduce the risk of developing cardiovascular disease in overweight/obese individuals.

Does moderate red wine consumption protect DNA and lipid systems from oxidative damage: in vivo measurements in young and old humans?
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Background - Red wine is a rich source of antioxidants, which may protect the body from oxidative stress. Oxidative stress has been shown to increase with age and is a major determinant of age-related disease. To date little is known about the potential of red wine to reduce the degree of oxidative stress in humans.

Objective - To determine the in vivo effects of moderate red wine consumption on DNA, lipid peroxidation, blood lipid, glucose profiles and whether these effects are dependent on age.

Design - Twenty young (18-30yrs) and 20 older (≥50yrs) volunteers were recruited. Each of the groups comprised of 10 treatment and 10 control subjects. Treatment subjects consumed 400 mL of red wine each day for two weeks and control subjects abstained from alcohol for two weeks. Blood samples were collected before and after the study periods and were used for analysis of glutathione (GSH) a marker of DNA damage and malondialdehyde (MDA) a marker of lipid peroxidation. Blood glucose and lipid profiles were also analysed.

Outcomes - Results from this study show no significant changes in serum glucose, plasma cholesterol, triglycerides, HDL, and LDL concentrations in all control and treatment groups. However, significant reductions in MDA were found for both young (pre 5.5µM, post 3.1µM, P ≤0.007) and old (pre 3.4 µM, post 1.1 µM, P <0.001) treatment groups, as well as significant reductions in GSH in young (pre 0.7µM, post 0.2µM, P = 0.026) and old (pre 2.4µM, post 1.0µM, P <0.001) treatment groups.

Conclusions - This study suggests that moderate consumption of red wine induces a significant decrease in lipid and DNA oxidation, but has no affect on blood glucose and lipid profiles in young and old individuals. It may be implied from this data that red wine provides oxidative protection of lipid systems and DNA in circulation.
Concurrent Session 11

Effects of dietary protein type on energy intake and appetite regulatory hormones

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Background - Dietary protein is associated with greater satiety relative to carbohydrate (CHO), however it is unclear if this relationship is affected by the type of dietary protein.

Objective - To determine whether appetite, ad libitum energy intake (EI) and post prandial satiety hormones are affected by protein type, relative to glucose.

Design - Seventy-two men, BMI 27.7 ± 0.5 kg/m² (range 20.7-40.0) consumed a liquid preload (1.1 MJ, 400 ml) containing 50 g of whey protein isolate, soy protein isolate, gluten or glucose in a randomised order. Subjective appetite was measured for 3 h after preloads (0, 15, 30, 45, 60, 90, 120 and 180 min) followed by a buffet lunch to assess ad libitum EI. Plasma cholecystokinin (CCK) and glucagon-like peptide-1 (GLP-1), (satiety hormones), ghrelin (a ‘hunger’ hormone) were measured in a subset of participants (n = 38) after each appetite measurement.

Outcomes - EI was higher (+ 401 ± 67 kJ) after the glucose preload compared to all protein preloads (glucose 3546 ± 168 kJ; soy 3209 ± 160 kJ; whey 3219 ± 147 kJ; gluten 3006 ± 147 kJ P <0.0001), although appetite ratings were not affected by treatment. GLP-1 and CCK were higher and ghrelin was lower after all protein treatments compared to glucose (time by preload effect, P < 0.01), independent of protein type.

Conclusions - Ad libitum EI is reduced after consumption of dietary proteins relative to glucose, independent of protein type. This difference may be mediated by the gastrointestinal derived hormones CCK, GLP-1 and ghrelin which are involved in appetite regulation.

This study was funded through the National Centre of Excellence for Functional Foods

The relationship of nutrient intake to blood pressure in females

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Background - Data from epidemiological studies have indicated that a number of dietary factors have been found to be associated with blood pressure and body composition, eg protein, fibre and electrolytes.

Objective - To assess the relationship between nutrient intake and blood pressure in women with a body mass index (g/m²)(BMI) between 18 – 40; young women (YW) aged 18 - 40.5 years and older women (OW) between 41 – 65 years.

Design - Cross-sectional sample of female twins and sisters participating in a longitudinal study assessing the predictors of risk factors for osteoporosis and cardiovascular disease. Subjects completed a 4-day food record (household measures), questionnaires on lifestyle practices, blood pressure measurement and underwent a Dual Energy Absorptiometry measurement to assess body composition.

Outcomes - The table indicates the mean (SD) for a selection of descriptive measures of the study populations. There was a positive association of age and BMI and systolic blood pressure (SBP) for OW and for BMI for YW (OW: R²=0.2, Age β=1.0 (0.1), BMI β=0.7 (0.2), YW: BMI R²=0.09, β=0.8 (0.1), adjusting for age, BMI in OW, protein intake was negatively associated with SBP (β=-0.11(0.04) P =0.017, as was dietary calcium (β=-0.005(0.003) P = 0.044, fibre (β=-0.3(0.1) P = 0.009, and magnesium (β=-0.04 (0.1) P = 0.001. Therefore a one SD increment in magnesium, fibre, protein and calcium was associated with a decrease in SBP of 3.2, 2.1, 2.0 and 1.5mmHg respectively.

Conclusion - In younger women it is difficult to detect any effect of dietary intake on blood pressure, although BMI did contribute to a higher SBP. In older women, in addition to age and BMI, and after adjustment for these factors dietary magnesium, fibre, protein and calcium and were all inversely associated with blood pressure. This confirms the results of previous studies, primarily conducted in men, that a diet containing significant amounts of magnesium, calcium and protein is also associated with lower levels of blood pressure in older women.
Concurrent Session 12

**The effect of lupin kernel flour bread on satiety, blood glucose and insulin response**
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**Background** - Lupin kernel flour (LKF) is derived from the kernel of lupin grain. LKF is rich in protein (42%), and fibre (30%), and contains negligible carbohydrate. Of all the nutrients investigated in relation to effects on hunger and food intake, dietary protein and fibre appear to have the greatest impact. Inclusion of LKF into high carbohydrate foods such as bread may increase post meal satiety and would be expected to reduce glycaemic load.

**Objective** - To determine the effect of consumption of LKF-enriched bread on: (1) postprandial blood glucose and insulin; and (2) hunger and food intake at a subsequent *ad libitum* meal.

**Design** - In a randomised cross-over trial, volunteers (n=17) consumed: (1) control white bread; (2) 12% (of final bread weight) LKF bread; and (3) 24% LKF bread for breakfast meals on three visits one week apart. All breakfast meals were matched for energy content. Blood samples were obtained, and questionnaires relating to satiety were completed, at baseline and multiple time points after breakfast. An *ad libitum* lunch was provided at 3 h.

**Outcomes** - Incorporation of LKF did not significantly alter the palatability of the bread. LKF-enriched bread resulted in a significant (*P* <0.05) and dose-related decrease in both the 3 h glucose and insulin areas under the curve. Self reported hunger and energy intake at the lunch meal were not significantly changed by LKF-enriched bread in comparison to the control bread.

**Conclusions** - Consumption of LKF-enriched bread has the potential to reduce post meal blood glucose and insulin. However, the results do not support the suggestion of increased satiety with increased protein and fibre content of the bread.

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**Whey proteins- GMP*, body fat reduction and altered insulin status in rats**

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**Background** - The ability of some high protein diets to reduce energy intake, body weight and/or adiposity in overweight humans has been observed. The influence of particular sources of proteins has been examined, and there is some evidence for whey protein concentrate (WPC) being more effective than some other protein sources eg red meat, although how and why is not understood. The presence of glycomacropeptide (GMP*- NatraPep) in WPC a breakdown product of κ caseins could be important, as this can be present in significant amounts in some whey fractions eg from cheese manufacture.

**Objective** - To examine the influence of GMP with whey protein isolate (WPI) on rat weight gain and body composition, and metabolism.

**Design** - Twelve week old Wistar rats were fed *ad libitum* for 8 weeks with semipurified rodent diets containing 15 and 30% protein as whey protein isolate (WPI*) (control), WPI*+10%GMP, WPI*+20%GMP, BBQd beef and casein. The rats were then analysed for body composition, and fasted plasma assayed for triglyceride, insulin and glucose.

**Outcomes** - There was a significant reduction in weight gain in rats fed GMP relative to control. This was particularly so for the 30% protein treatments, with a 9% reduction in visceral fat with WPI +20% GMP relative to WPI alone. Plasma triglyceride and insulin concentrations were significantly lower eg 64% lower insulin in WPI+20% GMP group relative to WPI alone (*P* <0.02).

**Conclusions** - GMP had a significant reducing effect on body weight gain, abdominal fat, plasma insulin and lipid status, suggesting a possible mechanism whereby GMP might have its effect.

**Acknowledgements** - The WPI* and GMP*-NatraPep products and financial support for this study were provided by Murray Goulburn Ltd. This study was supported by a Food into Asia grant.
Concurrent Session 12

**Adsorptive recovery of health-beneficial compounds from apple juice**

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**Background** - Numerous epidemiological studies have revealed a positive correlation between a diet rich in fruits and vegetables and a decreased incidence of certain degenerative diseases. Therefore, research interest has been focused on plant secondary metabolites, such as polyphenolics and carotenoids, which have been shown to exert certain health-beneficial effects. There is a need to find commercially appropriate means to isolate and concentrate these compounds as ingredients for functional or enriched foods.

**Objective** - The objective of this study was to systematically investigate the effect of various parameters on the adsorption and desorption behaviour of monomeric and polymeric phenolic compounds using a food grade polymeric adsorption resin.

**Design** - Batch adsorption experiments on a laboratory scale were conducted with fixed amounts of a diluted apple juice concentrate and weighed portions of a methacrylic resin under continuous stirring in a nitrogen atmosphere. The juice was allowed to be in contact with the resin until saturation conditions were achieved. Accelerated Solvent Extraction (ASE) technology was applied to study the elution efficiency of different solvents using resin which had been saturated with apple polyphenolics.

**Outcomes** - Although commonly applied in industrial processes there is still a lack of experimental data to predict performance thus making these processes empirical in nature. In contrast to previous findings on the adsorption behaviour of isolated flavonoids1 a lower pH value improved the adsorption efficiency. Moreover, a decrease in temperature and a higher feed concentration and juice : resin ratio increased the amount of phenolics bound to the resin. For the recovery of the compounds, the temperature during the elution step was the most important parameter besides the solvent composition.

**Conclusions** - The present study allows the development of efficient and cost-effective industrial processes that can also be applied to other matrices in order to fractionate and concentrate phenolic compounds for the production of tailor-made plant extract ingredients.

**References**


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**Does oleocanthal, a pungent principal in olive oil, contribute to the health benefits of a Mediterranean diet?**

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**Background** - Premium olive oils are characterized by a distinctive pungency that is unusual because it is sensed in the pharynx or throat but not the mouth. While attending a Molecular Gastronomy conference in Sicily1, one of the authors (GKB) noted the restricted throat irritation is remarkably similar to that elicited by the non-steroidal, anti-inflammatory drug (NSAID) ibuprofen.2

**Objective** - To determine if the perceptual similarity between olive oil and ibuprofen might be accompanied by similarities in pharmacological activity.

**Design** - A collaboration combining chemical separation, chemical identification, synthesis, sensory evaluation, and inflammation marker techniques.

**Outcomes** - We isolated, synthesized, and then determined the absolute stereogenicity of the irritant (+)-deacetoxyligstroside aglycone, which we term oleocanthal (oleo = oil; canth = sting; al = aldehyde). Sensory and chemical evaluation of 10 commercially available olive oils revealed a strong positive relationship between throat irritation intensity and oleocanthal concentration. Cyclooxygenase and lipoxygenase assays conducted with synthetic (+)-oleocanthal demonstrated that, as predicted, it is a natural NSAID with an anti-inflammatory profile and potency strikingly similar to that of ibuprofen.

**Conclusions** - Oleocanthal may play a significant role in the well-known health benefits associated with a diet high in olive oil. These findings also provide evidence that perceptual similarities between a novel compound and a pharmaceutical agent may predict similar pharmacological properties. Published: Nature 2005; 437: 45-46

**References**

Concurrent Session 12

Resistant starch attenuates colonic DNA damage induced by dietary whey, soy and casein in rats

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Background - A previous study using rats demonstrated that high levels of dietary casein resulted in increased levels of colonic DNA damage and a reduced thickness of the colonic mucus barrier in the absence of resistant starch.

Objective - This study aimed to establish whether diets high in different forms of proteins, whey and soy proteins, would cause a similar increase in colonic DNA damage to that of casein, and whether inclusion of resistant starch in the diet would protect against such damage.

Design - Male Sprague Dawley rats (~200 g) were fed a diet containing 15% or 25% casein, whey and soy each with or without 48% high amylose starch (Hi-maize™), and after four weeks rats were anaesthetised and tissues and gut contents were collected for measurements of colonic mucus thickness, DNA damage (comet assay) and short chain fatty acids.

Outcomes - In the absence of high amylose maize starch, high levels of dietary casein significantly increased the damage to colonocyte DNA compared with a low casein diet (comet tail moments for 15% vs. 25% casein; 388 ± 24 vs. 791 ± 54). In comparison, rats fed low levels of whey had similar levels of DNA damage to the low casein diet but the increase in DNA damage by the high dose was not as great for whey as it was for casein (tail moments for 15% vs. 25% whey; 357 ± 22 vs. 448 ± 25). However, DNA damage by the low soy diet was greater than for either the low dose casein or whey diets. High soy diets resulted in a large increase in DNA damage relative to the low dose (tail moments for 15% vs. 25% whey; 471 ± 51 vs. 997 ± 115). Addition of resistant starch to the diet increased the caecal and faecal SCFA pools and either fully (casein and whey) or partially (soy) abolished the increased DNA damage induced by the high levels of dietary protein, suggesting protection against genotoxic agents.

Conclusions - Different types of dietary proteins can have different effects on levels of colonic DNA damage and hence may represent different risks for development of colorectal cancer. Addition of resistant starch in the diet reduced protein-induced colonic DNA damage.

Whey protein supplementation and resistance training to enhance muscle growth in young and older adults

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Background - A major cause of age-related disabilities is progressive loss of skeletal muscle mass (sarcopenia). Protein ingestion and strength exercise have both been reported to increase protein synthesis through signalling cascades resulting in ribosomal activation via activating key components of the translation initiation complex. The extent at which supplemental protein ingestion and strength exercise training activate translation initiation in young and older individuals is poorly understood.

Objective - To determine whether whey protein isolate (WPI) consumed immediately after supervised strength-training exercise in younger and older men increases translation initiation activation.

Design - Skeletal muscle biopsy samples were taken from the thigh (vastus lateralis) from young (n=15) and older (n=15) men, after a single bout of exercise (untrained) and again following 12 weeks supervised resistance training with repeated WPI (25 g) or placebo supplementation. The anabolic response was measured by the increase in knee extensor strength, the activation of key translation initiation proteins and expression of genes regulating muscle hypertrophy/atrophy.

Outcomes - WPI supplementation significantly increased eccentric strength after training (25% greater than placebo) in young (P = 0.03), but not in older adults. Older participants consuming the WPI supplement demonstrated greater phosphorylation of the translational factor p70-S6K1 after 12 weeks training (2.9 fold increase, P = 0.03), when compared to the placebo group. This effect was not observed in the younger groups. Following exercise training older adults consuming WPI resulted in a 17.3 fold increase in Pax7 gene (marker of satellite cell activation) compared to a 2.6 fold increase in the placebo group post training. Only a small increase in Pax7 gene expression was observed in the young groups, with a 2.6 fold increase in the protein group and 1.9 fold increase in the placebo group.

Conclusions - These findings provide molecular evidence of enhanced activation of translation initiation with combining WPI intake and chronic resistance training in older participants. There were no beneficial actions of WPI on p70-S6K1 activation in young male subjects. Analysis of additional translation initiation factors and myogenic genes is ongoing.
Concurrent Session 13

Evaluation of the reliability and validity of a nutrition screening tool for residential aged-care facilities

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Background - Personal care and nursing staff of aged-care facilities can apply nutrition screening tools on residents to identify those at risk of deterioration in nutritional health. Residents are classified according to their level of nutritional risk, which is followed by appropriate intervention. It is essential that nutrition screening tools be tested for reliability and validity. If not, resident care may be compromised.

Objective - To evaluate the reliability and validity of a nutrition screening tool developed for residential aged-care facilities, titled the Nutritional Risk Screening Tool (NRST).

Design - Data was collected at five residential aged-care facilities (n=86). Three different assessors obtained a nutritional risk classification for each participant using the NRST. Reliability was assessed by calculating the percentage level of agreement and Fleiss’ Kappa. The principal investigator took various anthropometric measurements and measured food intake. Residents were assigned a ‘gold standard’ nutritional risk classification. One assessor obtained a nutritional risk classification for each participant using a currently available reliable and valid nutrition screening tool, titled the Mini Nutritional Assessment (MNA). Validity was assessed by calculating the percentage level of agreement between the ‘gold standard’ and the NRST and MNA classifications, as well as Fleiss’ Kappa, sensitivity and specificity.

Outcomes - There was a ‘high’ percentage agreement (81%) between the three assessors. Fleiss’ Kappa (0.66) inferred a ‘good’ level of agreement. There was a ‘moderate’ percentage agreement (59%) between the ‘gold standard’ and the NRST classifications, whilst the Fleiss’ Kappa (0.11) inferred a ‘low’ level of agreement. There was a ‘moderate-high’ level of sensitivity (71%) and specificity (75%). The NRST showed a higher level of validity than the MNA.

Conclusions - The NRST has a high level of reliability and a moderate-high level of validity however these levels may be improved. It is more appropriate for use than the MNA.

References

Anthropometric and biochemical markers for nutritional risk among residents within an Australian residential care facility

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Background - The risk of malnutrition is high among the elderly population yet few studies have measured indicators of nutritional status among the elderly in Australian residential care facilities.

Objective - To determine the prevalence of malnutrition in elderly residents living in a residential care facility, who were recruited to participate in a larger study, investigating the effects of a nutritional intervention.

Design - Anthropometric and biochemical analyses were measured from 83 High Level Care (HLC) and 29 Low Level Care (LLC) residents.

Outcomes - The mean (SD) body mass index (BMI) for all subjects was 26.3 (5.0) kg/m². Seven percent of subjects were underweight (16.4 (1.6) kg/m²) and 17% were obese (33.9 (2.3) kg/m²). Mid upper arm circumference was measured in 101 subjects, and “muscle wasting” (<24 cm) occurred in 16% of subjects (22.1 (1.3) cm). Low serum zinc levels (<10.7 µmol/L) were found among 46% of subjects (9.1 (1.2) µmol/L). Four percent of subjects had frank vitamin D deficiency (<12.5 nmol/L, 9.7 (2.8) nmol/L), 22% had marginal deficiency (12.5-25 nmol/L, 18.6 (4.0) nmol/L), and 52% had insufficient levels (25-50 nmol/L, 35.5 (7.2) nmol/L). Fourteen percent of subjects had low levels of albumin (33.7 (0.76) g/L). Those in LLC had higher serum albumin (39.8 ± 0.6 g/L vs. 38.3 ± 0.4 g/L, P = 0.026, mean ± SEM) compared with those in HLC.

<table>
<thead>
<tr>
<th>Mean ± SEM</th>
<th>BMI (kg/m²)</th>
<th>MUAC (cm)</th>
<th>Zinc (µmol/l)</th>
<th>Vitamin D (nmol/L)</th>
<th>Albumin (g/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HLC (n=72)</td>
<td>26.1 ± 0.6</td>
<td>28.3 ± 0.5</td>
<td>11.1 ± 0.3</td>
<td>36.1 ± 2.2</td>
<td>38.3 ± 0.4</td>
</tr>
<tr>
<td>LLC (n=29)</td>
<td>26.8 ± 0.8</td>
<td>28.2 ± 0.7</td>
<td>11.5 ± 0.3</td>
<td>39.4 ± 2.3</td>
<td>39.8 ± 0.6*</td>
</tr>
<tr>
<td>Deficiency: HLC:</td>
<td>10%</td>
<td>18%</td>
<td>41%</td>
<td>77%*</td>
<td>17%</td>
</tr>
<tr>
<td>LLC:</td>
<td>0%</td>
<td>10%</td>
<td>31%</td>
<td>83%*</td>
<td>7%</td>
</tr>
</tbody>
</table>

* P=0.026; † <50 nmol/L; MUAC: Mid Upper Arm Circumference

Conclusions - In this group, at least 30% of subjects were deficient in serum zinc, and more than 75% had low levels of vitamin D. This indicates that the elderly in long term residential care facilities are at high risk for nutrient deficiencies, potentially increasing morbidity and mortality.
Concurrent Session 13

**Dietary patterns over 17 years during adult life and cardiovascular disease risk**

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**Background** - Assessment of dietary patterns aims to capture the complex nature of diet and the interactions that may occur between a variety of food components and constituents. Healthy dietary patterns may be important in the prevention of cardiovascular disease (CVD), however there are few longitudinal investigations.

**Objective** - The objective of this study was to assess the impact of different dietary patterns during adult life (at age 36, 43 and 53 years) on risk factors for CVD at age 53 years (BMI, waist circumference, blood pressure, total cholesterol, HDL cholesterol, LDL cholesterol, glycated haemoglobin and red cell folate).

**Design** - Participants of a longitudinal study of health and development completed a five-day food diary at three ages during adult life (n = 1265). Factor analysis was used to identify dietary patterns in men and women and pattern scores were calculated from the consumption of the food items in each dietary pattern and at each age. Means and 95% confidence intervals for dietary pattern scores were calculated for each CVD risk category using random effects models adjusted for time and the relevant confounding factors (e.g. socio-demographic factors and lifestyle behaviours).

**Outcomes** - Factor analysis revealed three dietary patterns for women, labeled cosmopolitan, traditional and healthy, and two dietary patterns in men, labeled cosmopolitan and sweet-healthy. In women, the healthy pattern was negatively associated with BMI, waist circumference, blood pressure and positively associated with red cell folate. The cosmopolitan pattern was also negatively associated with blood pressure, while the traditional pattern was positively associated with glycated haemoglobin only. In men, the sweet-healthy pattern was significantly negatively associated with waist circumference and blood pressure, and there were no significant associations with the cosmopolitan pattern.

**Conclusion** - Specific dietary patterns during adult life were associated with cardiovascular disease risk. Results suggest that these patterns influence affecting disease outcomes through effects on central obesity and blood pressure.

**Nutrition indicators: how does Australia compare?**

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**Background** - Indicators are important for assessing progress towards Australia’s nutrition goals (1). While there are no formally endorsed indicators for use in monitoring nutrition in Australia, the Dietary Guidelines for Australian Adults (2) is a key statement of the Australian Government’s policy goals and directions for supporting better nutritional outcomes for the population.

**Objectives** - a) To identify available data for reporting against the new Dietary Guidelines for Australian Adults.

b) To investigate available international data relevant to these indicators.

**Design** - The indicators presented in this report are aligned to the dietary guidelines and were selected based on those which have been historically reported against. Data from Canada, New Zealand, France, Japan, the USA and the UK were sourced by request and through the internet. Only published data that are freely available are reported.

**Outcomes** - Key data sources include the 1995 National Nutrition Survey, the ongoing National Health Survey, apparent consumption data, and the 1989 Risk Factor Prevalence Survey. However, it is evident that key components of these data are no longer recent - in particular, the data relating to dietary intakes and biomedical risk factors. The international data presented suggest that Australian data collection is largely comparable to that in a range of similar other countries, and in some cases Australian data is shown to be very comprehensive. However, the available international data also highlighted other gaps and deficiencies, including the non-ongoing nature of some relevant Australian data collection.

**Conclusion** - There is a large body of data pertinent to food and nutrition indicators available in Australia, which is largely comparable to that in other countries. However, there is a lack of recent data, and little structure for ongoing data collection for monitoring purposes. A formally endorsed set of indicators for use in Australia would assist in guiding future data collection and provide a consistent forum for monitoring trends relating to food and nutrition.

**References**

Concurrent Session 13

**How to assess ‘food miles’ – a pilot study**

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**Background** - The concept of ‘food miles’ has been developed to express the distance that food travels between primary producer and consumer, and recognises that transport is a major source of environmental cost in the food supply chain. An extension of this concept includes the distance that the consumer travels to obtain the food. In both cases, the form of transport is relevant to environmental cost, and the point of production of the food may be relevant to consumers who wish to support local primary producers. Typically, ‘food miles’ have been investigated for food commodity groups available to a population, however quantification of food miles for individual intake could lead to insight into the dynamics of food transport within a population.

**Objective** - To determine the barriers to assessment of the distance travelled and the transport modes used for food to arrive at a place of consumption for all of the food intake of an individual.

**Design** - Student subjects (n=8) from Melbourne and dietitians (n=3) from different cities in Australia were asked to keep food records and for each food provide details such as place of purchase, transport from place of purchase to place of consumption, brand, and place of production of primary food.

**Outcomes** - Educated consumers are unable to provide information on place of primary production of most foods such that a useful estimate of food miles can be made. Food packaging provides relatively non-specific information on the place of primary production (eg made in Australia, or imported), and information on where food was produced is most often not available from the point of purchase for ready-to-eat foods. It is not clear how to partition an estimate of food transport pre- or post-purchase when transport is undertaken for multiple purposes. Home primary production is uncommon.

**Conclusions** - Consumers are unaware of the place of primary production of their food. A low cost method of assessing ‘food miles’ of individual food intake is not practical at present.

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**Reported dietary habits and intentions of Australian primary care patients with diabetes, obesity, hypertension and hyperlipidaemia**

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²CCRE Therapeutics, Department of Epidemiology and Preventive Medicine, Monash University, VIC

**Background** - The cvTRAC plus program is a national general practitioner-based assessment of coronary heart disease (CHD) risk factors in ‘at risk’ patients which aims to facilitate a comprehensive and co-ordinated approach to CHD risk management in general practice.

**Objective** - To undertake an examination of dietary behaviours in patients considered to be ‘at risk’ of CHD.

**Design** - Statistical analysis of baseline data from the 55880 cvTRAC patients was performed using SPSS v12.

**Outcomes** - The mean age ± SD of the cohort was 60.1 ± 11.1 years, and the proportion of males to females was 48.7:51.3. The majority of patients with diabetes (n=18279) reported following a low-fat diet (70.6%), and a greater proportion of female than male diabetics indicated following a low-fat diet (74.4% versus 67.4% respectively, P<0.001). The prevalence of obesity (BMI ≥ 30 kg/m²) in the cohort was 40.7%. Females with obesity were more likely to report following a low-fat diet than males (63.6% in females and 53.3% in males, P<0.001). Similarly for hyperlipidaemia (n=35656), females were more likely than males to report consumption of a low-fat diet (68.7% versus 60.1% respectively, P<0.001). In hypertensive patients (n=42795), 54.9% reported following a low-salt diet compared with 53.9% in the whole cohort. Female hypertensive patients were more likely to report following a low-salt diet than were male hypertensive patients (58.4% versus 51.3% respectively, P<0.001).

**Conclusions** - Females at risk of cardiovascular disease were more likely to report the adoption of risk-reducing dietary behaviours than males. The message for those with diabetes to adopt a low-fat diet appears to be well implemented, whereas the adoption of a low-salt diet by those with hypertension is less well implemented.

*The cvTRAC program is funded by an educational grant from AMRAD Pharmaceuticals/Merck Sharp & Dohme.*
Concurrent Session 13

**Factor analysis identifies a Mediterranean-style pattern of dietary intake that is protective against diabetic retinopathy**

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**Background** - Factor (principal components) analysis of dietary intake identifies patterns of food consumption in populations, and may be a more useful (comprehensive and meaningful) approach to investigating a potential diet-disease link than conventional single nutrient analyses, particularly for diseases like diabetic retinopathy (the major cause of preventable blindness in the developed world) where there is no known specific relationship to diet.

**Objective** - To identify the patterns of food consumption that may protect against the onset of diabetic retinopathy.

**Design** - This cross-sectional study identified patterns of dietary intake in 407 men and women, mean age 64 years, about half with Type 2 diabetes and equally divided between Greek-born and Australian-born. Factor analysis, a data reduction technique, generated variables representing patterns of dietary intake from a list of the 121 foods in the food frequency questionnaire, administered at the clinical data-collection visit. Retinopathy was photo-documented and graded according to a validated protocol by one assessor, masked to other participant data.

**Outcomes** - Of the identified 9 patterns of dietary intake, one pattern of food consumption was inversely associated with prevalent diabetic retinopathy, after adjusting for established retinopathy risk factors and confounders of dietary intake. This ‘Very Greek” pattern of food intake correlated positively with the intake of, in order of importance, onions/leeks, olive oil, garlic, and feta cheese, and inversely with cream/butter/margarine, and was also inversely associated with prevalent hypertriglyceridemia and hyperhomocysteinemia.

**Conclusions** - Factor analysis identified a “Very Greek” Mediterranean-style pattern of dietary intake that was protective against diabetic retinopathy and may also be cardio-protective.

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**Effect of a nutritional intervention on cognitive performance in primary school aged children in Australia and Indonesia**

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**Background** - Adequate nutrition has been linked to cognitive performance in a number of studies, particularly in infancy and preschool children, but there is limited data for primary school-aged children whose cognitive functions continue to develop as the brain continues to grow.

**Objective** - To investigate links between nutrition and cognition in 6-10 year-old Australian and Indonesian primary school children participating in a longitudinal supplementation study, who are either apparently well-nourished or at risk of undernutrition.

**Design** - Approximately 400 children from each country took part in a four arm intervention study comprising a placebo arm and three supplement intervention arms: one with B vitamins, iron and zinc at about 1RDA per day, one with omega 3 fats and the third a combination of these two. Measures of attention and concentration, speed of information processing, memory, executive function, verbal ability and school achievement were obtained at baseline, 6 and 12 months, blood measures for iron, zinc, folate, B12 and plasma lipids at baseline and 12 months.

**Outcomes** - At baseline, associations between nutrient status and cognitive performance varied between country, gender and cognitive measures. Correlations, adjusting for age, indicated consistent, though weak, significant relationships between iron status and cognitive performance for both Australia and Indonesia, and to a lesser extent, between cognitive performance and zinc status for Australia and folate and omega fatty acid status for Indonesia. After 12 months of supplementation effects were seen for the vitamin/mineral interventions.

**Conclusions** - In cross-sectional analysis there are some weak but significant associations between iron status and cognitive performance in both apparently adequately and marginally nourished school-age children. Low level supplementation over one year suggests that the mineral/vitamin supplementation could benefit some children.

Water absorption from thickened fluids in a rat model
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Background - Individuals with swallowing difficulties (dysphagia) commonly have to have oral fluids thickened in order to avoid aspiration into the lungs. Most thickening agents are either gum-based, guar or xanthan, or are derived from modified starches. There is evidence, predominantly anecdotal, that dysphagic individuals, many of whom are elderly, are sub-clinically dehydrated. It has been speculated that this may be due, in part, to the water holding capacity of these thickening agents decreasing water absorption from the gut.

Objective - To determine the rate of intestinal absorption of water from thickened fluids.

Design - Laboratory study in rats in vivo. Rats received, by gavage, on a body-weight basis, bolus doses of water or water thickened to the same viscosity with commercially available thickeners and containing tracer amounts of $^{3}$H$_2$O. Blood samples, from the tail vein, were obtained at intervals for up to 4 h and the specific activity of $^{3}$H determined by liquid scintillation spectrometry. The rate of absorption of water was calculated from a compartmental model following exponential curve fitting. Differences in absorption rates between treatments were assessed by ANOVA with post hoc multiple comparisons.

Outcomes - No significant differences in water absorption rates between thickened fluids or pure water were observed: water - 0.0140 ± 0.004; xanthan - 0.0142 ± 0.007; guar - 0.0159 ± 0.008; starch, 0.0146 ± 0.006 µl min$^{-1}$ ml$^{-1}$ blood.

Conclusions - These data provide no support for the view that the addition of thickening agents, irrespective of type, to orally ingested fluids significantly alters the absorption rate of water from the gut. These data do not however preclude the possibility that absolute absorption, i.e. total fluid uptake, may be decreased by thickeners.

Tea catechins reduce body fat mass associated with a high fat diet and improves glucose tolerance in Sprague Dawley rats

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School of Psychological Sciences, La Trobe University, Bundoora, Vic 3086

Background - Tea is a widely consumed beverage and its potential health benefits have long been reputed. Flavonoids, potent antioxidants found in tea, have been shown to exert antidiabetic and antiobesigenic properties.

Objectives - The effect of prolonged treatment of tea catechins on body weight gain associated with a high fat diet and glucose tolerance was assessed on Sprague Dawley rats.

Design - Male animals (n=12/group) were placed on a 15% (high) fat diet from 3 weeks of age. They were given one of four fluid treatments from four weeks of age: Green tea (GT), Black tea (BT), Epigallocatechin Gallate (EGCG), a flavonoid found in abundance in green tea, or water (control). Weekly body weights were recorded and fluid and food intakes measured daily. Body composition of animals was determined at 11, 18 and 25 weeks of age. Glucose tolerance was tested at 19 weeks of age. All comparisons made are relative to water treated rats.

Outcomes - Throughout the study, there were no differences in food or fluid intakes. There were no differences in body weight at weeks 11 or 18. However, the EGCG treated animals were significantly heavier than the water (P <0.01) and black tea (P <0.001) treated groups at week 25. Green and black tea groups showed a lower percentage fat (P <0.05) and higher lean mass (P <0.01) at week 18. At week 25, lean mass was significantly greater and percentage fat significantly lower in all treatment groups. Fat mass in green and black tea treated groups was significantly lower at weeks 18 (GT P <0.01, BT P <0.05) and 25 (GT P <0.05, BT P <0.01). Glucose tolerance testing showed that the control animals had impaired glucose handling compared to all treatment groups. This was significant at 90 minutes (GT P <0.001, BT P <0.01, EGCG 0.001) and 120 minutes (GT P <0.05, BT P <0.05, EGCG 0.01) after glucose loading.

Conclusion - These results demonstrate that tea catechins may be used as a novel therapy in the treatment of obesity and diabetes.
Concurrent Session 14

**Phenolic-rich palm fruit juice raises plasma HDL-C concentrations and improves antioxidant status in Golden Syrian hamsters fed an atherogenic diet**

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**Background** - Consumption of phenolic compounds is reported to exert a favourable effect on plasma lipids. We showed previously that a phenolic-rich extract from palm fruit inhibits liposomal oxidation and protects against oxidation of human erythrocytes.

**Objective** - To investigate the effects of consuming palm fruit juice (PFJ) on plasma lipids and antioxidant status of Golden Syrian hamsters (*Mesocricetus auratus*) fed a high-fat, high-cholesterol (1.5g/kg) atherogenic diet.

**Design** - Male hamsters, 4-wk old, were assigned randomly to four groups and fed the atherogenic diet *ad libitum* for 8 wk. The Control group was provided with water while the three other groups were provided PFJ at 3 different doses: 500, 1000, or 1500 mg gallic acid equivalents (GAE)/L. At the end of 8 wk, fasting plasma total cholesterol (TC), triglycerides (TG), HDL-C and non-HDL-C concentrations were determined. Plasma antioxidant capacity was measured by its ferric reducing antioxidant power (FRAP).

**Outcomes** - Consumption of PFJ at the higher dose (1500 mg GAE/L) increased plasma TC, HDL-C and FRAP significantly compared to Control and other treatment groups. Plasma TG and non-HDL lipid levels were unaffected.

<table>
<thead>
<tr>
<th></th>
<th>Control (n=12)</th>
<th>500 mg/L (n=11)</th>
<th>1000 mg/L (n=14)</th>
<th>1500 mg/L (n=12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC (mmol/L)</td>
<td>4.15 ± 0.58</td>
<td>4.00 ± 0.91</td>
<td>4.67 ± 1.07</td>
<td>4.86 ± 0.60</td>
</tr>
<tr>
<td>HDL-C (mmol/L)</td>
<td>3.28 ± 0.53</td>
<td>3.17 ± 0.77</td>
<td>3.80 ± 0.82</td>
<td>3.98 ± 0.47</td>
</tr>
<tr>
<td>FRAP (µg Trolox equivalents/mL)</td>
<td>11.42±6.25</td>
<td>9.53±4.08</td>
<td>14.06±6.62</td>
<td>18.94±11.42</td>
</tr>
</tbody>
</table>

(Values are means ± SD, values in the same row with different superscript differ significantly, \( P < 0.05 \)).

**Conclusions** - The consumption of PFJ containing 1500 mg GAE/L contributes to lowering the risk of heart disease by increasing plasma HDL-C levels and improving antioxidant status. The effect of PFJ appears to be dose-mediated and the exact mechanism of action needs further evaluation.

**References**
1. Balasundram N, Agar NS, Sundram K, Samman S. Palm fruit extracts protect against oxidative damage in human red blood cells. Asia Pac J Clin Nutr 2004; 13 (Suppl) : S75.

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**Isoflavones influence the extent of plasma cholesterol reduction by soy protein**

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**Background** - Regular consumption of soy protein (SP) has been shown to significantly reduce plasma total cholesterol (TC) and triglycerides (TG). However, the potential contribution of isoflavones (ISO) associated with the SP to its lipid lowering effects remains unclear. The relative requirements for SP and ISO are critical to the development of more palatable soy products that can deliver this health benefit.

**Objectives** - To enhance the palatability of soy by combining it with dairy so that daily consumption of soy is more readily achievable by consumers. To assess the relative impact on plasma lipids of regular consumption of soy and soy/dairy formulations.

**Design** - A double blinded randomised crossover intervention trial incorporating three 6-week long dietary phases in 35 volunteers with elevated TC (>5.5mM). The trial was designed to compare cardiovascular benefits of eating soy foods (S) or soy/dairy combination foods (S/D) with that of dairy foods (D). Intended daily nutrient intakes from foods on each diet were 24g of SP + 80mg of ISO on the S diet, 12g of both SP and dairy protein (DP) + 80mg of ISO on the S/D diet and 24g of DP on the D diet.

**Outcomes** - ISO intakes on the S and S/D diets were less than anticipated (57 and 70mg/day respectively). TC was 4.4% lower \( (P < 0.05) \) while subjects consumed S compared to D but was unaltered by the S/D diet, despite a higher daily ISO intake. The S diet also tended to improve LDL, HDL and TG levels. Regression analysis revealed that the extent of TC reduction was dependent on an individual’s intake of ISO \( (P < 0.05) \).

**Conclusions** - Combining DP with SP has the potential to enhance consumer acceptability of soy products. However, soy protein intakes exceeding 12g/day appear necessary to significantly reduce TC. The magnitude of reduction is dependent on the concomitant ISO intake.
Concurrent Session 14

**Green tea supplementation in high fat fed Sprague-Dawley rats has no effect on gene transcripts relating to muscle metabolism**

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⁴School of Exercise and Nutrition Sciences, Deakin University, VIC 3127; ⁵Department of Food Science, Royal Melbourne Institute of Technology, Vic 3000; ⁶School of Psychological Science, La Trobe University, Vic 3086

**Background** - Functional food ingredients beneficial for weight regulation are of considerable importance given the marked increase in obesity experienced throughout the world. Green tea has previously been found to lower body fat and improve fat distribution in both human and animal models.

**Objectives** - This study aimed to investigate the impact of green tea, green tea catechins or black tea supplementation on rodent skeletal muscle gene transcripts essential for energy metabolism and lipid homeostasis.

**Design** - Sprague-Dawley rats were fed a high fat diet and supplemented at 100% of their fluid intake from 4 weeks of age, with water as a control (n=7), green tea (n=7), epigallocatechin-3-gallate (EGCG) (n=7) or black tea (n=7) for a period of 6 months. Following this, mRNA levels of genes important in energy metabolism including; cytochrome c oxidase 3 and 4 (COX 3 & 4) and lipid homeostasis including; fatty acid transferase (FAT/CD36), peroxisomal proliferators activated receptor alpha (PPAR-α), uncoupling protein-3 (UCP-3), peroxisome proliferators activated-receptor gamma co activator 1alpha (PGC-1α) and pyruvate dehydrogenase kinase isoenzyme 4 (PDK4) were measured by real-time PCR in quadriceps muscle samples.

**Outcomes** - There were no significance changes in mRNA expression of genes in groups supplemented with green tea, EGCG or black tea, this is despite a significant reduction in fat mass within the green tea and EGCG groups.

**Conclusion** - The supplements investigated did not elicit changes in the expression of genes essential for total oxidative and lipid metabolism in quadriceps muscle. This is despite the alterations in total adiposity evident following green tea and EGCG supplementation. Further analysis is required to evaluate the actions of green tea and catechins on other tissues, including adipocytes.

**Cheddar cheese: a potential food carrier for the delivery of folic acid?**

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**Background** - Fortification with folic acid in one or more of the commonly consumed dietary items is now regarded as the best method to ensure that increased folate intake reduces the risks associated with folate deficiency. No studies have been reported yet regarding Cheddar cheese fortification; although the concept of increasing folate levels in dairy products through “natural” synthesis using bacterial cultures has been explored elsewhere. World cheese consumption and Cheddar in particular, has grown by 15% since 1997 with the forecast set to increase further during the next decade. This makes Cheddar cheese an important food commodity and the subject of an international trade of substantial value.

**Objective** - To investigate the possible application of various food grade polymers to encapsulate folic acid for use in Cheddar cheese manufacturing as an alternative medium for delivery of the vitamin.

**Design** - Edible gums were evaluated for folic acid encapsulation efficiency as single and mixed polymers. They were tested for their stability in a milk system where pH was adjusted from 6.7 to 4.5 over a 4 hr period. Stress tolerance was studied under simulated cheese press pressures for 4 h until a force of 84.3 g/cm² was detected. Cheddar cheese with and without capsules was made to evaluate the effectiveness of microencapsulation during the process and cheese ripening.

**Outcomes** - Alginate and pectin yielded the highest encapsulation efficiencies, 54 and 49% respectively. Upon being combined and the encapsulation conditions optimised, the alginate – pectin (alg-pect) mixture resulted in about 90% encapsulation efficiency. Folic acid retention under the test conditions was 100% indicating the capsules ability to remain intact in a milk system, to tolerate stress and protect folic acid during 9 months of ripening.

**Conclusions** - The combination of alginate and pectin polymers resulted in capsules with high encapsulation efficiency, notable stability in a milk system, significantly improved stress tolerance properties as seen by high folic acid retention during cheese pressing. Encapsulated folic acid has excellent stability in capsules during cheese ripening than free folic acid. These results suggest that Cheddar cheese can be an effective medium for folic acid delivery particularly if alginate-pectin capsules are used.
Concurrent Session 14

**Removal of microcystin from water using potential probiotic lactic acid bacteria**

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**Background** - Microcystins are cyclic heptapeptide toxins produced by several genera of freshwater cyanobacteria (blue-green algae). In addition to potent acute hepatotoxicity, microcystins are tumour promoters and possible carcinogens. Exposure to microcystins is facilitated through water and food supply and it has been associated with the illness and mortality of animals and humans. Microcystin toxins are a drinking water quality problem as they are recalcitrant to conventional water treatment. With the ongoing concern regarding the addition of chemicals to our water supply, biological decontamination is becoming more attractive. Pilot studies have indicated that food grade lactic acid bacteria may have the ability to bind microcystin thus removing it from water and reducing the risk of harmful intake by humans.

**Objective** - In this study we used current and potential probiotic lactic acid bacteria to bind microcystin-LR from drinking water.

**Design** - Twenty strains of lactic acid bacteria were screened for their ability to remove microcystin-LR from water samples under a variety of conditions. For specific strains, the results for viable bacteria were compared with non-viable bacteria to determine if viability has a significant impact on toxin removal.

**Outcomes** - A significant number of study bacteria were found to remove microcystin-LR from drinking water. Heat and acid killed bacteria in some cases had lower removal when compared with other viable bacterium samples.

**References**

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**Dose-dependent inhibition of the post-prandial glycemic response to a standard carbohydrate meal following incorporation of α-cyclodextrin**

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**Background** - The glycemic response to consumption of a meal may be modified by altering its carbohydrate composition or, alternatively, by including nutrients that change the response to existing carbohydrate components.

**Objective** - To evaluate dose-response effects of α-cyclodextrin, an amylase inhibitor, on glycemic and insulimic responses to the consumption of a standard carbohydrate meal.

**Design** - In a double-blind, randomized, cross-over trial, 10 healthy subjects consumed boiled white rice containing 50 g of digestible carbohydrate to which 0 (control), 2, 5 or 10 g of α-cyclodextrin was added. Plasma glucose and insulin concentrations were determined prior to, and for two hours after, consumption of each meal.

**Outcomes** - The area under the plasma glucose curve was negatively related to the dose of α-cyclodextrin ($r^2 = 0.97, P = 0.02$), with the areas being significantly reduced at the 5 g and 10 g doses compared with the control ($P <0.05$). α-cyclodextrin did not affect the area under the plasma insulin curve ($P = 0.39$). Higher doses of α-cyclodextrin resulted in greater satiety, but were associated with reduced palatability and an increased incidence of minor gastrointestinal complaints (stomach ache, nausea, bloating).

**Conclusion** - α-cyclodextrin reduces the glycemic response to a standard carbohydrate meal in a dose-dependent manner and may be useful as an ingredient for reducing the glycemic impact of such foods.
Concurrent Session 15

Effects of prenatal malnutrition on hippocampal BDNF expression and spatial learning behavior in rats

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Background - A growing volume of literature indicates that brain-derived neurotrophic factor (BDNF) plays an important role in brain functional development, particularly in learning and memory function.

Objective - This study aimed to investigate the effects of prenatal malnutrition on brain BDNF expression and its relationship with spatial learning and memory behavior.

Design - Twelve pregnant Wistar rats were randomly assigned into three treatment groups of four animals each. Animals in one group were allowed free access to laboratory chow (control). Animals in the remaining two groups were restricted to 50% daily food intake of the control from eighth day of pregnancy (early prenatal malnutrition) or fifteenth day of pregnancy (later prenatal malnutrition). After giving-birth all animals were allowed free access to laboratory chow. The pups were weaned at three weeks of age and were tested for spatial learning and memory behaviour by Morris water maze at three or five weeks of age. The animals were sacrificed at the end of the behaviour test and the levels of BDNF protein and mRNA in the brain tissue were measured using ELISA and real-time PCR, respectively.

Outcome - It was observed that both early and later prenatal malnutrition significantly impaired the spatial learning and memory ability of the pups at three weeks of age. Early prenatal malnutrition significantly reduced both BDNF mRNA and BDNF protein levels in the hippocampus region of the brain.

Conclusion - The results of this study indicate that prenatal malnutrition reduces BDNF expression in the hippocampus region of the brain and affects spatial learning and memory behaviour.

Importance of body composition in explaining variation in feed conversion efficiency and residual feed intake between sheep

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Background - The efficiency with which an animal utilises energy during growth, is dependent on a number of physiological factors including body composition and the relative proportions of lean tissue mass (LTM) and fat tissue mass (FTM), due to differences in the energy cost of depositing and maintaining these tissues. However, the relationship between body composition and maintenance energy expenditure in sheep is less clear.

Objective - To determine the relationship between feed conversion ratio (FCR, kg feed:kg gain) and residual feed intake (RFI) with body composition in rams at six months of age.

Design - Whole animal body composition, using dual energy X-ray absorptiometry (DXA) was measured in 52 cross-bred rams (6mo, 36 kg) at the start and end of the study. The individually-housed rams were fed ad libitum pellets (12 MJ/kg DM, 16% CP) with feed intakes and live weights recorded for 49 d. Feed conversion efficiency was calculated as feed eaten:liveweight gain (FCR). To calculate RFI, feed intake is regressed against mean metabolic liveweight (W0.75) and average daily gain, with the residual portion, used as the measure of efficiency. The more negative the RFI value, the more efficient the animal is. Restricted maximum likelihood (REML) analysis was used to develop models relating body composition to either FCR or RFI.

Outcomes - LTM at the start and end of the study accounted for 66% of the variation in FCR, yet only accounted for 3% of the variation in RFI. FTM at the start and end of the study accounted for 11% of the variation in FCR, and none of the variation in RFI.

Conclusions - LTM is a major determinant of FCR in young sheep. Given that FCR is primarily a function of growth, and sheep at this age typically deposit more lean tissue over fat tissue, this result is not surprising. However, the non-significant relationship between RFI and body composition in sheep at 6mo, suggests that efficiency of energy use is independent of composition and is driven by other physiological functions.
Concurrent Session 15

Stimulation of the hexosamine biosynthetic pathway by glucosamine in sheep

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Department of Primary Industries, Werribee & Attwood, VIC

Background - The hexosamine biosynthetic pathway (HBP) is purportedly a nutrient sensing pathway that is activated by increased levels of glucose and free fatty acids. Studies in rodents have shown that activation of the HBP can occur independently of changes in glucose or free fatty acids by infusing glucosamine, an intermediate of this pathway, which causes insulin resistance by inhibiting the translocation of the GLUT4 transporter to the cell membrane. We hypothesise that variation in the sensitivity of this pathway to excess nutrients may in part explain differences between sheep in the efficiency of nutrient partitioning.

Objective - To determine if an intravenous infusion of glucosamine in sheep affects glucose, non-esterified fatty acid (NEFA) and insulin concentrations via stimulation of the hexosamine biosynthetic pathway.

Design - Four crossbred pregnant ewes (mean 46.7 kg ± 0.5) were used in a cross-over design involving a 2 h basal period, followed by a 4 h infusion of either 5 mg/kg/min glucosamine or saline (0.9%) then a 7.5 h recovery period. Blood was sampled at half hour intervals to determine glucose, NEFA and insulin levels.

Outcomes - Blood glucose concentration (basal 2.2 ± 0.05 mM) increased (P < 0.05) within 1.5 h of the start of the infusion and rose steadily peaking at 136% above basal 1 h post infusion, declining to basal levels by 6 h post infusion. Plasma insulin concentration (basal 11.0 ± 0.75 mU/ml) was increased (P < 0.05) 3.5 h after the infusion commenced and continued to rise to 422% above basal 2 h post infusion, declining to basal levels after a further 5 h. Plasma NEFA concentration increased (P < 0.05) 253% above basal within 2 h of the infusion commencing before rapidly declining throughout the rest of the infusion period to below basal levels 1 h post-infusion, remaining below basal for much of the recovery period.

Conclusion - Infusion of glucosamine into pregnant ewes appears to acutely stimulate the HBP resulting in development of insulin resistance as indicated by the observed hyperglycaemia, hyperinsulinaemia and stimulation of lipolysis. Thus, the sheep is capable of responding in a similar manner to rodents to activation of the HBP independent of changes in nutrient status.

References

Breed and nutrition influence the responses to homeostatic signals in lambs

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Background - Responses to homeostatic challenges are in part mediated via the hypothalamic pituitary-adrenocortical and sympathetic nervous systems. For example, corticotrophin-releasing hormone and epinephrine secretion during stress stimulates the release of cortisol, which in turn stimulates glycogenolysis and lipolysis. Also, there is evidence that there are breed differences in the ability to respond to nutritional and other stressors.

Objective - To determine whether breed and nutrition modulate responses to homeostatic signals.

Design - Twenty four seven month old Merino (MM) and second cross (2X = Merino x Border Leicester x Poll Dorset) lambs weighing 44.5 and 50.0 kg, respectively were allocated to a 2x2 factorial design with the respective factors being breed (MM vs 2X), sex (ewes vs wethers) and diet. Lambs were fed either a moderately-low (ML; oat pasture: lucerne hay =15:85, 17.6% CP and 9.1 MJ ME/kg) diet for 3 wk in a crossover design. After 3 wk feeding, animals were injected with insulin (10 µg/kg BW) and epinephrine (0.8 µg/kg BW) on consecutive days. Blood samples collected pre- and post-injection were analysed for glucose, non-esterified fatty acids (NEFA), cortisol and lactate.

Outcomes - Basal glucose (3.93 vs 3.65 mM, P < 0.001), lactate (1.04 vs 0.74 mM, P < 0.001) and cortisol (29.0 vs 17.6 µM, P < 0.02) concentrations were higher in 2X than in MM lambs but were not effected by diet. Basal NEFA were higher in lambs fed ML diet (116 vs 90 µM, P < 0.001) but there was no difference between breeds. Over the first 90 min post-infusion, 2X lambs had lower glucose (-117 vs -169 mM.min, P < 0.003) and NEFA (380 vs 8027 µM.min, P < 0.01) responses to insulin than MM lambs. Over the first 60 min post-infusion lambs on ML diet had greater glucose (67 vs 42 mM.min, P < 0.03) and NEFA (2870 vs 1165 µM.min, P < 0.01) responses to epinephrine while the glucose response was lower (P < 0.01) for MM than 2X lambs. Lactate and cortisol responses to both insulin and epinephrine were greater in 2X than MM lambs.

Conclusions - These data clearly indicate that both nutrition and breed can influence basal metabolism as well as responses to homeostatic signals. In particular, 2X lambs have higher basal and stimulated cortisol responses than MM lambs. On the other hand, MM lambs had an exaggerated NEFA rebound response to insulin, presumably in response to cortisol. These differences may in part explain how breeds of sheep differ in their responses to nutritional and other stressors.
Concurrent Session 15

Effect of chaff quantity and length on rate of intake in horses fed a concentrate diet

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Background - Grains are commonly fed to horses that have a high energy requirement. However, large quantities and fast consumption of grain can result in disorders such as laminitis, colic, tying-up, gastric ulcers and fractious behaviour. Thus, controlling the rate of grain intake is an important aspect in managing equine nutrition.

Objectives - To measure the relationship between chaff quantity and length and the rate of intake of oats.

Design - Each morning, six geldings (BW 479 ± 18 kg) were fed a constant meal of oats at 3 g/kg bodyweight in combination with either longer ground wheaten chaff (4 cm), or short chopped wheaten chaff (< 2 cm) at one of five different addition rates in a random latin square design. Ryegrass/clover hay was provided each afternoon to meet maintenance energy requirements.

Outcomes - Rate of intake varied with chaff quantity (P <0.001, ANOVA for repeated measures), but was not affected by chaff length. A maximal decrease in rate of intake occurred at the addition rate of 50% chaff.

<table>
<thead>
<tr>
<th>Chaff addition rate (%)</th>
<th>7.5</th>
<th>15</th>
<th>30</th>
<th>50</th>
<th>60</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of intake (g/min)¹</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short chaff</td>
<td>47.24 ± 3.17</td>
<td>41.75 ± 3.08</td>
<td>42.25 ± 3.61</td>
<td>31.26 ± 1.82</td>
<td>39.32 ± 2.09</td>
</tr>
<tr>
<td>Long chaff</td>
<td>47.39 ± 2.78</td>
<td>41.85 ± 3.25</td>
<td>40.57 ± 3.38</td>
<td>32.53 ± 2.54</td>
<td>35.19 ± 1.94</td>
</tr>
</tbody>
</table>

¹Mean ± SE

Conclusion - Relative to earlier studies a large amount of chaff was required to decrease rate of intake. It is not clear whether this is due to meal size, chaff type, or chaff processing method. Chaff length appeared to have no effect on rate of intake. However, the long chaff was ground and not chopped, which would have decreased the surface area and chewing required for ingestion. Further research is required to standardise a method of measuring rate of intake and to explore differences in chaff properties.
Concurrent Session 16

Search for the original Mediterranean diet(s)

AS Truswell and A Noah

Human Nutrition Unit, Building G.08, University of Sydney, NSW 2006

Eighteen countries have coasts on the Mediterranean Sea, all with different diets. But the ideal diet for today’s nutritionists seems to be what Italians and Greeks were eating as their countries started to recover from being battlefields in World War II. It would be helpful to have these diets for reference in quantitative terms.

In Italy individual intakes were measured by the Seven Country Study team at three sites in 1960 and 1961. NICOTERA is a small seaside town on the toe of Italy. MONTEGIORGIO (farming community) is in the middle of Italy, 20 km above the Adriatic coast. CREVALCORE up north is in the Po valley, near Bolonga. Only a small survey was done in Nicotera, though it is the most Mediterranean site. More measurements were made at the central and northern sites. Intakes (only for men) were first published (1964) as percent total calories from food groups. Foods in g/day were not published until 1989 (for men), only for Montegiorgio and Crevalcore.2 Food figures (g/day) for Nicotera, (men and women) appear in a paper Flaminio Fidanza gave in London in 1991.2 In these 3 surveys by Keys et al., much more meat and milk was consumed in Crevalcore, more vegetables and cereals in Nicotera. The Euratom household consumption study in the early 1960s also reported that north Italians ate more meat, milk and butter and less fruits, vegetables and olive oil than in the south.

In Greece, Keys et al., measured food intakes, only on the islands of CRETE and CORFU. Crete was still very poor after the War. A large case study of Crete as an underdeveloped area had been made by Allbaugh in 1948.3 Their household diet records give good descriptions of the Cretan diet at that time. 1960 food intake records in Crete and Corfu by Keys et al., were lost but Kromhout &Bloemberg (2002) reconstructed the general characteristics, expressed in g/day of food groups for men.4 Food intakes were measured at a sixth Mediterranean site by the Seven Country team in 1960, in Dalmatia, now coastal Croatia. Data for men for these six Mediterranean cohorts of 45 years ago are collected in the table, together with Australia (1995).

<table>
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<tr>
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<tbody>
<tr>
<td>Total cereals incl bread</td>
<td>488</td>
<td>529</td>
<td>498</td>
<td>404</td>
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<td>495</td>
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<td>Potatoes</td>
<td>56</td>
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<td>190</td>
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<tr>
<td>Legumes</td>
<td>12</td>
<td>5</td>
<td>283</td>
<td>141</td>
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<tr>
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<td>Meat</td>
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<td>154</td>
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<td>8</td>
<td>313</td>
<td>16</td>
<td>95</td>
<td>75</td>
<td>72</td>
</tr>
<tr>
<td>Cheese</td>
<td>15</td>
<td>9</td>
<td>24</td>
<td>95</td>
<td>13</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>Olive oil</td>
<td>46</td>
<td>24</td>
<td>32</td>
<td>95</td>
<td>75</td>
<td>72</td>
<td>72</td>
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</tbody>
</table>

References
Concurrent Session 16

**Dietary fatty acids and the five year incidence of age-related maculopathy**

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2Department of Molecular & Microbial Biosciences, NSW Centre for Public Health Nutrition, University of Sydney, 2006
3Centre for Clinical Epidemiology and Biostatistics, University of Newcastle, NSW, 2300

**Background** - Several prospective studies have found increased risk of age related maculopathy (ARM) in participants with high intakes of dietary fat, including monounsaturated and polyunsaturated fats.1,2

**Objectives** - To assess longitudinal associations between dietary fat and incident (ARM) in a cohort of older Australians.

**Design** - Population-based prospective cohort studied of 3654 persons, 49+ years, who participated in the Blue Mountains Eye Study (BMES I, 1992–4); 2335 (75.1% of survivors) were re-examined after 5 years (BMES II, 1997–9). Dietary data were collected from 2895 people at baseline (79%) using a semi-quantitative food frequency questionnaire, used to calculate dietary fat intakes. Fatty acids were analysed using the RMIT fatty acid database.3 ARM was graded from retinal photographs (Wisconsin System). Logistic regression adjusted for age, sex, vitamin C and smoking.

**Outcomes** - Participants with the highest vs lowest quintiles of omega-3 polyunsaturated fat intake had lower risk of incident early ARM (OR 0.4, CI 0.2-0.8). A 40% reduction of incident early ARM was associated with fish consumption at least once /week (OR 0.6, CI 0.4-0.9), while fish consumption at least 3 times /week may reduce incidence of late ARM (OR 0.3, CI 0.1-1.0). We found no association between incident ARM and consumption of butter, margarine or nuts.

**Conclusion** - A diet high in fish, suggests protection against both early and late ARM. Our study could not confirm the deleterious effect of higher polyunsaturated fat intakes reported recently from other clinic-based studies.

**References**


**When is the best time for dietary LCPUFA supplementation; pregnancy or lactation?**

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**Background** - Long chain polyunsaturated fatty acids (LCPUFA) such as docosahexaenoic acid (DHA) and arachidonic acid (AA) have been associated with improved growth and development of infants. The relative importance of supplementation during pregnancy and/or during lactation remains to be elucidated.

**Objective** - The objective of this study was to evaluate in an animal model the effect of supplementing rat dams with LCPUFA during pregnancy and/or lactation on brain fatty acid status of pups.

**Design** - Hooded Wistar rats (n=24) were assigned to one of two dietary groups: LCP diet (5% DHA, 2.5% AA) or basal (B; no LCP) (both diets contained 35% LA, 5% ALA, ratio 7:1) and were fed their respective experimental diet for two weeks before and during pregnancy. At parturition the diets were changed for lactation where appropriate to create four groups– B-B, B-LCP, LCP-B, LCP-LCP. At fifteen days postpartum, animals were sacrificed. Samples were collected from dams (plasma, milk) and pups (plasma, brain) for fatty acid analysis.

**Outcomes** - Only small changes were seen in AA levels in all tissues for both dams and pups. Dams fed LCP during lactation showed equivalent DHA levels in tissues and milk to dams maintained on the LCP diet during both pregnancy and lactation (table). Dams fed LCP during pregnancy alone produced DHA levels in milk above those observed in dams fed basal diet throughout. Changes in dam tissue LCP were reflected in pup plasma and brain.

**Conclusions** - These data show that dietary supplementation of the mother with DHA in pregnancy and lactation, or lactation alone, has a notable effect on levels of brain DHA of the newborn. LCPUFA supplementation during pregnancy only, improved LCP status of pups above that achieved on basal diet throughout.

<table>
<thead>
<tr>
<th>Dietary treatment</th>
<th>Dam plasma DHA (n=6)</th>
<th>Milk DHA (n=6)</th>
<th>Pup Brain DHA (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal-Basal</td>
<td>3.89 ± 0.81</td>
<td>0.25 ± 0.06</td>
<td>13.90 ± 0.75 (30)</td>
</tr>
<tr>
<td>Basal-LCP</td>
<td>7.17 ± 0.58</td>
<td>2.54 ± 0.27</td>
<td>15.72 ± 0.74 (28)</td>
</tr>
<tr>
<td>LCP-Basal</td>
<td>5.80 ± 0.98</td>
<td>0.59 ± 0.16</td>
<td>15.03 ± 0.90 (27)</td>
</tr>
<tr>
<td>LCP-LCP</td>
<td>7.91 ± 0.37</td>
<td>2.67 ± 0.23</td>
<td>15.67 ± 1.02 (30)</td>
</tr>
</tbody>
</table>

Values are mean ± SD; values in column without common superscript are significantly different at P<0.05.

This study was funded by Wyeth Nutritional International, Philadelphia PA.
Concurrent Session 16

The influence of n-6 fatty acids and low-dose fish oil on n-3 fatty acid incorporation into heart cell membranes of the rat

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**Background** - Dietary fish oil (FO) reduces the risk of primary cardiac arrest, due to the incorporation of DHA into heart phospholipids. The n-6 PUFA-rich human western diet restricts conversion of α-linolenic acid (18:3n-3) to long chain n-3 PUFA but direct effects on their myocardial incorporation are not known.

**Objective** - To establish the dose-response effects of very low dietary FO intake on myocardial membrane content of long-chain n-3 PUFA and the influence of dietary n-6 PUFA on this incorporation.

**Design** - Rats were fed 5, 1.25, 0.63, 0.31, 0.16 or 0% FO with either olive oil as a background or 5% linoleic acid (18:2n-6)-rich sunflower seed oil plus oleic acid (18:1) rich olive oil to bring to 10% dietary fat, for four weeks followed by analysis of the phospholipid fatty acid content of myocardial membranes.

**Outcomes** - Fish oil produced dose-related increases in membrane n-3 PUFA incorporation primarily as DHA (22:6n-3), which was significant at all doses (table). N-6 PUFA decreased with increasing FO dose, wholly due to decreased 20:4n-6 (18:2n-6 increased, reflecting reduced conversion). High dietary n-6 PUFA increased both 18:2n-6 and 20:4n-6 and reduced 18:1 but had no significant effect on DHA and only a small effect on EPA incorporation (P<0.001).

<table>
<thead>
<tr>
<th>Diet</th>
<th>0% FO</th>
<th>0.16% FO</th>
<th>0.31% FO</th>
<th>0.63% FO</th>
<th>1.25% FO</th>
<th>5% FO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventricles</td>
<td>Low n-6</td>
<td>7.69 ± 0.55</td>
<td>12.75 ± 0.57</td>
<td>14.91 ± 0.38</td>
<td>17.90 ± 0.44</td>
<td>19.29 ± 0.41</td>
</tr>
<tr>
<td></td>
<td>High n-6</td>
<td>6.69 ± 0.21</td>
<td>13.00 ± 0.82</td>
<td>14.29 ± 0.52</td>
<td>17.16 ± 1.09</td>
<td>19.36 ± 0.95</td>
</tr>
</tbody>
</table>

1mean ± SEM n=4 per group. Common superscripts indicate not significantly different P>0.05).

**Conclusions** - There was a dose-response relationship between dietary fish oil and the composition of heart cell membranes that was sensitive to the absolute amounts of long-chain n-3 PUFA in the diet but not to the dietary ratio of n-6:n-3 PUFA, even at low fish oil intakes.

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Fish, fish oils and long chain omega 3 fatty acids – cardiac benefit and risk: review by the Nutrition and Metabolism Committee of the National Heart Foundation of Australia

D Colquhoun1,2, A Ferreira-Jardim1,2 & B Eden3 for the Nutrition and Metabolism Committee of the National Heart Foundation of Australia

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**Background** - Fish is a rich source of protein and omega-3 fatty acids (n-3). New findings have been reported regarding the benefits of long chain n-3 on coronary heart disease (CHD) risk. Recent concerns have also been raised about the potential toxicity of fish from heavy metals, pesticide contamination and microbial infection along with the possibility of ciguatera poisoning.

**Objective** - To undertake a comprehensive review of the cardiac effects of omega 3 consumption and the associated benefits and potential risks associated with fish and fish oil intake.

**Design** - A comprehensive MEDLINE and internet search of clinical and epidemiological research was undertaken on the cardiac and general health benefits associated with the intake of fish, fish oils and n-3 fatty acids—in particular alpha-linolenic (ALA), docosahexaenoic (DHA), docosapentaenoic (DPA) and eicosapentaenoic acid (EPA). Similarly, a review was conducted of research concerning the toxicity of methyl mercury, dioxin contamination and risk of ciguatera poisoning in fish, along with relative potential benefits and risks associated with consumption of possibly contaminated fish species. Furthermore, the guidelines of Australian, United States, European Union, Japanese, British and WHO statutory bodies and health agencies were synthetically examined and assessed in relation to acceptable mercury and dioxin levels for human consumption.

**Outcomes** - Consistent with the above evaluations, new National Heart Foundation of Australia intake guidelines are proposed for the intake of fish, fish oil and n-3 fatty acids for the general population and for populations at risk of mercury poisoning (e.g. pregnant women).

**Conclusion** - There is a need for a national nutrition survey to assess intake of nutrients, food items and measurement of biomarkers in blood – such as n-3. Marine n-3 fortification of foods is likely to play an increasing role in facilitating an adequate intake of marine n-3 in the general population and as an alternative means of therapeutic intake of marine n-3 for patients with CHD or elevated triglycerides.
Concurrent Session 16

Three weight loss diets of markedly different total and saturated fat composition decrease plasma saturated fatty acids; implications for the cholesterolaemic effects of weight loss diets

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Background - Low-carbohydrate, high-fat weight loss diets do not increase plasma cholesterol concentrations despite being high in saturated fat and cholesterol.

Objective - To determine if the dissociation that occurs between dietary fat and plasma cholesterol during high saturated fat weight loss diets is related to the lack of effect of these diets on plasma fatty acid composition.

Design - Ninety six women were randomised to follow one of three weight loss diets for two months; a high-carbohydrate, low-fat diet (HC), a high-protein diet (HP), or a low-carbohydrate, high-fat diet (HF).

Results - Mean energy intake in all three groups was 1.5 to 2.0 MJ/d lower during the weight loss period than before. During the weight loss period fat made up 57, 35 and 25 percent of energy (%kJ) in the HF, HP and HC groups, respectively, of which 22, 11, and 8 %kJ was saturated fat. Mean weight loss in the HF (6.4 kg) and HP group (5.5 kg) was significantly greater (P<0.05) than in the HC group (4.3 kg). Fasting plasma total cholesterol concentration decreased in the HC and HP but remained unchanged in the HF group. The changes in fatty acid composition of plasma triacylglycerol did not differ between the three diet groups. Myristic acid (C14:0) and palmitic acid (C16:0) composition decreased whereas oleic acid (C18:1n-9) and linoleic acid (C18:2n-6) increased.

Conclusion - During weight loss the fatty acid composition of plasma does not reflect dietary fat intake. We speculate that most dietary fat is oxidised during weight loss and that plasma fatty composition quickly reflects endogenous stores or synthesis. This might explain why high-fat high-saturated fat weight loss diets do not increase plasma cholesterol.
Systemic and airway levels of glutathione and α-tocopherol in asthma

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**Background** - Antioxidant defences are impaired in asthma. Measurement of the reduced and oxidized forms of key antioxidants in the airways will improve our understanding of the role of antioxidants in asthma.

**Objective** - To investigate antioxidant defences in asthma, by measuring the oxidized and reduced forms of key antioxidants (glutathione and α-tocopherol) in the airways (induced sputum) and systemically (peripheral blood).

**Design** - Induced sputum and peripheral blood were collected from stable asthmatics (n=44) and healthy controls (n=31). Total glutathione (GSHt), reduced glutathione (GSHr) and glutathione disulfide (GSSG) concentrations were determined by colorimetric assay. α-tocopherol and α-tocopherol quinone levels were measured by HPLC.

**Outcomes** - Concentrations of GSHt, GSHr and GSSG in sputum supernatant were elevated in asthma versus controls [GSHt (median (IQR)); 15.3 (10.0-22.4) versus 7.0 (4.7-14.3) µM, P = 0.002, GSHr; 4.1 (1.4-6.8) versus 1.2 (0.0-3.8) µM, P = 0.026 and GSSG; 5.9 (4.0-8.4) versus 2.6 (1.8-5.1) µM, P = 0.005]. Sputum supernatant GSSG was inversely associated with FEV1/FVC% (r=-0.316, P = 0.029). Circulating α-tocopherol levels were low in asthma versus controls [plasma; 7.3 (5.7-8.1) versus 12.5 (6.6-18.6) µg/L, P = 0.020 and whole blood; 2.2 (1.5-2.8) versus 2.8 (2.1-3.7) µg/L, P = 0.076]. Subjects with asthma had elevated whole blood levels of α-tocopherol quinone (2.4 (2.1-3.3) versus 1.6 (1.0-2.5) µg/L, P = 0.039) and %α-tocopherol quinone (53.8 (47.2-64.4) versus 44.6 (21.0-51.9)%), P = 0.039 and %α-tocopherol quinone correlated with asthma control score (r=0.804 and P = 0.009).

**Conclusion** - In asthma, the oxidant-antioxidant balance is disturbed both systemically and in the airways. Measurement of the oxidized forms of antioxidants is important, as the oxidized forms of both glutathione and α-tocopherol are clinically relevant, being associated with worse clinical outcomes in asthma.

Green tea supplementation alters gene transcripts involved in hepatic fat oxidation and synthesis in rats fed high fat diets

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**Background** - Green Tea has been shown to induce many health related benefits including reductions in bodyweight and waist circumference, decreased insulin resistance and improvement in blood lipid profiles all of which are implicated in the aetiology of non-alcoholic fatty liver disease. However, to date little is known about the effect of green tea on the molecular mechanisms regulating hepatic lipid synthesis, storage and oxidation.

**Objectives** - This study investigated the impact of green tea, tea catechins or black tea supplementation on rodent liver gene transcripts essential for lipid oxidation and synthesis, and on liver fat accumulation.

**Design** - Sprague-Dawley rats were fed a high fat diet and supplemented at 100% of their fluid intake with water as a control (n=7), green tea (n=7), epigallocatechin-3-gallate (EGCG) (n=7) or black tea (n=7) from 4 weeks age for a period of 6 months. Following supplementation the mRNA levels of Peroxisome Proliferator Receptor Alpha (PPARα), Carnitine Palmitoyl Transferase 1 (CPT1), Acetyl CoA Oxidase (ACO), Sterol Regulatory Element Binding Protein 1c (SREBP-1c), Fatty Acid Synthase (Fsynth), Malonyl CoA Decarboxylase (MCD) and Acetyl CoA Carboxylase (ACC) were measured. Histology and triglyceride analysis was performed to establish the extent of fatty infiltration in the liver.

**Outcomes** - Green tea and black tea supplementation significantly decreased the rodents fat mass and increased the expression of all genes examined, particularly ACO (GT = 20 fold, BT = 14 fold) and MCD (GT = 12 fold, BT = 13 fold). The supplementation with green and black tea also resulted in greater fatty infiltration of the liver than both the control and the EGCG groups.

**Conclusions** - Green and black tea, but not EGCG, appear to cause an increase in the amount of fatty infiltration in the liver, possibly as a consequence of the increased expression of lipid synthesis genes. The concomitant increase in the expression of genes involved in the metabolism of fat suggests that fatty acid turnover in the liver was increased.
Concurrent Session 17

Acute effects of exercise on postprandial chylomicron metabolism
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Background - In addition to the benefits of chronic exercise on cardiovascular disease risk factors it appears that acute exercise may also confer similar benefits. It has been reported that on the day following 90 minutes of moderate cardiorespiratory endurance exercise, fasting and postprandial triglyceride levels are reduced in response to an oral fat load. However the effects of such exercise on fasting and postprandial chylomicron levels are unknown.

Objective - To determine whether a single bout of moderate intensity exercise reduces fasting and postprandial chylomicron levels.

Design - Randomised crossover study of lean healthy subjects (age 29.8 ± 2.0 yr (mean ± SEM)) to compare fasting and postprandial measures on the day following 90 min of moderate (Borg Scale 12-14) intensity exercise to that observed following control (no exercise). On the day following either exercise or no exercise (control) a high fat mixed meal was administered. Fasting and postprandial triglyceride, apo B48 (marker of chylomicron particles), glucose, insulin, non-esterified fatty acids (NEFA) and fasting cholesterol (total, HDL and LDL) were measured.

Outcomes - Fasting and postprandial triglyceride levels were reduced following exercise by 16% and 41% respectively, however the reduction in postprandial levels did not reach significance (P = 0.053). The fasting and postprandial concentration of chylomicron particles however was not affected by a single bout of prior exercise.

Conclusions - A single bout of moderate intensity exercise reduces fasting triglyceride levels; however chylomicron levels are not similarly reduced. As the reduction in postprandial triglyceride levels was primarily due to reduced fasting levels it is likely that exercise leads to a reduction in hepatic VLDL secretion rather than via increased lipoprotein lipase activity and/or improved metabolism of chylomicron particles.

Coeliac disease and bone mineral density: is normal the true normal?
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2Monash University Dept Medicine and Body Composition Laboratory, Monash Medical Centre, Clayton, Victoria

Background - The rate of diagnosis of coeliac disease (CD) is increasing. The need to treat patients with few symptoms and normal nutrition is being debated. One reason for treatment is to optimise bone status. Newly diagnosed CD is associated with reduced bone mineral density (BMD) that improves with a gluten free diet. However significance of a “normal” BMD and the effect of a gluten free diet in this population is unexplored.

Objective - To examine bone and bone-related nutritional status of patients with newly diagnosed CD, to identify predictors of abnormalities and effect of the gluten free diet.

Design - 40 consecutive patients aged 20-73 (median 45) yrs, 23% males with CD newly diagnosed by duodenal biopsy were recruited. Patients were classified into ‘grossly’, ‘moderately’, or ‘minimally’ symptomatic; and underwent nutritional assessment: DEXA scan and micronutrient status. Patients with reduced BMD were offered calcium and vitamin D supplementation. The tests were repeated after 12 months on a gluten free diet.

Outcomes - 36% were classified asymptomatic, 41% moderately symptomatic, and 23% grossly symptomatic. At diagnosis, calcium status was normal and vitamin D deficiency was evident in 13%. Total bone density (>1 SD) was reduced in 16%. A significant relationship was found between total BMD and severity of symptoms (P =0.02), and the degree of villous atrophy (P=0.009). Vitamin D status did not improve despite supplementation. BMD improved in the whole group after twelve months of diet (P <0.01), irrespective of initial BMD.

Conclusion - Severity of gastrointestinal symptoms and villous abnormality predict reduced BMD in newly diagnosed CD indicating the importance of treatment in this group. However, even in the clinically milder group, implementation of a gluten free diet optimises BMD – a desirable clinical goal that potentially reduces future morbidity. Thus, a gluten free diet should be encouraged in all patients with coeliac disease.
Concurrent Session 17

The skeletal response to prolonged sun deprivation in Antarctic conditions
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*Australian Antarctic Division, Kingston, Australia

Background - Lack of exposure to solar ultraviolet radiation (UVR) results in decreased synthesis of vitamin D, with low serum levels associated with increased bone turnover and bone loss.

Objective - To investigate the skeletal response to solar UVR deprivation on healthy adults (n = 57) aged 38.6 yrs (range 21.0 – 61.2 yrs) during their wintering employment in Australia’s Antarctic program.

Design - Longitudinal observational study. Anthropometry was measured at baseline and dietary intake at 6 months. Blood samples were taken at baseline and quarterly there on, and analysed for vitamin D and markers of bone turnover (OC; osteocalcin), formation (P1NP; procollagen Extension Peptide) and resorption (Beta X Laps; Beta Cross laps).

Outcomes - Mean (± SE) height; 180.2 ± 1.4 cm, weight 85.7 ± 4.5 kg and calcium intake 755 ± 52 mg/day were recorded.

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>3 mths</th>
<th>6 mths</th>
<th>9 mths</th>
<th>12 mths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vit. D (nmol/l)</td>
<td>55.2</td>
<td>39.8*</td>
<td>37.9*</td>
<td>39.6*</td>
<td>44.2*</td>
</tr>
<tr>
<td>OC (ng/ml)</td>
<td>23.0</td>
<td>24.5</td>
<td>23.4</td>
<td>22.6</td>
<td>25.3</td>
</tr>
<tr>
<td>P1NP (ng/ml)</td>
<td>49.8</td>
<td>49.2</td>
<td>52.3</td>
<td>52.7</td>
<td>56.1</td>
</tr>
<tr>
<td>Beta XL (ng/ml)</td>
<td>0.312</td>
<td>0.344</td>
<td>0.320</td>
<td>0.332</td>
<td>0.339*</td>
</tr>
</tbody>
</table>

*Different to Baseline

Serum Vitamin D levels at 3 months were significantly lower than baseline, and remained lower for the year (P < 0.01). Bone resorption was higher at 12 months compared to baseline (P <0.06). Time since arrival (TSA - duration of sun deprivation) was negatively correlated with vitamin D levels (r = -0.41, P <0.001), and positively correlated with bone resorption (r = 0.18, P <0.07). After accounting for calcium intake TSA was positively correlated with OC (P <0.01) and P1NP (P <0.05).

Conclusions - Short-term sun deprivation negatively impacts on bone, especially in extreme environments. The long-term detriment to bone is still to be determined.

Diet and mood state
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Background - There is some limited data indicating that dietary intake may alter mood states, but most of this is anecdotal. A number of dietary factors have been associated with reduction in blood pressure, which could, in part be related to positive effects on general mood states.

Objective - To determine if urinary excretion of particular minerals is associated with different mood states and if changing to one of the test diets DASH type diet (high fruits, vegetables and low fat dairy products) (OZDASH), a low salt, high fruit/vegetable diet (LNAHK) or a high calcium diet (HC) has an effect on mood state.

Design - Subjects completed an abbreviated 37-item version of the Profile of Mood States weekly throughout a 14-week dietary study. Each person consumed two different types of diets for 4 weeks, preceded by a 2 week control diet and performed 24-hr urine collections fortnightly.

Outcomes - For the 62 subjects who completed all tasks, throughout the study, there was a significant inverse association with 24-urinary excretion of calcium and potassium with depression (r= -0.26 P <0.05, r= -0.25 P <0.05), calcium and fatigue (r= -0.29 P <0.01) and a positive association for sodium and vigour (r=0.39 P =0.01). When assessing the change in urinary electrolytes, moving from the control diet to one of the test diets, there was a significant reduction in tension and anger with all diets (OZDASH (n=93) P <0.05, LNAHK (n=43) P <0.01 and HC (n=47) P <0.01), a reduction in confusion on the OZDASH and HC (P <0.01), a reduction in depression on the OZDASH and LNAHK (P <0.05) and a reduction in depression on the HC diet (P <0.05) there were no differences in the vigour scores on any diet. The HC diet had the lowest anger and depression scores and both the OZDASH and HC diet reported lower fatigue scores.

Conclusion - These findings strongly suggest that mood is related to mineral metabolism. Dietary change may affect mood state, particularly the inverse association of calcium and potassium to depression/fatigue. These findings should be treated with caution but strongly suggest further replication studies are warranted.
Posters

Profile of patients with metabolic syndrome recruited for a study of an automated dietary assessment website in primary care

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² National Centre of Excellence in Functional Foods, University of Wollongong, NSW 2522

Background - An automated dietary assessment website has been developed for patients with metabolic syndrome.

Objective - This study outlines the profile of patients using the website and their rates of completion of the assessment.

Design - Computers have been set up in local GP practices to which the GP may refer their patients. These patients enter their dietary information into the website and receive an individualised dietary prescription put together by a dietitian.

Outcomes - Recruited patients were primarily female (70%). Ranging between 22 and 75 years of age patients reported to be overweight (99%), have high cholesterol concentrations (47%), elevated blood pressure (41%) and/or type 2 diabetes mellitus. Intermediate levels of computer experience were reported with most patients preferring to use the website at home as opposed to in their GP practice. Of the 73 patients recruited 57 completed the entire assessment, 17 allowed their accounts to expire and the remainder had partially completed the assessment.

Conclusions - Results indicated that use of a computer for dietary assessment appears to capture a large proportion of the population who otherwise would not be able or willing to receive face-to-face advice from a dietitian. Such an application is highly useful in the field of nutrition due to the ever increasing rates of overweight and obesity within Australia.

Dietary quality in under-reporters and non-under-reporters

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Background - Exclusion of under-reporters (UR) have affected conclusions in some dietary studies.

Objectives - To investigate differences between non-UR (NUR) and UR in dietary quality.

Design - Analysis of four day records of dietary intakes and activities in 475 non-pregnant, non-lactating female university students, studied between 1998 and 2003. Daily energy expenditure (EE) was determined using a factorial method. Subjects were classified as UR when their reported energy intake (EI) was <76% of their EE. Dietary quality was measured using three composite indexes: the Healthy Eating Index (HEI), the Dietary Quality Index Revised (DQIR) and the Dietary Guidelines for Americans Index (DGI-US). Differences between UR and NUR were evaluated using the Mann Whitney U test.

Outcomes - Of the subjects, 267 were classified as NUR and 208 as UR. The total dietary quality scores and the statistical significance of differences between NUR and UR (P value) are shown in the table. There were no differences between NUR and UR in dietary quality using the HEI or DQIR, but UR had higher dietary quality using the DGI-US. However, analysis of scores for each component of the composite indexes showed many significant differences between NUR and UR. Scores relating to total food consumption (especially grains, meat, dairy, dietary variety and nutrient adequacy) were higher in NUR than UR in all but a few instances, while scores relating to dietary balance (percentage of energy from fat and saturated fat, cholesterol, sodium and moderation) were higher in UR than NUR (data not shown).

<table>
<thead>
<tr>
<th>Index</th>
<th>Maximum score</th>
<th>NUR (mean ± SD)</th>
<th>UR (mean ± SD)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEI</td>
<td>100</td>
<td>72.8 ± 12.7</td>
<td>72.4 ± 12.7</td>
<td>0.370</td>
</tr>
<tr>
<td>DQIR</td>
<td>100</td>
<td>67.8 ± 12.8</td>
<td>68.4 ± 13.3</td>
<td>0.549</td>
</tr>
<tr>
<td>DGI-US</td>
<td>18</td>
<td>10.3 ± 2.8</td>
<td>10.9 ± 2.4</td>
<td>0.050</td>
</tr>
</tbody>
</table>

Conclusions - There were no differences between NUR and UR in dietary quality using the HEI or DQIR, but UR had higher dietary quality using the DGI-US. However, total scores for composite indexes of dietary quality hide apparently different dietary patterns for NUR and UR.
Posters

Effects of green tea extracts on learning and memory behaviour in rats
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Background - Green tea contains various bioactive compounds, such as polyphenol antioxidants and caffeine. There have been numerous claims of health benefits in association with tea consumption, including hypolipidemic effect and blood pressure reduction. There are also suggestions that tea consumption may improve brain functions.

Objective - This study investigated the short- and long-term effects of green tea extract ingestion on learning and memory behaviour in rats. The protective effects of tea extract ingestion on brain oxidative stress were also examined.

Design - Male SD rats of 4 or 12 weeks of age were assigned to three treatment groups with five animals in each group. To study the short-term effect, the animals were administered via an oral-gastric tube 1.0 mL/100g body weight of water containing 0, 0.3 or 3 mg/mL green tea extracts. Learning and memory behaviour was assessed 30 minutes after the tea extract administration using Morris water maze test. The experimental animals were then maintained on standard laboratory chow with drinking water containing 0, 0.03 or 0.3 mg/mL tea extracts for nine months. The learning and memory behaviour of the animals was assessed again at the end of the feeding trial. At the end of the experiment, all animals were euthanized and the brain tissue samples were collected for measurements of oxidative stress.

Outcome - Oral-gastric administration of the tea extracts significantly improved the learning and memory ability in the rats in a dose and age dependent manner. In 4-week-old rats oral administration of 0.3 mg/100g body weight of the green tea extracts significantly reduced the escape latency in the water maze test while in 12-week-old rats oral administration of 3 mg/100g body weight of the extract significantly reduced the escape latency. Long-term ingestion of the tea extracts had no significant effect on the learning and memory behaviour but reduced brain tissue oxidative stress level.

Conclusion - Consumption of green tea may have a beneficial effect on the brain.

References

Effects of oral ingestion of colostrum on intestinal expression of TGF-beta receptors in the newborn pig

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Background - An earlier study in our laboratory showed a transient decline of TGF-beta receptor intensity in the intestinal epithelium in newborn pigs following the onset of suckling. It was speculated that such decline may result from the exposure of the intestine to colostrum-borne TGF-beta.

Objective - This study examined the effects of oral ingestion of diets known to contain very different levels of TGF-beta on intestinal TGF-beta receptor intensity in newborn pigs.

Design - A total of 25 newborn piglets were bottle-fed with equal volume of porcine colostrum, bovine colostrum, porcine milk, human infant formula or water for 24 hours. Five naturally suckled piglets were used as the control. At the end of the feeding experiment, all animals were euthanized and the expression intensity of TGF-beta receptors in the small intestine was estimated by immunohistochemical staining.

Outcome - Oral ingestion of liquid diets had significant effects on the expression intensity and distribution of TGF-beta receptors in the small intestine of newborn pigs. In pigs fed with milk, milk formula or water, intensive expression of the receptors was seen in the basal membrane of the intestinal villous epithelium and in the Brunner’s glands of the duodenum. Oral ingestion of colostrum significantly reduced the expression intensity of the receptors in the villous epithelial cells and the Brunner’s glands (P <0.05). The reduction was up to 60% when estimated by immunostaining intensity. On the other hand, the villous height and crypt depth of the small intestine were significantly greater in pigs fed colostrum than those fed milk, milk formula or water.

Conclusion - Exposure of newborn pigs to colostrum, which is known to contain high levels of TGF-beta, leads to a down-regulation of TGF-beta receptor expression in the small intestine.
Posters

**Omega-3 polyunsaturated fatty acid composition of Sydney rock oyster in different seasons**
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**Background** - The richest food source of long chain n-3 polyunsaturated fatty acid (PUFA) is seafood. Previous studies showed that n-3 PUFA composition varied between the seasons. However, there has been no report on the seasonal variation of fatty acid composition of Sydney rock oyster, *Saccostrea commercialis*.

**Objective** - To measure the fatty acid composition of Australian commercial oyster species, *Saccostrea commercialis* in different seasons.

**Design** - Five to eight samples of oysters were analysed bimonthly for a whole year. The total lipid was extracted with chloroform-methanol (2:1, v/v) containing butylated hydroxytoluene. The fatty acid methyl esters were prepared by saponification using KOH, followed by transesterification in BF₃ in methanol. The fatty acid methyl esters were separated by gas liquid chromatography. One-way ANOVA and Tukey HSD multiple comparisons were performed to determine differences in individual fatty acid levels between different seasons.

**Outcomes** - Oysters harvested in late summer (February), autumn (April) and winter (August) had a higher percentage composition of total n-3 PUFA than samples from early winter (June) and summer (December) (P<0.05). Higher composition of both EPA and DHA were recorded from February to April, and August to October. August samples also showed the lowest composition of SFA.

<table>
<thead>
<tr>
<th>Fatty Acids</th>
<th>February</th>
<th>April</th>
<th>June</th>
<th>August</th>
<th>October</th>
<th>December</th>
</tr>
</thead>
<tbody>
<tr>
<td>20:5n-3 (EPA)</td>
<td>14.4 ± 0.7</td>
<td>14.0 ± 0.9</td>
<td>13.4 ± 1.0</td>
<td>15.6 ± 1.0</td>
<td>14.2 ± 0.8</td>
<td>12.2 ± 1.9**</td>
</tr>
<tr>
<td>22:6n-3 (DHA)</td>
<td>16.0 ± 2.6</td>
<td>18.6 ± 3.2</td>
<td>14.5 ± 1.3</td>
<td>17.2 ± 1.0</td>
<td>15.8 ± 1.2</td>
<td>15.0 ± 2.0**</td>
</tr>
<tr>
<td>Total n-3 PUFA</td>
<td>41.1 ± 2.7</td>
<td>42.9 ± 3.3</td>
<td>36.9 ± 2.1</td>
<td>43.3 ± 1.4</td>
<td>39.5 ± 1.9</td>
<td>36.9 ± 3.0**</td>
</tr>
<tr>
<td>Total n-6 PUFA</td>
<td>6.1 ± 0.4</td>
<td>6.3 ± 0.4</td>
<td>5.3 ± 0.6</td>
<td>6.4 ± 0.4</td>
<td>6.7 ± 0.7</td>
<td>5.5 ± 0.6**</td>
</tr>
<tr>
<td>Total SFA</td>
<td>36.9 ± 1.4</td>
<td>34.7 ± 1.9</td>
<td>39.2 ± 2.6</td>
<td>31.9 ± 1.6</td>
<td>36.7 ± 2.0</td>
<td>43.3 ± 4.0**</td>
</tr>
<tr>
<td>Total MUFA</td>
<td>15.9 ± 2.1</td>
<td>16.1 ± 2.9</td>
<td>18.6 ± 1.0</td>
<td>18.3 ± 0.9</td>
<td>17.1 ± 0.8</td>
<td>14.2 ± 1.5**</td>
</tr>
</tbody>
</table>

Values are mean ± SD. **P<0.01.

**Conclusion** - Composition of n-3 PUFA in oysters is related to the season when animals are harvested and this may be attributed to several factors such as water temperature, food availability and reproductive activities.

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**Nutrient intake and plate waste from an Australian residential care facility**
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**Background** - The risk of developing nutritional deficiencies appears to be high among the institutionalised elderly, but few studies have assessed the food waste (plate waste), energy, and nutrient intake among residents in Australian residential care facilities.

**Objectives** - To determine the plate waste, energy, and nutrient intake, from elderly residents living in a long-term care facility.

**Subjects** - Forty five High Level Care (HLC) and 21 Low Level Care (LLC) residents.

**Design** - Single, whole day assessment of plate waste, energy, and nutrient intake, using a visual rating plate waste scale.

**Outcomes** - Mean plate wastage from main meals was 23%, which was similar to that wasted at mid meals (17%). The lowest mean wastage occurred at breakfast (10%) in comparison with lunch (24%, P<0.001) and dinner (29%, P<0.001). The mean (SD) daily energy served in HLC was lower than energy served in LLC (7.4 (1.2) MJ vs. 8.2 (1.8) MJ, P =0.042). The mean daily energy intake in HLC was 5.8 (1.8) MJ, which was no different to the intake in LLC (6.0 (2.2) MJ). Seventy-nine percent of residents consumed less than 7.5 MJ per day, with no difference between HLC and LLC. The mean calcium intake was 781 (352) mg, with no difference between HLC and LLC, and the median vitamin D intake was 2.26 [inter-quartile range, 1.88] µg. The mean energy intake from mid-meal snacks was 863 (512) kJ.

**Conclusion** - On the day of measurement, three-quarters of the group were at risk of consuming an inadequate energy intake, and low intakes of calcium and vitamin D. Although wastage was not excessive and energy served was adequate, the amount of food eaten was insufficient to meet energy and nutrient requirements for a significant number of residents.
Characterisation of vitamin D spectra produced under natural and artificial ultraviolet radiation using an in vitro model

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Background - Exposure to sunlight, specifically short wavelength ultraviolet (UV) radiation, is responsible for synthesis of pre-vitamin D in human skin. Vitamin D is essential for calcium and phosphorous absorption which impacts on bone health and metabolism. Over time, it has become evident that the Vitamin D receptor (VDR) can be found not only in cells and tissues involved in calcium and bone metabolism, but it is also found in a variety of other cells and tissues, including cancer cells. Many studies have investigated vitamin D in tumour cell growth regulation, treatment of cancer and the development of synthetic analogues. Thus, the importance of directly quantifying the vitamin D synthetic capacity of sunlight and solar simulated light remains high as this is the most common source of Vitamin D for humans.

Objective - This work aims to refine the in vitro model for vitamin D synthesis by using a wide range of pre-vitamin D concentrations and UV radiation exposure conditions.

Design - Using an in vitro model of vitamin D synthesis, 7-dehydrocholesterol at varying concentrations (2.5 – 30 ug/ml) in ethanol solution was subjected to different levels of UV exposure under natural and simulated UV radiation. Spectra of each reaction determined at the 200-350 nm wavelength region were categorized by absorbance and slope changes at 5 regions.

Outcomes - Spectral changes with increasing UV exposure were comparable under natural sunlight and solar simulated conditions for 7-dehydrocholesterol concentrations of 20 ug/ml and above. A proportional increase in absorbance at 202 nm, decreases at 263, 272, 282 and 294 nm and a decrease in slope of the 250-263 nm region accompanied an increase in UV exposure (0-4MED). On the other hand, results using lower concentrations of 7-dehydrocholesterol (2.5-10 ug/ml) produced inconsistent spectral changes, suggesting some irradiation level at which toxicity reactions may arise. These form a theoretical basis for determining the threshold and optimum conditions and the impact of the incident UV spectra for Vitamin D synthesis under both conditions of UV irradiation and for designing conditions for effective exposure.

Conclusions - This research highlights the need for further research into the photochemistry of pre-vitamin D production in human skin and suggests that varying UV irradiation spectra impact on the synthesis of pre-vitamin D. Results gained will help us understand how sunlight exposure is required to maintain optimum 25 (OH) D status and guide health authorities in creating appropriate health recommendations to the public.
Posters

Viability of probiotic bacteria in foods during storage
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Background - Viability of probiotic bacteria in foods has recently received increasing interest partly because of new findings suggesting that yoghurts containing viable bacteria are more beneficial to health and nutrition than heat-sterilized yoghurts containing only non-viable bacteria. Recently, probiotic bacteria have been shown to enter a dormant state during storage. Nutritional significance of such dormant probiotics is yet to be defined.

Objective - To assess viability status of probiotic bacteria by monitoring different intrinsic properties of the bacteria during storage.

Design - Nine fermented probiotic products were prepared and the viability of the cells was measured by plate counts, quantitative reverse-transcriptase PCR, and flow cytometry combined with three different fluorescent staining procedures measuring membrane condition, enzyme activity, and internal pH of the cells.

Outcomes - A significant subpopulation of probiotic cells entered a dormant state during storage. Internal pH and membrane condition of the cells remained unchanged, while cells with esterase activity decreased by 1 log units. Cell activity measured by RNA levels remained unchanged. In comparison, plate counts of the cells decreased 6-8 log units, suggesting that the cells had become dormant.

Conclusions - It has become apparent that the viability of probiotic cells is not just a question of the cell being simply dead or alive, and that a multi-method approach may be needed for reliable assessment of viability. The health effects and nutritional significance of so-called dormant probiotic cells needs to be assessed, and the occurrence of such bacteria in foods should be taken into account when regulations and guidelines for products containing probiotic bacteria are set.

References

Nutritional quality of grain legumes
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Background - Grain legumes are potential substitutes for soybean meal in poultry feed formulations, but their utilisation is limited due to uncertainty about their nutritional quality. Limited data are available on the nutritive value of grain legumes grown under New Zealand conditions.

Objective - To determine nutritional quality of four grain legumes for poultry.

Design - A total of 68 samples representing narrow leaf lupin, white lupin, chickpeas and peas were analysed for protein and amino acids. In addition, the protein quality was determined in studies with broiler chickens from day 1 to 12 post-hatching. Semi-purified diets containing raw legumes and a control soybean meal were fed to broiler chickens for 10 days. Weight gain and feed intake were recorded, and the protein efficiency ratio (PER) was calculated. The effects on organ weights (heart, liver and pancreas) were also recorded.

Outcomes - PER values and amino acid scores suggested that the protein quality of the test ingredients was in the following order: soybean meal > chickpeas > peas > lupins. Mortality was not increased by feeding of raw forms of legumes, suggesting that these do not contain significant levels of any anti-nutritive factors. The lack of effects ($P >0.05$) on the relative organ weights indicated that the levels of anti-nutrients in these legumes were low.

Conclusion - The protein quality of the tested legumes for poultry was poorer compared to soybean meal, which is related to the deficiency of key limiting amino acids, rather than to the presence of anti-nutrients.
Posters

Ileal endogenous flow of amino acids in the avian ileum is increased by protein sources with high fibre contents

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Background - Addition of purified sources of fibre to diets has been shown to increase the flow of undigested endogenous protein leaving the small intestine of pigs and poultry. No reports exist on the effects of high levels of fibre naturally occurring in feed ingredients, because until recently no method was available to estimate the ileal endogenous recoveries associated with specific feedstuffs. Guanidination is a novel technique that allows the quantification of endogenous flow generated by specific feed ingredients.

Objective - To measure the ileal endogenous flow of amino acids in broiler chickens fed diets containing casein, soybean meal, canola meal and cottonseed meal.

Design - The four ingredients were guanidinated and, assay diets based on dextrose and the guanidinated ingredients were offered ad libitum to three pens of 5-week old broilers for seven days and ileal digesta were collected. Endogenous flow was calculated using the homoarginine: amino acid ratios.

Outcomes - Ileal endogenous flows of protein and amino acids were lowest ($P < 0.05$) in casein, intermediate in soybean meal, high in canola meal and highest ($P < 0.05$) in cottonseed meal. The flows were correlated ($P < 0.01$) with dietary fibre levels.

Conclusion - Endogenous flows of protein and amino acids in the avian ileum were significantly increased by protein sources with high fibre contents.

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Vietnamese traditional fermented foods as a source of novel probiotic bacteria

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Background - The bacteria of traditional fermented foods are what created the concept of probiotics. Most western countries, however, now produce these foods by specific starter cultures not selected for health promotion, but rather for their ability to fulfill commercial production criterion. These products no longer necessarily contain beneficial bacteria. In many Asian countries the art of fermentation using indigenous bacteria is still common, and therefore it is proposed that these foods may contain novel bacteria that have probiotic potential.

Objective - This study examined naturally fermented Vietnamese foods for bacteria that survive \textit{in vitro} simulated gastrointestinal conditions, the first step in identifying potential probiotic bacteria.

Design - Vietnamese fermented foods derived from 7 different produce were examined: mustard leaves, brinjals, onions, cabbages, taro stems, radish leaves and meat. For each sample, 1 g of food was resuspended in 10 mL of MRS broth, prior to consecutive exposure to acidic MRS broth (pH 2.5) and MRS broth containing 1% bile salts. After exposure, the samples were plated onto MRS agar. Isolates were tested for survival in \textit{in vitro} simulated gastric juice at pH 2.0; 2.5 and 3.0, and simulated small intestinal juices with or without 0.3% bile salts at pH 8.0. Tolerant strains were observed morphologically and were identified using their carbohydrate fermentation patterns.

Outcomes - Eleven strains out of 57 isolates from Vietnamese fermented foods showed potential probiotic characteristics. Among them five strains of \textit{Lactobacillus plantarum}, three of \textit{Lactobacillus fermentum}, two of \textit{Lactobacillus acidophilus} and one of \textit{Lactobacillus brevis} were identified.

Conclusion - Naturally fermented foods may contain an abundant array of potential probiotic bacteria. Careful selection of these bacteria will provide an opportunity to develop foods that not only fulfill the commercial requirements, but also give the food functionality. This study has demonstrated that in traditional Vietnamese fermented foods, there exist bacteria that survive \textit{in vitro} gastrointestinal simulated conditions, the first step in identification of novel probiotics. How these bacteria can impact clinically on the consumer needs to be further investigated.
Posters

Extraordinarily low vitamin D content of fortified milk, milk based infant formula and powder milk
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Background - It has been reported that vitamin D deficiency diseases and low vitamin D levels do exist in Saudi Arabia in various sectors of the community in spite of abundance of sunlight.

Objectives - To measure the vitamin D content of milk, liquid yogurt, milk-based infant formula and powder milk.

Design - We have used a state of the art high performance liquid chromatography technique to achieve the objective of this research. The following samples were purchased randomly from supermarkets in various regions of the country, 60 containers of vitamin D fortified normal fat milk, 24 containers of non-fortified normal fat milk, 12 containers of fortified skinned milk, 42 containers of fortified normal fat liquid yogurt, 30 containers of fortified low fat milk, 60 cans of fortified milk-based infant formulas, 30 cans of fortified and non-fortified milk powder.

Outcomes - Out of the 60 fortified normal fat milk samples as high as 60% (36 samples) contained amount of vitamin D far below the 400 IU/L stated on the label. Only 10% (six samples) contained 78% (312 IU/L) of added vitamin D, and 30% (18 samples) contained higher, level of vitamin D, than 400 IU/L, where the level has exceeded 140% (568 IU/L). All of the 24 containers of non-fortified normal milk samples analyzed contained undetectable or very low vitamin D. Fifty percent of vitamin D fortified skinned milk contained undetectable level of vitamin D, whereas the other 50% (six samples) contained 68% of the vitamin stated on the label. The vitamin D content of the 42 containers of fortified normal milk fat was as follow; 57% (24 samples) with undetectable level of vitamin D, and 28.5% (12 samples) contained vitamin D content in the range of 108% to 130% of the amount of vitamin D stated on the label. The rest of the samples contained 62% of the added vitamin D. In the 30 containers of vitamin D fortified low fat milk, only 10% (six samples) contained 82% of the added vitamin D, while the remaining 90% contained no or extremely low content of vitamin D in comparison to what is stated on the label. Only 10% (six cans) of infant formulas contained six percent of the amount of vitamin D stated on the label. Only two brands (12 cans) of milk powder were fortified with vitamin D and the content of this vitamin was in the range of 100% - 120% of the amount reported on the label.

Conclusions - Some milk and its derivatives produced in Saudi Arabia contained undetectable levels of vitamin D and are unlikely to improve the vitamin D nutritional status of the population.

Effective weight loss and maintenance strategies in polycystic ovary syndrome
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Background - Polycystic ovary syndrome (PCOS), a common endocrine condition in women of reproductive age, improves with weight loss but the optimal strategy for weight maintenance is unknown.

Objective - To assess the use of meal replacements as a weight loss strategy and the effects of carbohydrate or fat restriction on weight maintenance, reproductive and metabolic parameters in overweight women with PCOS.

Design - Overweight women with PCOS (n=43; age=32.1±5.2 years; weight=96.1±18.4 kg; mean±SD) followed an 8 week weight loss regime (2 meal replacements daily) followed by a carbohydrate (<120 g/day) or fat restricted (<50 g/day) weight maintenance regime for 6 months. Both dietary groups were followed up monthly and received advice on reducing the glycemic index and saturated fat content of their diet. Weight, waist circumference, body composition (bioelectrical impedance analysis), insulin, testosterone, sex-hormone binding globulin and free androgen index (FAI) were assessed at the beginning and end of each study phase.

Outcomes - Thirty two women completed the weight loss and 23 women completed the weight maintenance phase with similar dropouts in each diet group. During the weight loss phase, reductions in weight (5.6±2.4 kg), waist circumference (6.1±2.5 cm), body fat (4.1±2.2 kg), insulin (2.8±1.1 mU/L), testosterone (0.3±0.7 nmol/L) and FAI (3.1±4.6) (P<0.05) occurred. These changes were sustained during the weight maintenance phase with no differences between diet groups for any variables. At 6 months both approaches maintained a net weight loss of 4.7±4.6 kg. 2 pregnancies occurred during the weight maintenance phase (2 fat restricted) with 6.5 and 11.8 kg weight losses at estimated conception time.

Conclusions - In conclusion, meal replacements are an effective strategy for the short-term management of PCOS. Fat and carbohydrate restriction were equally effective in maintaining weight reduction.
Posters

Inter- and intra-individual variation in DNA damage potential of faecal water assessed in the WIL2-NS cell line
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Background - As human faeces represent the outcome of the digestion process as well as the metabolic products of colonic bacteria, the assessment of the faecal contents provides a non-invasive mechanism for studying the environment in the colon and its contribution to risk of colorectal cancer. The ability of faecal water (aqueous phase of the faeces) to induce DNA damage in a cell line as measured using the cytokinesis block micronucleus (CBMN) assay has not been assessed, such that the extent of inter- and intra-individual variation with this assay is unknown.

Objectives - To measure the inter-individual and intra-individual effect of faecal water on DNA damage using the WIL2-NS cell line.

Design - Faecal samples were collected from 1 individual on 6 occasions and 6 individuals on 1 occasion. The WIL2-NS cell line was used to measure DNA damage of 1% faecal water assessed by the CBMN assay. CBMN assay biomarkers measured were micronuclei (MN, marker of chromosome breakage/loss), nucleoplasmic bridges (NPB, marker of chromosome rearrangement) and nuclear budding (NBud, marker of gene amplification), as well as necrosis and nuclear division cytotoxicity index (NDCI).

Outcomes - MN, NPB, NBuds and necrosis increased significantly and NDCI decreased significantly in the presence of 1% faecal water. Interindividual variation was greater than intraindividual variation (%CV) for all biomarkers measured. Fold increase relative to %CV suggest MN, NPB and NBud are the most reliable and sensitive biomarkers.

Conclusions - The CBMN assay is a comprehensive and reproducible method for measuring the DNA damage potential of faecal water within a population. The most reliable and sensitive biomarkers appear to be MN, NPB and NBuds.

References

Depression of postprandial hyperglycemia and hyperinsulinemia by low glycemic index cookies in diet-induced insulin resistant Wistar rats
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Background - The postprandial hyperinsulinemia is a causative factor of obesity, pancreatic beta-cell exhaustion and the development of diabetes. The metabolic syndromes are characterized by the insulin resistance in peripheral tissues and are considered to be induced by the excessive postprandial hyperglycemia and hyperinsulinemia. High glycemic index (GI) diet led to at the initial phase an increased insulin secretion during an intravenous glucose tolerance test.

Objective - To examine whether the disposition behaviour of blood glucose and insulin secretion are manipulated by the intake of the low GI cookies with non-digestible dextrin in rats fed high sucrose high fat (HSHF) diet. These parameters were determined during and after the intravenous infusion of glucose and after the intake of the reference starch solution (Toleran-G).

Design - Male Wistar rats were fed HSHF diet for 16 weeks. The glucose was intravenously infused into these rats to clarify the relationship between blood glucose and insulin levels. The low GI cookies and Toleran-G were administered orally to estimate the values of GI and the insulinenic index (II) of the low GI cookies.

Outcomes - The basal insulin concentration in the HSHF diet group (1.8±0.8 ng/ml; mean±SD) was significantly higher than that of the standard chow group (0.8±0.4 ng/ml). Although the excessive postprandial hyperinsulinemia were observed after the oral administration of Toleran-G, theGI and II values for the low GI cookies was maintained low in HSHF diet group (GI: 27±11, II: 23±6).

Conclusions - Low GI cookies have the potential to depress hyperglycemia and hyperinsulinemia. The low GI cookies might be useful for the prevention of the metabolic syndromes.
Posters

Relationship between glycemic index and insulinemic index in healthy volunteers after intake of low glycemic index products
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Background – The glycemic index (GI) has particular relevance to the metabolic syndromes associated with the obesity and the insulin resistance. The insulin resistance is considered be induced by the hyperinsulinemia. Although the insulin responses are closely related to the glycemic responses, the insulinemic index (II) may be affected by not only the quantity and quality of the carbohydrate uptake inhibitor, such as the non-digestible dextrin, but also by the effect of fat and protein on the secretion of the primary incretin hormones.

Objective - The GI and II values were determined for low GI jellies, with palatinose, and low GI cookies containing non-digestible dextrin, in healthy volunteers to examine whether hyperinsulinemia is caused by the intake of these low GI products.

Design - Eighteen healthy volunteers, 4 men and 14 women aged 41.2 ± 8.3 y, with normal body mass indexes (21.8 ± 1.6 kg/m²) participated. The blood samples were collected before and 15, 30, 60, 90, 120 min after the intake of the low GI products and the reference starch solution (Toleran-G) containing 50 g carbohydrate.

Outcomes - The II values (62 ± 31) of the low GI jellies were similar to their GI values (61 ± 16) but the II values (67 ± 23) of the low GI cookies were higher than the GI values (31 ± 25). This discrepancy might be explained by the insulinotropic effects of protein or fat which are involved in the low GI cookies.

Conclusions - Both low GI jellies and cookies have a depressant effect on hyperglycemia and hyperinsulinemia. These low GI products might be useful for the prevention of the metabolic syndromes.

Correcting postprandial dyslipidaemia in viscerally obese men: effects of fish oil and exercise
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Background - Lifestyle interventions including regular exercise and dietary fish oils have been shown to improve plasma lipid profiles in viscerally obese subjects but specific evidence of their effect on chylomicrons is scarce. Furthermore it is unknown whether a combination of these interventions have synergistic effects on the fasting and postprandial chylomicron levels.

Objectives - To determine the effects of a 12-week moderate intensity walking programme with and without fish oil supplementation on fasting and postprandial response of apo B-48 as a marker of chylomicrons.

Design - We conducted a randomised single blind parallel trial in obese men with the metabolic syndrome (BMI 32.2 ± 0.8 kg/m²) and compared the effect of chronic fish oil ingestion (1 g EPA, 0.7 g DHA/day) plus a moderate-intensity walking programme (3 x 1 h sessions/week) versus a placebo and the same walking programme. Fasting and a nine hour postprandial profile of apo B-48 and lipids were measured pre-and post-intervention following a high fat breakfast.

Outcomes - Fasting apo B-48 and triglyceride decreased significantly in the exercise + fish oil group by (14.3%) and (22.5%) respectively (P<0.05) while there were no changes to the exercise only group. These changes were paralleled by reductions in the postprandial metabolism of apo B-48 (19.0%) and triglycerides (27.7%) with the combined intervention but not the exercise only group (P<0.01).

Conclusion - Changes were seen in the chylomicron and triglyceride profiles of subjects undertaking the combined exercise and fish oil treatments and no changes occurred with exercise alone. Our results imply synergistic effects may occur between exercise and fish oil to promote a lower basal chylomicron secretion rate and possibly accelerated particle clearance. No changes were seen with exercise alone, which could suggest that an exercise intervention of higher intensity or longer duration may have been necessary.
Posters

Low glycemic load, high protein diet lessens facial acne severity
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Background – Acne vulgaris is a multi-factorial skin disorder which affects the 85-100% of the adolescent population in Western civilizations. Despite its high prevalence in the West, acne prevalence is extremely low or rare in non-westernized societies. It has been proposed that refined, high glycemic foods common in Western societies may accentuate underlying causal factors responsible for its proliferation.

Objective - To determine whether a low glycemic load diet, comprised of high levels of protein and low GI foods, can alleviate the severity of acne symptoms in young males

Design – Male acne sufferers [n=43, age=18.3 ± 0.4 (mean ± SEM)] were randomly assigned to either the dietary intervention (n=23) or control groups (n=20). The intervention diet consisted of 25% energy from protein and 45% energy from low glycemic index carbohydrates. The control group received no information about diet nor were they given dietary instruction. The efficacy of dietary treatment versus control was clinically assessed by a dermatologist using a modified Cunliffe-Leeds acne scale. The dermatologist assessed facial acne by means of lesion counts and was blinded to the subject’s group.

Outcomes - Dietary intervention resulted in a reduction in total lesion counts (-23.1 ± 4.0 lesions, P<0.001) and inflammatory counts (-16.2 ± 3.0 lesions, P<0.001). The control group also showed a reduction in total lesion counts (-12.0 ± 3.5 lesions, P<0.01) and inflammatory counts (-7.4 ± 2.5 lesions, P<0.05). However, between group analyses showed that the reduction was significantly greater in the intervention group for total counts (P<0.05) and inflammatory counts (P<0.05).

Conclusion - These data indicate that a low glycemic load diet, comprised of high levels of protein and low GI foods, significantly decreased the mean number of facial acne lesions, therefore alleviating the severity of acne symptoms. However, the multi-factorial nature of this condition is reflected in the fact that the control group also showed a decrease over time, thereby suggesting that other factors are at play.

References

Red wine polyphenols improve vascular function in postmenopausal women
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Background - Moderate red wine consumption has been shown to reduce cardiovascular disease (CVD) risk. Arteriosclerosis and elevated systolic blood pressure are independent risk factors for CVD. However, the effect of red wine and its polyphenolic components on vascular function has not been previously investigated. In this study we have investigated the effect of moderate consumption of dealcoholised red wine (DRW) and full complement red wine (RW) on vascular function in postmenopausal women.

Objectives - To elucidate whether chronic consumption of red wine and/or red wine polyphenols improves arterial stiffness and systolic blood pressure in hyperlipidaemic postmenopausal women.

Design - A randomised parallel-arm study where 45 postmenopausal women were asked to consume 400 ml of either water, DRW or RW with their evening meal for 6 weeks, following a 4-week washout. Fasting measures of haemodynamic indices and pulse wave analysis (PWA) were taken before and after intervention. Augmentation index (Alx) and augmentation pressure (AP) were measured by PWA, using SphygmoCor®, which provides an indirect index for arterial stiffness. Systolic blood pressure was measured using an automated sphygmomanometer.

Outcomes - After a six week intervention a reduction in Alx (9%; P<0.05) and in AP (12%; P<0.05) was observed within the DRW group. Systolic blood pressure was significantly improved following 6 weeks of chronic DRW consumption (-8%, P<0.05). Whereas, full complement RW had no effect on vascular function.

Conclusion - In conclusion, chronic consumption of red wine polyphenols improve central and peripheral haemodynamic indices in hyperlipidaemic postmenopausal women. The improvements in arterial stiffness and systolic blood pressure may be potential mechanisms by which polyphenols attenuate CVD risk.
Posters

Caffeine as a flavour additive in soft drinks
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Background - Caffeine is a central nervous stimulant that, when added to a food or beverage, produces physiological and psychological dependence for that food or beverage. Moreover, caffeine is a bitter stimulus that is added to beverages (e.g., cola drinks) as a flavour enhancer or modifier. However, does the concentration of caffeine actually modify flavour in soft drinks? If not, caffeine’s presence is presumably to aid the development of an individual’s physiological and psychological dependence on the soft drink. Such dependence can be considered a consumer health issue, as caffeine is commonly added to high energy dense soft drinks and excessive consumption of soft drinks is one putative cause of diet induced obesity.

Objective - To assess whether caffeine can act as a flavour modifier in soft drinks.

Design - A human psychophysical study investigating taste perception and taste modification.

Outcomes - Thirty subjects (four male, age 23 ± 3) participated in the experiments. Caffeine taste thresholds were determined (1.03 mM ± 0.42SD), and dose response curves (0-72 mM caffeine) for each individual were constructed. The intensities of three sweeteners were matched to the sweetness intensity of Coca Cola (iso-intense concentrations: 204 mM sucrose, 1.5 mM aspartame, 0.421 mM sucralose). A series of triangle tests (n=1530) were performed using the iso-intense sweeteners solutions as a base. Over a number of days subjects were asked to discriminate between the sweet solutions and the sweet solutions with a range of concentrations of caffeine below their detection thresholds (i.e., concentration at which subjects are unable to detect the presence of caffeine in water), including the concentration of caffeine in Coca-Cola. Subjects could easily discriminate the difference between a sweet solution and the sweet solution with sub-threshold concentrations of caffeine (<0.001), even at caffeine concentrations 68% lower than the average detection thresholds in water (0.33 mM ± 0.25SD). A directional paired comparison test revealed the addition of subthreshold caffeine to the iso-intense sweeteners significantly decreased the sweetness of solutions (P <0.001). Caffeine, at the concentration in Coca-Cola (0.67mM), was added to the uncaffeinated diet Coca-Cola and using a triangle test discrimination task, none of the subjects were able to discriminate between the caffeinated and uncaffeinated Coca-Cola samples.

Conclusions - Sub-threshold concentrations of caffeine inhibit sweetness and thereby modify flavour using this simple model. However, when caffeine, at the concentration in Coca-Cola, was added to a complex soft drink matrix it did not modify the flavour. There is no flavour rationale for the addition of caffeine to soft drinks; addition of caffeine to high energy soft drinks will promote an individual’s physiological and psychological dependence on the beverage which may lead to excessive consumption and diet induced obesity.

The addition of glucose to an oral fat load decreases postprandial triglyceride levels; but not chylomicron levels
AP James, JCL Mamo
School of Public Health, Curtin University of Technology, WA 610; ATN Centre for Metabolic Fitness

Background - Impaired postprandial lipid metabolism is now recognised as an independent risk factor for cardiovascular disease. Despite this the factors regulating postprandial lipid metabolism (including chylomicron levels) remain to be determined. A limited number of studies have investigated the effect of the addition of glucose to an oral fat challenge on postprandial triglyceride levels; however the results obtained have been variable. Furthermore the effect on postprandial chylomicron levels is unknown.

Objective - To determine the effect of the addition of glucose to an oral fat challenge on the postprandial concentration of triglyceride and chylomicron particles.

Design - Randomised cross-over design of lean healthy subjects (aged 24.8 ± 2.2 yr (mean ± SEM)) to determine the effect of the addition of glucose (50 g; glucose syrup) to an oral fat load (flavoured milkshake containing 37 g fat) on fasting and postprandial lipid and lipoprotein metabolism. Fasting and postprandial (incremental area under the postprandial curve (corrected for baseline levels)) triglyceride, apo B48 (marker of chylomicron particles), glucose, insulin, NEFA and fasting cholesterol (total, HDL and LDL) were measured.

Outcomes - The addition of glucose to an oral fat load increased postprandial insulin levels. Furthermore the postprandial levels of triglyceride were reduced by 50.4% (P <0.05) following the addition of glucose to the fat load. However postprandial apo B48 levels, were identical following either meal.

Conclusions - The addition of glucose to an oral fat load significantly reduces postprandial triglyceride levels in lean healthy subjects; however chylomicron particle number is not affected. A number of mechanisms may be responsible for the observed reduction in postprandial lipaemia, but they appear to be independent of those affecting chylomicron levels.
Posters

Growth of preterm infants fed high dose docosahexaenoic acid

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Background - Some early trials in preterm infants suggested that formula supplementation with n-3 long-chain polyunsaturated fatty acids (LCPUFA) was associated with poor weight gain and reductions in linear growth, despite improvements in visual function. Although some subsequent trials have shown no effect of supplementation on growth the area remains controversial.

Objective - To determine if preterm infants fed breast milk or formula supplemented with high DHA (1% of total fat w/w) have altered growth when compared with infants fed the standard dose (0.3% w/w of total fat) of DHA.

Design - Infants born at <33 weeks gestation were enrolled in a double-blind randomised controlled trial of DHA supplementation. Enrolments were stratified for gender and birth weight (<1250 g and ≥1250 g). Infants were fed the test diets from enrolment until their due date. Daily weight and weekly length and head circumference measurements were taken during hospitalisation. Growth was measured at discharge, at expected due date (EDD), and at 2 and 4 months corrected age (CA).

Outcomes - Of 143 infants enrolled, 138 were invited to attend follow-up assessment appointments (4 withdrawals and 1 infant died). Mean birth weight was 1278 ± 401 g for females, and 1398 ± 463 g for males. Intention-to-treat comparisons of the control and treatment groups demonstrated no significant differences in weight, length or head circumference at the end of the intervention period or at 4 months CA. Boys demonstrated greater weight gain and linear growth than girls.

Conclusion - Negligible effects of high dose DHA supplementation were found on growth performance of preterm infants.

Quality assessment of canned tuna in brine during storage based on changes in composition of lipids, fatty acids and thiobabuturic acid production

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Background - Fish and fish product are known as a good source of n-3 polyunsaturated fatty acid (PUFA). Canned fish is an important food item, especially for bush walkers, travellers and armed service personnels. However, there is no data on effect of storage length on composition of lipids and fatty acids in canned tuna in brine.

Objective - The aim of the present study was to investigate the effect of storage length on composition of lipids and fatty acids in canned tuna in brine.

Design - Twenty-five canned tuna in brine were obtained from the same batch production, they were supplied by Thai-Ruamsin Co. Ltd., and kept at room temperature until analysis. The lipids were extracted by chloroform-methanol (2:1, v/v) containing 10mg/L of butylatedhydroxytoluene (BHT) and 0.2 mg/mL of tricosanoic acid (23:0) as internal standard. Lipids were separated by Iatroscan TLC/FID, fatty acids and thiobabuturic acid (TBA) were analyzed by standard methods.

Outcomes - The most predominant lipid was phospholipid (PL). Cholesterol ester was stepwise increasing (P<0.05), and triacylglycerol, free fatty acids, sterols and PL were stepwise decreasing with storage time. The concentrations of total PUFA, total n-3 and n-6 PUFA were decreased from 0 to 3 to 6 to 9 and 12 months (P <0.05), DHA, 22:5n-3 and 22:5n-6 started decreasing from 6 months, and 20:5n-3, 20:4n-6 and 22:4n-6 decreasing from 3 months (P <0.05). Decreased DHA and total n-3 PUFA were associated with an increased TBA values.

Conclusions - Based on the present results, we suggest that the canned tuna in brine should not be stored longer than 6 months in respect with decomposition of n-3 PUFA and production of TBA.
Posters

Lipids and fatty acids in edible insects in Thailand
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Background - Some insects have long been consumed in Thailand and they are recognised locally to have beneficial effects for human health, however, there are no data on their lipid and fatty acid content.

Objective - The aim of the present study was to investigate the lipid and fatty acid content in the edible insects in Thailand.

Design - The insects Giant water bug (Lethocerus indicus Lep.-serv, LILS), True water beetle (Cybister limbatus Fabricius, CLF), Water scavenger beetle (Hydrous cavistanum bedel, HCB) and Scarabaeidae (Holotrichia sp, HT) were collected from the local lake, Mahasarakham, Thailand. The lipids were extracted by chloroform-methanol (2:1, v/v). Total lipid content was measured gravimetrically, fatty acids were analysed by gas liquid chromatograph.

Outcomes - Total lipid content of the analyzed insects ranged from 1.8% to 20.1% (g/100g). The table below reports the lipid (g/100g) and fatty acid contents (% of total fatty acid) of analyzed insect samples, Mean ± SD, n=3.

<table>
<thead>
<tr>
<th></th>
<th>Total lipids</th>
<th>Total SFA</th>
<th>18:2n-6</th>
<th>18:3n-3</th>
<th>20:4n-6</th>
<th>20:5n-3</th>
<th>Total PUFA</th>
</tr>
</thead>
<tbody>
<tr>
<td>LILS</td>
<td>20.1±2.7</td>
<td>39.2±1.0</td>
<td>42.4±1.8</td>
<td>9.0±1.5</td>
<td>3.4±0.3</td>
<td>4.1±0.3</td>
<td>1.9±0.7</td>
</tr>
<tr>
<td>CLF</td>
<td>5.8±0.6</td>
<td>37.2±0.6</td>
<td>36.0±2.8</td>
<td>13.3±1.7</td>
<td>6.3±0.5</td>
<td>4.0±0.3</td>
<td>1.6±0.3</td>
</tr>
<tr>
<td>HCB</td>
<td>2.9±0.4</td>
<td>31.2±0.2</td>
<td>34.3±1.3</td>
<td>21.5±1.3</td>
<td>3.1±0.4</td>
<td>7.1±0.2</td>
<td>2.7±0.1</td>
</tr>
<tr>
<td>HT</td>
<td>1.8±0.2</td>
<td>38.3±0.4</td>
<td>34.6±1.8</td>
<td>22.4±1.8</td>
<td>3.1±0.3</td>
<td>1.6±0.2</td>
<td>nd</td>
</tr>
</tbody>
</table>

Conclusions - The present results indicated that the lipid and fatty acid content in the edible insects varied greatly. All analyzed insects contain 18:2n-6, 18:3n-3 and 20:4n-6, and 20:5n-3 except HT.

Alpha-linolenic acid content in edible wild seeds in Thailand
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Background - It has long been known that edible nuts and seeds have beneficial effects on human health due to the content of vitamins, phytochemicals, minerals as well as alpha-linolenic acid (18:3n-3).1

Objective - The aim of the present study was to investigate the lipid content and composition of the edible wild seeds in Thailand.

Design - The edible wild seeds of Red sandalwood (Adenanthera pavonia Linn, APL), Kapok (Boxmbax ceiba Linn, BCL), Passion fruit (Passiflora foetida Linn, PFL) and Bengal almond (Terminalia catappa Linn, TCL) were collected from northeastern Thailand. The lipids were extracted by chloroform-methanol (2:1, v/v). Total lipid content was measured gravimetrically and the fatty acid composition was analyzed by gas liquid chromatography.

Outcomes - Total lipid content of the analyzed edible wild seeds ranged from 19% to 47% (g/100g). The Table below reports the content of lipids (g/100g) and main fatty acids (% of total fatty acid) of analyzed edible wild seeds, Mean ± SD, n=3.

<table>
<thead>
<tr>
<th></th>
<th>Total lipids</th>
<th>18:3n-3</th>
<th>18:2n-6</th>
<th>18:1</th>
<th>Total SFA</th>
<th>Total MUFA</th>
<th>Total PUFA</th>
</tr>
</thead>
<tbody>
<tr>
<td>APL</td>
<td>23.8±1.1</td>
<td>nd</td>
<td>54.6±0.7</td>
<td>16.2±0.1</td>
<td>11.6±0.3</td>
<td>17.1±0.2</td>
<td>71.3±1.0</td>
</tr>
<tr>
<td>BCL</td>
<td>21.1±1.5</td>
<td>1.1±0.0</td>
<td>35.9±1.0</td>
<td>22.4±0.7</td>
<td>34.4±2.3</td>
<td>25.6±1.0</td>
<td>40.0±1.6</td>
</tr>
<tr>
<td>PFL</td>
<td>18.8±0.3</td>
<td>0.4±0.0</td>
<td>71.4±0.4</td>
<td>16.2±0.5</td>
<td>11.8±0.8</td>
<td>16.4±0.5</td>
<td>71.8±0.4</td>
</tr>
<tr>
<td>TCL</td>
<td>47.1±1.7</td>
<td>nd</td>
<td>36.4±1.0</td>
<td>31.1±0.3</td>
<td>32.5±0.7</td>
<td>31.1±0.3</td>
<td>36.4±1.0</td>
</tr>
</tbody>
</table>

Conclusions - The present results indicated that the edible wild seeds were very low in 18:3n-3, and high in 18:2n-6 and total lipid.

References
Posters

**Alpha-linolenic acid content in edible wild vegetables in Thailand**

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**Background** - There are substantial varieties of vegetables in Thailand. These are not just planted, they are also wild, and grow both in water or on land.

**Objective** - The aim of the present study was to investigate the alpha-linolenic acid (18:3n-3) content of the wild vegetables grown in Thailand.

**Design** - Fourteen wild vegetables: Koon (Colocasia giganta Hook. f.), Khayang (Limophila aromatica (Lak.) Merr.), Kratin (Leucaena leucocephala de Wit), Chi farang (Erynginum foetidum Linn), Kare (Sesbania grandiflora (L.) Pers), Kee-lek (Cassia siamea Lamk), Neamhuseu (Coleus amboinicus Lour), Krad (Spilanthes acmella Murr), Bon (Colocasia esclenta Sahott), Phai (Polygonum odoratum Lour), Wan (Melientha suavis picre), Tew Khoaw (Cratoxylum Formosum Dyer), Chi nam (Oenanthe stolonifera) were collected from north-eastern Thailand. The lipids were extracted by chloroform-methanol (2:1, v/v). Total lipid content was measured gravimetrically, fatty acid composition was analysed by gas liquid chromatography.

**Outcomes** - Total lipid content of the analyzed vegetables ranged from 0.14 of Bon to 2.33% (g/100g) of Kwinin. The 18:3n-3 content ranged from 4.9% in Koon up to 47.8% (% total fatty acid) in Kare. The 18:2n-6 content ranged from 13% of Wan to 45% of Bon. Another main fatty acid was 16:0, which ranged from 15.4% of Chi farang to 37.2% of Neamhuseu.

**Conclusions** - The present results indicate that wild Thai vegetables are good sources for 18:3n-3, and that consumption of wild Thai vegetables could contribute to 18:3n-3 intake, especially in vegetarians.

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**Omega-3 PUFA status in type 2 diabetes mellitus patients, a case-control study**

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**Background** - Controlled clinical studies have shown that consumption of n-3 polyunsaturated fatty acids (PUFA) have protective effects on cardiovascular risk factors in patients with type 2 diabetes mellitus (T2DM) without adverse effects on insulin activity and glucose control.

**Objective** - To investigate the plasma phospholipid (PL) n-3 PUFA status in T2DM patients, and age and sex matched healthy controls.

**Design** - Seventy-four T2DM in-patients from 2nd Affiliated Hospital of Medical School, Zhejiang University, and 72 age and sex matched healthy controls from Hangzhou were participated the study. Plasma PL fatty acids were analyzed with capillary gas chromatography. Plasma lipids were measured by enzymatic assay. Homeostasis model assessment (HOMA-IR) was applied to assess the status of insulin resistance (IR).

**Outcomes** - Plasma PL n-3 PUFA in T2DM group (% of total fatty acid) were significantly lower than in healthy control group, however, monounsaturated fatty acid (MUFA) and n-6 PUFA were higher than those of normal control group ($P < 0.05$). Bivariate correlate showed that fasting plasma glucose was negatively correlated with C20:2n-6 ($P < 0.05$), HbA$_1c$ was negatively correlated with 20:2n-6 and 20:3n-6 ($P < 0.05$). HOMA-IR was significantly positively correlated with C16:0, BMI, serum total cholesterol, triacylglycerol and LDL-cholesterol, and negatively correlated with HDL-C ($P < 0.05$).

**Conclusions** - T2DM in-patients had a lower plasma PL n-3 PUFA levels compared with sex and age matched healthy control group.

**References**

Posters

**Lipid content and composition in Chinese *Mytilus galloprovincialis* with seasonal variations**

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**Background** - Mussels are widely distributed in China, especially the black mussel (*Mytilus galloprovincialis*) which has been consumed for thousands of years.

**Objective** - The aim of this study was to analyze the lipid content and composition of Chinese black mussels collected in four different seasons.

**Design** - Chinese black mussels, collected in different seasons, were supplied by Dept of Science and Technology, Shensi County, Zhejiang, China. The lipids were extracted from freeze-dried mussels using chloroform-methanol (2:1, v/v) containing 10mg/L of butylatedhydroxytoluene (BHT). Lipids were separated by Iatroscan TLC/FID, and were identified and the composition calculated by comparison with standard mixtures of lipids (Nu-Chek-Prep, Elysian, MN, USA).

**Outcomes** - Lipid content (g/100g dried powder) and composition (% of total lipid) are reported in the Table, as mean ± SD, n=3.

<table>
<thead>
<tr>
<th></th>
<th>Total Lipid</th>
<th>Cholesterol esters</th>
<th>Triacylglycerol</th>
<th>Free fatty acids</th>
<th>Sterols</th>
<th>Phospholipid</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spring</strong></td>
<td>14.49±0.78</td>
<td>8.23±0.98</td>
<td>44.68±1.81</td>
<td>2.53±0.27</td>
<td>4.34±0.40</td>
<td>40.22±1.54</td>
</tr>
<tr>
<td><strong>Summer</strong></td>
<td>8.39±0.59</td>
<td>6.49±0.12</td>
<td>33.59±1.08</td>
<td>3.58±0.10</td>
<td>8.56±0.31</td>
<td>47.78±1.19</td>
</tr>
<tr>
<td><strong>Autumn</strong></td>
<td>7.85±1.08</td>
<td>10.32±0.10</td>
<td>24.59±0.57</td>
<td>2.62±0.22</td>
<td>8.97±0.22</td>
<td>53.50±0.63</td>
</tr>
<tr>
<td><strong>Winter</strong></td>
<td>9.26±1.07</td>
<td>20.46±0.26</td>
<td>18.46±0.51</td>
<td>2.58±0.06</td>
<td>6.63±0.57</td>
<td>51.87±0.95</td>
</tr>
</tbody>
</table>

**Conclusions** - Present results showed that total lipid content was higher in spring than in other seasons, triacylglycerol was stepwise decreased from spring to summer to autumn to winter. The proportion of other lipids was also subject to seasonal variations.

**Omega-3 fatty acids in Chinese turtles with seasonal variations**

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²Dept of Food Science and Nutrition, Zhejiang University, China, 310029

**Background** - Turtle is considered to be a precious sea/aquatic medicinal food for more than 3000 years in China. Turtle is an easily cultured shellfish, it is a fast-growing fishery in China.

**Objective** - The aim of the present study was to determine the content of n-3 PUFA in different species of turtles in spring, autumn and winter (there was no turtle sample available in summer, since turtle is considered as a hot food in Chinese medicine, and it is not suitable for consumption in summer).

**Design** - Qingxi turtle and Trionyx sinensis were purchased from different supermarkets in May, September and December in Hangzhou, Zhejiang, China. The lipid was extracted by chloroform-methanol (2:1, v/v) containing 10mg/L of butylatedhydroxytoluene (BHT). Fatty acids were analyzed by gas liquid chromatograph.

**Outcomes** - Lipid content (g/100g) and fatty acid compositions (% of total fatty acid) are reported in the Table.

<table>
<thead>
<tr>
<th></th>
<th>Qingxi turtle</th>
<th>Trionyx sinensis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spring Autumn</td>
<td>Winter Spring</td>
</tr>
<tr>
<td><strong>Total lipid</strong></td>
<td>1.0±0.1</td>
<td>0.7±0.1</td>
</tr>
<tr>
<td>18:3n-3</td>
<td>2.2±2.8</td>
<td>1.4±0.3</td>
</tr>
<tr>
<td>20:5n-3</td>
<td>8.6±6.7</td>
<td>14.2±6.2</td>
</tr>
<tr>
<td>22:5n-3</td>
<td>2.2±1.1</td>
<td>3.0±1.4</td>
</tr>
<tr>
<td>22:6n-3</td>
<td>8.9±5.4</td>
<td>14.6±7.0</td>
</tr>
<tr>
<td><strong>Total n-3</strong></td>
<td>22.0±11.3</td>
<td>33.2±12.6</td>
</tr>
</tbody>
</table>

**Conclusions** - Chinese turtles are good alternative source of dietary n-3 PUFA, especially 22:6n-3 and 20:5n-3. The total lipid content and n-3 PUFA composition were subject to seasonal variation.
Posters

Calcium bioavailability from dairy and non-dairy sources: possible suppression by paracetamol (Acetaminophen)
NK Cummings, MJ Soares
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**Background** - Dietary calcium is now being linked to the control of adiposity. We have previously shown that a high dairy breakfast meal resulted in a greater postprandial fat oxidation. It was important to establish whether a greater calcium bioavailability was the key to this finding.

**Objective** - To determine the bioavailability of 3 test meals, using 3 standard approaches: serum ionised calcium (iCa) (Method 1), intact parathyroid hormone (iPTH) suppression (Method 2) and urinary excretion of calcium (UC) (Method 3).

**Design** - 16 subjects (6 F, 10 M), (mean ± SEM, age 54.1 ± 1.7 yr, BMI 33.5 ± 1.0 kg/m²) participated in a randomised, single blind, 3-way crossover design over 6 h. Subjects were provided a low calcium-low vitamin D meal (LD), a high dairy calcium-high vitamin D meal (high dairy, HD) and a high calcium (calcium citrate) meal with orange juice (high calcium, HC). 8 of these subjects co-ingested 1000 mg Paracetamol with every meal, as a marker of gastric emptying. Data was expressed as percent change from baseline, and analysed as a repeated measures ANOVA with the use of paracetamol as a between-subject factor.

**Outcomes** - Gastric emptying was similar between meals. Methods 2 (P=0.009) and 3 (P=0.02), but not Method 1 (iCa), detected a significant difference between the 3 test meals. However, the rank order of effects was similar across all the 3 methods with LD<HD<HC (iCa 1.4 ± 3.3, 3.6 ± 6.0, 9.6 ± 4.2 %; iPTH 52.9 ± 29.8, 6.4 ± 40.6,-70.5 ± 37.2 %; urinary calcium 58.5 ± 25.7, 154.1 ± 74.8, 243.8 ± 73.8 %). There was no significant effect of paracetamol, nor a diet x paracetamol interaction. However, a consistent trend with all 3 methods suggested that co-administration of paracetamol may have suppressed calcium bioavailability.

**Conclusions** - Bioavailability of non-dairy calcium was better relative to dairy calcium. This may indicate the involvement of other bioactive components in dairy which influence fat oxidation. Paracetamol may interfere with calcium bioavailability.

**Acknowledgement** - Funded by Dairy Australia.

Postprandial lipid metabolism and insulin sensitivity following sequential meals: effect of dairy calcium and vitamin D
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School of Public Health, Curtin University of Technology, WA 6102

**Background** - Insulin sensitivity varies within the day in relation to meal composition, and influences substrate utilization accordingly. It is lower following a second meal, with a rapid release of chylomicrons into circulation. A high calcium, high vitamin D breakfast increased fat oxidation and thermogenesis following lunch.

**Objectives** - (1) To document the effect of sequential meal ingestion on insulin sensitivity, triacylglycerol (TG) and chylomicron concentrations and, (2) to examine whether higher calcium and vitamin D at breakfast modified the response to lunch.

**Design** - Eight subjects (mean ± SEM, age 55.5 ± 1.2 yr and BMI 28.9 ± 1.6 kg/m²) participated in a single blind within-subject study. Subjects were randomised to high dairy calcium, high vitamin D breakfast (HCB) or low dairy calcium, low vitamin D breakfast (LCB). The same very low calcium standard lunch (SL) was ingested four hours after each breakfast. Glucose, insulin, TG and apolipoprotein B₄₈ were measured at baseline and on the hour for eight hours. HOMA-R was calculated for each time point. Postprandial responses were calculated as % change from fasting values (Δ). A 2x2 repeated measures design, for diet effects (HCB+SL vs. LCB+SL), meal effects (breakfast vs. lunch) and diet x meal interaction was used for statistical purposes.

**Outcomes** - The change in glucose, insulin and HOMA-R scores were significantly higher after lunch compared to breakfast (P <0.05). There was no statistical difference in ΔTGs between diets, but a doubling of the breakfast response was observed after lunch. ΔapoB₄₈ was significantly higher after lunch compared to breakfast (P <0.05). The TG:apoB₄₈ ratio was similar between meals, but overall was 50% lower following the HCB+SL diet.

**Conclusions** - The study confirmed that greater TG and chylomicron concentrations accompanied the deterioration of insulin sensitivity after lunch. Calcium and vitamin D intake at breakfast may affect chylomicron size by modulating the amount of TG within the particle.

**Acknowledgement** – This study was funded by Dairy Australia.
Intra-individual variations in energy metabolism of free living overweight and obese individuals: significant effects despite weight stability

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Health Surveillance and Evaluation Section, Department of Human Services, VIC 3000

Background - Measurements of energy expenditure and substrate utilization are essential to understanding the metabolic basis of obesity, and the physiological responses to perturbations in habitual food intake.

Objective - To document the intra-individual variation to a high calcium mixed test meal in older obese.

Design - Eight free living subjects (five females and three males; mean ± SEM, age 57.6 ± 0.83 yr, & BMI 31.86 ± 2.12 kg/m²) had resting (1 hr) and postprandial responses (5 hr) to the same test meal measured on two occasions 19.4 ± 0.2 weeks apart. Resting metabolic rates (RMR), postprandial energy expenditure (PPEE), fat oxidation rates (FOR) and carbohydrate oxidation rates (COR) were assessed. Two reliable DEXA models (1) were used to track body composition (visit 1:DPX-IQ, visit 2:Prodigy). Data was analysed using paired t tests and one-way ANOVA with covariates.

Outcomes - Despite stability of weight and waist circumference, there was a significant decrease in FM (39.8 ± 3.14 vs. 36.9 ± 2.90 kg, P = 0.017) and an increase in FFM (53.4 ± 5.53 vs. 57.1 ± 5.69 kg, P = 0.003). These effects were beyond expected differences between models.1 RMR and basal COR were not different between visits, unadjusted or adjusted for FFM and FM. In contrast, both unadjusted (P=0.009) and adjusted basal FOR was significantly different (P=0.013). Intra-individual variations (partial eta²) accounted for 41.0% of total variance in FOR. Postprandial COR and FOR adjusted for basal values, were not different between visits. However, postprandial energy expenditure adjusted for RMR, was different between visits (P=0.05), with intra-individual variations accounting for 26.5% of the total variation in PPEE.

Conclusions - In this study, weight stability was not synonymous with stability of energy metabolism.

Acknowledgement - The ATN Centre for Metabolic Fitness funded the study.

References

Depletion and recovery of docosahexaenoic acid are region-specific in rat brain

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Background - Docosahexaenoic acid (DHA) is the most abundant fatty acid in brain and retina. Depletion of DHA in brain has been associated with a loss in nervous system function in experimental animals as well as in human infants fed vegetable oil-based formulas. Since the different regions of brain have the special biological functions, any change in the composition of fatty acids is likely to influence the cellular function, which in turn may cause certain neural deficiencies.

Objective - To examine whether alpha-linolenic acid deficiency induces regional depletion and recovery of DHA in rat brain.

Design - DHA depletion was induced by feeding rats with a n-3 fatty acid deficient diet for two generations. The F2 n-3 deficient rats at weeks 5 were switched to the n-3 adequate diet for 12 weeks. The rat brain was dissected into 7 parts, namely cerebellum, medulla oblongata, hypothalamus, striatum, hippocampus, cortex and midbrain. The fatty acid composition of the different regions in rat brain at various time points was analyzed using gas-liquid chromatography.

Outcomes - DHA was not proportionally depleted in various regions of brain when the rats were maintained on an n-3 deficient diet for two generations. The results demonstrated that cortex, hippocampus, striatum, cerebellum and hypothalamus had DHA depleted by >71%, whereas midbrain and medulla had only 64% and 57% DHA depleted, respectively. The most important observation was that the diet reversal for 12 weeks had DHA recovered completely in all regions except for medulla where the recovery was only 62%.

Conclusion - Location of DHA, n-3 deficiency-induced DHA depletion and reversibility of DHA deficiency across the brain were region-specific.
Posters

Possible developmental and reproductive toxicity of isoflavones in soybean and Kudzu root
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Background - Numbers of researches over the last decades have suggested protective effects of soybean compounds against some chronic diseases, the root of Kudzu had been used to treat coronary heart disease, heart failure, and hypertension in Asian countries. It is found that the major effective component of the two plants is isoflavones, which possess both estrogenic and anti-estrogenic activity. However, a number of side effects have been also postulated, as well as mechanisms by which such effects may be mediated.

Objective - To investigate the possible developmental and reproductive toxicity of isoflavones in soybean and the root of Kudzu.

Design - SD rats (4 weeks of age) were used as an animal model to study the potential developmental and reproductive toxicity of isoflavones to immature animals. Both male and female rats were gastrogavaged daily with different doses of isoflavone extracts from soybean and kudzu root (30, 150, 300, and 600 mg/kg body weight), respectively, for three months.

Outcome - Feeding for 3 months led to reduced body weight gain compared with the control group in both genders with dose-related relationship. Administration of soybean and kudzu root isoflavones also caused an increased relative weight of main reproductive organs in both genders. The two kinds of isoflavones could decrease both estradiol and progesterone concentrations statistically in female rats with the increasing dosage. For soybean isoflavones, both estradiol and progesterone levels in high dose group (600 mg/kg body weight) would be reduced by 72% and 45%, respectively, compared with the controls. Male rats had not only total testosterone levels but also sperm count significantly decreased by 64% and 50%, respectively, in high dose group compared with the control group administered with the soybean isoflavones.

Conclusions - High dose of isoflavones affected not only growth but also development of reproductive system at least in rats.

Resting and postprandial substrate utilisation following high protein and high carbohydrate weight maintenance diets: interactive effects of diet and insulin resistance
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Background - The effects of weight loss per se, as well as insulin sensitivity, may confound adaptive changes in energy metabolism to manipulation of macronutrient intake.

Objective - We examined the changes in energy metabolism during high protein and high carbohydrate weight maintenance diets, and assessed the role of insulin sensitivity in these effects.

Design - 19 lean to obese subjects (11 men, 8 women) completed a double stranded, 6-week weight maintenance trial. Subjects were randomised to receive either a low protein (12%)-high carbohydrate (53%) diet (HC), or a high protein (25%)-low carbohydrate (40%) diet (HP). Resting energy expenditure (REE), postprandial thermogenesis (PPT), fat oxidation rate (FOR), and carbohydrate oxidation rate (COR) were measured before and after each arm of the study. Based on HOMA-R at entry, Group 0: <1.68 & Group 1: ≥ 1.68 were generated. Within-subject modelling, with adjustment for covariates, determined statistical significance at the 5% level.

Outcomes - The subjects randomised to the HP diet were significantly older by 14 yr, but there was no difference in the change in weight or body composition. Change in quantitative insulin check index (QUICKI) adjusted for age, mean fat free mass (FFM) and fat mass (FM), was significantly different between diets with a significant diet x group interaction. In the fasting state there was no difference between diets in the change of adjusted REE, FOR or COR. There was however a significant diet x group interaction in both adjusted FOR and COR. Postprandial metabolism adjusted for basal values, was not different between diets. A significant diet x group interaction was however observed for postprandial COR. The latter indicated that the HC diet stimulated COR in Group 0 relative to Group 1, while the HP diet did the reverse.

Conclusions - Insulin sensitivity, as judged by QUICKI, varied as a function of the macronutrient composition of the diet and insulin resistance status during stability of body composition. This diet x phenotype interaction was also present in changes to basal and postprandial substrate oxidation.

Acknowledgement – The ATN Centre for Metabolic Fitness and Meat and Livestock Association.
Posters

Polyphenols and health: using cell-based assays to aid in the development of new functional foods

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Background - There is increasing consumer interest in health benefits of food. Phenolic phytochemicals are abundant micronutrients in fruit and vegetables and evidence of their health benefits is emerging.

Objective - To use cell-based assays to measure biological activity such as anti-inflammatory activity and protection from oxidative stress induced damage of fruit extracts as screens for possible health effects.

Design - Anti-inflammatory activity of four apple extracts (A, B, C and D) was measured by the inhibition of an inflammatory mediator (TNF-α) from LPS-stimulated macrophage cell line (RAW 267.4). Apoptosis or protection from hydrogen peroxide induced apoptosis of human T cells (Jurkat) after treatment with these extracts was evaluated. The phenolics composition of these apple extracts was obtained by HPLC analysis.

Outcome - Results demonstrated that the four extracts inhibit TNF-α production of LPS-stimulated macrophages at certain concentrations. The level of inhibition varies with each extract. The extent of the activity differed with the phenolic composition of the extracts.

<table>
<thead>
<tr>
<th>Extracts concentration</th>
<th>0µM</th>
<th>31µM</th>
<th>500µM</th>
<th>1000µM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cells alone</td>
<td>11±1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cells+ LPS</td>
<td>2883±45</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cells+ LPS+ extract A</td>
<td></td>
<td>3227±155</td>
<td>2964±13</td>
<td>258±13</td>
</tr>
<tr>
<td>Cells+ LPS+ extract B</td>
<td></td>
<td>1719±101</td>
<td>3258±34</td>
<td>2049±92</td>
</tr>
<tr>
<td>Cells+ LPS+ extract C</td>
<td></td>
<td>2420±29</td>
<td>3342±154</td>
<td>2304±34</td>
</tr>
<tr>
<td>Cells+ LPS+ extract D</td>
<td></td>
<td>2054±46</td>
<td>3132±10</td>
<td>2965±10</td>
</tr>
</tbody>
</table>

1 Mean ±STD, TNF-α concentrations measured in ng/ml, extracts+ unstimulated cells were the same as cells alone.

All four apple extracts showed different levels of protection against hydrogen peroxide induced apoptosis in a dose-dependent manner (0-10 µM).

Conclusion - Cell based-assays can provide preliminary evidence for the health benefits of phytochemicals and help to establish which components are present in fruit and vegetables extracts are best for preventative nutrition.

A multidisciplinary approach to weight management

BJ Morton

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Background - Obesity is a growing problem in Australia, in the year 2000, 67% adult males and 52% adult females were either overweight or obese. A weight loss of 5-10% body weight can result in significant health benefits.1 Successful long term weight loss programs include behavioural strategies, eating diet low in fat, frequent self monitoring of body weight and food intake and high physical activity.2 These strategies formed the basis of The Healthy Weight Management Program at Ballarat Health Services for overweight people for overweight and obese people with chronic health conditions.

Objective - To treat overweight and obese patients who have two or more co morbidities, with a multidisciplinary group program.

Design - A 12 month program was offered with an initial phase being a 6 week course covering diet, lifestyle and behavioural change and exercise. It was presented by a dietitian, psychologist and exercise therapist. The weekly program lasted 2½ hours with 1 hour spent in a gym program suited to individuals needs. Patients were expected to keep a food and activity diary during the 6 week period. The group was then followed up at week 10, 16, 26, and 52 where a review of diet, exercise and motivation took place as well as measurements.

Outcomes - The average weight loss over the 12 month period was 3.2kg which was 3.3 % of initial body weight. During the first 6 months the average weight loss was 4.9kg, which is 5.25% of initial body weight.

Conclusion - To achieve further weight loss or maintenance of weight loss in the last 6 months of the program more regular follow up and support is required. Benefits of the multidisciplinary approach included the establishment of regular activity in people who were initially unable to exercise, a feeling of increased self esteem and control over body weight. The program continues as the primary method of weight management at Ballarat Health Services.

References
1. NHMRC. Clinical practice guidelines for the management of overweight and obesity in adults. September 2003
Posters

Comparison of three ‘non-dieting’ interventions for overweight women: A randomised trial
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Background - The lack of long-term success of traditional treatments for obesity has been the impetus for the development of novel treatments. ‘Non-dieting’ programmes aim to encourage eating in response to hunger and satiety. Intensive training in the relaxation response may enhance the success of non-dieting interventions.

Objectives - To evaluate and compare the effectiveness of three non-dieting interventions in maintaining improvements in lifestyle habits, health and well being at 12-months and 2-years.

Design - A randomised trial of three non-dieting interventions, in 225 obese/overweight women (BMI ≥ 28; age 25-68 years) at high cardiovascular risk. Two group programmes, one with a focus on training in the relaxation response (P1) and one without (P2), were compared to a self-guided mail-delivered programme. All three interventions involved an initial 10-week programme, followed by eight months of fortnightly/monthly intervention.

Outcomes - At 12-months, P1 produced the greatest improvements in stress management behaviours, depression, intuitive eating, medical symptoms and self-efficacy for low-fat eating. All three programs resulted in significant reductions in psychological distress and medical symptoms (P <0.05); and significant improvements in eating self-efficacy and health-promoting lifestyle behaviours (P <0.01). At 12-months, mean weight was unchanged. 107 women have completed the 2-year follow-up, and the long-term impact of the three interventions will be presented.

Conclusions - Over 12-months, all three non-dieting interventions enhanced psychological wellbeing and lifestyle habits for overweight/obese women. However, inclusion of intensive relaxation response training in P1 resulted in greater improvements in several measures.

Zeolite and the efficiency of urea utilisation by sheep fed a low-quality forage
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Background - Ruminants are often fed supplementary urea to improve their N status when grazing low-quality forages. The efficiency of urea-N use is limited by its rapid hydrolysis to NH₃ and subsequent loss from the rumen. Zeolite traps NH₃ in vitro and may also act in vivo to delay NH₃-N loss from the rumen. This experiment investigated the effect of zeolite on the utilisation of urea-N provided as a supplement to sheep eating a low-quality forage.

Design - Fourteen Merino cross wethers were used in an experiment in which in the first period (the covariate period) all sheep were fed ad lib a basal diet consisting of barley straw plus 2% molasses, followed by a second period (the experimental period) in which seven sheep were given the basal diet plus 1% urea and the other seven were given the basal diet plus 1% urea plus 5% zeolite (Supersorb Environmental NL, Albany, WA).

Outcomes - Urea increased (non-significantly) dry matter (DM) intakes from 757 ± 51.9 to 799 ± 57.1 g DM/day (mean ± standard error; P = 0.33). DM and N digestibilities were 55.7 ± 1.24 and 50.6 ± 1.77% respectively in the covariate period, and 52.5 ± 2.44 and 62.6 ± 2.56% in the experimental period (DM digestibility, P =0.074; N digestibility, P <0.0001). Addition of zeolite did not further increase DM intakes or affect the digestibility of DM or N. Rumen NH₃ concentrations measured 4 hours after feeding were significantly (P=0.005) increased by zeolite, from 4.83 ± 0.453 to 7.30 ± 0.548 mg/100ml. There was a numerical increase in the efficiency of microbial protein synthesis from 288 ± 16.1 to 325 ± 45.4 g MCP/kg digestible DM. This increase was not statistically significant (P = 0.461) because of an increased variability in the MCP response of the sheep fed zeolite.

Conclusions - The rumen NH₃ data suggest that zeolite may potentially improve urea-N utilization. Work is needed on appropriate zeolite delivery methods and the possible role of Na⁺ in releasing NH₃ from the zeolite lattice.
Posters

Stability of (-)-epigallocatechin gallate (EGCG) in a strawberry sorbet
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Background - Epigallocatechin gallate (EGCG) is suggested to be the active constituent of green tea involved in reducing the risk of cardiovascular disease and cancer. However, EGCG is unstable at high temperature and at neutral or alkaline pH and it may therefore be unsuitable as an ingredient in functional food products. Strawberry sorbet is one of the lowest pH food products (pH < 4), it does not need any heat treatment and is stored frozen.

Objective - The purpose was to test the stability of EGCG in a strawberry sorbet immediately after the sorbet was made and during storage in order to determine the feasibility of making a functional food containing EGCG.

Design - Three batches of strawberry sorbets with 0.15% and 0.30% (w/w) EGCG were made and the pH measured. The EGCG was then measured by high pressure liquid chromatography (HPLC) immediately after the sorbets were made and after storage at -18°C for 4, 8 and 12 weeks and the results were expressed as mean ± standard deviation.

Outcomes - Immediately after the sorbets were made 95% and 92% of the added EGCG was measured in the 0.15% and 0.30% (w/w) EGCG sorbets, respectively. After storage at -18°C for up to 12 weeks, the lowest recoveries represented 81% and 90% of the added EGCG from the 0.15% and 0.30% (w/w) EGCG sorbets, respectively. The pH of the sorbets ranged from 3.45 to 3.59.

<table>
<thead>
<tr>
<th>Added</th>
<th>Just Made</th>
<th>4 weeks at -18°C</th>
<th>8 weeks at -18°C</th>
<th>12 weeks at -18°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>EGCG % (w/w)</td>
<td>0.150</td>
<td>0.142 ± 0.010</td>
<td>0.123 ± 0.001</td>
<td>0.122 ± 0.003</td>
</tr>
<tr>
<td>EGCG % (w/w)</td>
<td>0.300</td>
<td>0.276 ± 0.002</td>
<td>0.271 ± 0.005</td>
<td>0.274 ± 0.003</td>
</tr>
</tbody>
</table>

Conclusion - The EGCG was stable in the strawberry sorbet, especially at the highest concentration of 0.30% (w/w). This is likely to be because the sorbets had a low pH, no heat treatment was involved in making them and they were stored frozen at -18°C. Strawberry sorbet may therefore be useful for making a functional food containing EGCG.

Effect of dietary sialic acid supplementation on gene expression of polysialyltransferase ST8Sia IV in piglets
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Background - Sialic acid (Sia) is the building block of polysialic acid (PSA) and a quantitatively important component of human milk and brain ganglioside and glycoprotein. Polysialyltransferase ST8Sia IV (PST) is a key enzyme controlling the expression of PSA during neural development.

Objective - To examine the effect of dietary Sia supplementation on gene expression of PST in 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 of Sia for 5 wks: 140 mg/L (control), 300 mg/L (group 2), 635 mg/L (group 3) and 830 mg/L (group 4). Quantitative analysis of PST 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:

\[
\text{Ratio} = \frac{(E_{\text{target}})^{\Delta C(T,M) \text{Control} - \Delta C(T,M) \text{Sample}}}{(E_{\text{reference}})^{\Delta C(T,M) \text{Control} - \Delta C(T,M) \text{Sample}}}
\]

Outcomes - The supplemented groups had higher mRNA levels of PST gene in the hippocampus with a significant dose-response relationship (P = 0.002). The relative mRNA level in the hippocampus of group 3 and 4 was 2 and 2.4-fold higher than that of the control group (P = 0.01 & 0.003) and group 2 (P = 0.01 & 0.003). In frontal cortex, group 4 was about 1.4 - fold higher than that of the control, however the results did not reach statistical significance (P >0.05). The PST mRNA level of brain frontal cortex and hippocampus was significantly higher than those of the liver (P = 0.001).

Conclusion - PST mRNA levels responded to dietary supplementation of Sia in piglets. The high level of PST mRNA might contribute to the high Sia incorporation into the brain. Dietary Sia may be important for optimal brain growth and development.
Posters

Binge eating disorder: prevalence and correlates in sub-groups of the Australian population
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Background - Binge Eating Disorder (BED) occurs infrequently in the general population, but is relatively common amongst obese treatment seekers. Given its positive association with adiposity, investigation into factors that predict binge eating across a broad community spectrum is warranted.

Objective - To investigate the prevalence of BED within sub-groups of the Australian population, and explore any association between body weight, eating and exercise behaviours, psychological status and quality of life.

Design - In this cross-sectional cohort study, data were collected on eating behaviours, symptoms of depression, dietary intake, activity levels, QoL and body image via a series of self-report questionnaires. Preliminary data on binge eating behaviours and symptoms of depression for the first 260 respondents (58%) are presented here (planned n=450). Study populations include 1) individuals in the general community (n=101, 22M, 78F, mean age 42.5 ± 14.4 yr), 2) individuals seeking behavioural weight loss treatments (n=68, 2M, 66F, mean age 54.1 ± 13.4 yr), and 3) individuals seeking obesity surgery (n=91, 21M, 70F, mean age 44.3 ± 11.6 yr). Chi squared analysis, one-way ANOVA, and binary logistic, and linear regression were performed using SPSS version 12.

Outcomes - Binge eating frequency and mean group BMI are tabled below. Both BMI (P=0.017) and elevated depression score (P<0.001) show significant independent predictive effects on binge eating. Individuals with high depression scores were more likely to have a high BMI (P<0.001), be female (P<0.001), and binge eat (P=0.007).

<table>
<thead>
<tr>
<th>BMI (kg/m²)</th>
<th>General community</th>
<th>Obese Rx seekers</th>
<th>Surgery candidates</th>
<th>BMI (kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=97 (96%)</td>
<td>n=57 (83.8%)</td>
<td>n=59 (64.2%)</td>
<td></td>
</tr>
<tr>
<td>Sub BED</td>
<td>n=4 (4%)</td>
<td>n=7 (10.3%)</td>
<td>n=9 (9.9%)</td>
<td></td>
</tr>
<tr>
<td>Full BED</td>
<td>n=0 (0%)*</td>
<td>n=4 (5.9%)*</td>
<td>n=23 (25.3%)*</td>
<td></td>
</tr>
<tr>
<td>All binge eaters</td>
<td>n=4 (4%)*</td>
<td>n=11 (16.2%)*</td>
<td>n=32 (35.2%)*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>31.8 ± 10.1</td>
<td>40.4 ± 11.7</td>
<td>43.9 ± 8.1</td>
<td>42.5 ± 9.8</td>
</tr>
</tbody>
</table>

Statistical analysis using Chi-squared. *All results statistically significant at P < 0.001; BMI, mean ± SD; Statistical analysis using One-way ANOVA.

Conclusion – Across all groups, a positive association exists between obesity, binge eating and depression. The interconnected nature of this relationship requires elucidation.

Frontal cortex sialyltransferase activity during learning and sialic acid supplementation in piglets
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Background - Sialic acids (Sias) are found in large amounts in the brain and human milk. Sia supplemented rodents exhibit increased memory recall in Y-mazes with corresponding Sia content in the brain. To determine if sialyltransferase activity is influenced by learning and Sia supplementation in frontal cortex samples.

Design - Three-day-old male piglets were randomly allocated to one of four groups fed milk supplemented with a protein-bound form of Sia (estimate) for five wks: 77 mg/L (group 1, control), 250 mg/L (group 2), 600 mg/L (group 3) and 842 mg/L (group 4). Between 23 and 35 days of age, learning and memory were assessed using an eight-arm radial maze. On day 35 the piglets were euthanased and sialyltransferase activity in frontal cortex (n=50) were analysed using a rapid radioactive assay. The supplemented groups learned the visual cue significantly faster than the control groups for the easy (P = 0.0014) and difficult task (P = 0.0177). There were no significant differences in sialyltransferase activity between the groups. There was a significant positive correlation between sialyltransferase activity and learning performance in the easy task, which occurred one week prior to sacrifice (r = .368, P = 0.0009), with a stronger correlation for group 4 piglets alone (r = .590, P = 0.043).

Conclusion - The degree of sialylation in the frontal cortex may be influenced by prior learning events, as noted during long-term memory formation, which occurs in a progressive manner. This was observed prominently in piglets fed high doses of Sia.
Posters

Grains composition and nutrition online database
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Background - Data on the nutrient content and composition of grains, relevant to human nutrition, are scattered throughout the literature or in some cases may not exist at all. In other cases data may be found in databases compiled specifically for feed grain purposes and information that is relevant to human nutrition is difficult to identify. Scientists in this field do not have information integrated into an efficient/well authenticated web-based system and lack of accessibility significantly reduces the value of the publicly available information.\textsuperscript{1}

Objectives - To compile, from public resources, a database profiling the composition and nutrient content of cereal grains and pulses for application to food production for human consumption. An essential part of this GrainFoods Cooperative Research Centre funded project is the presentation of the database in a “user-friendly” searchable interface that enables efficient web-based access to information and incorporates visualisation and analytic tools. In addition, the project will identify ‘gaps’ in the data and where the addition of information on grains, pulses or specific nutrients needs to be generated.

Design - An initial prototype database was established using information from a pilot study. Subsequently new prototype databases were generated with data sourced from a wide range of literature and datasets compiled in various formats. Archival information was scanned and edited for the electronic database. Tables of data were identified, critical summaries included and statistical analyses verified. A dictionary and language has been established for the database to allow meaningful queries and answers to be developed by industry users. A particular focus is to ensure the origins and descriptions of the data in the database are well defined. Prototype databases and interrogation systems are currently regularly updated and available for industry colleagues to test, criticise and send-back for revision.

Outcomes - A secure, web-based, fully searchable grains nutrition database has been developed. It has a web-based upload facility, End-note based referencing system and graphical visualisation of nutrient/composition data.

Conclusion - The database allows immediate access to up-to-date nutrient data on grains and provides the ability to share confidential data in a secure environment.

References

A sensitive and selective method for quantification of natural folates in foods using electrospray tandem MS
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\textsuperscript{1}Food Science and Technology, School of Chemical Engineering and Industrial Chemistry, University of New South Wales, Sydney 2052, Australia; 
\textsuperscript{2}Bioanalytical Mass Spectrometry Facility, University of New South Wales, Sydney 2052, Australia

Background - In the present scenario of folate fortification there is an underestimation of the amounts actually present in foods and declared on labels, due to the lack of a robust analytical method to distinguish between the added and natural forms of folates. This is vital when the public derives its folate not only from the synthetic folic acid but also from the natural forms present in food as they have been proven to differ in stability and bioavailability.

Objective - The project aim was to develop and optimise a sensitive and robust method for quantifying folate vitamers in foods using electrospray ionization tandem MS and to evaluate MS compatible clean up procedures currently used in the purification of food samples.

Design - Liquid chromatography-tandem mass spectrometry (LC-MS/MS) was used as a sensitive and specific analytical tool capable of discriminating between the different vitamers and quantifying them accurately. LC was performed on a C18 reverse phase column with a binary gradient of aqueous formic acid and acetonitrile. The LC was interfaced to an ion trap mass spectrometer using positive mode electrospray ionisation. Folate vitamers are recognised by their individual m/z values, or specific fragment ions when using tandem mass spectrometry. Quantification of folates was performed using external and internal standards.

Outcome - Separation and identification of folate vitamers using a fast LC-MS method and confirmation on the specificity using Selected Reaction Monitoring (SRM) on MS/MS mode which identifies structurally diagnostic unique fragments were achieved. Ongoing validation of this method using commercially available folate standards and SPE-SAX purification, which has been proven effective for folate standards, helped to protect the mass spectrometer from the buffer ions which might otherwise contaminate the instrument and cause signal suppression. It was also found that ascorbic acid used as the main anti-oxidant in the sodium acetate buffer as the eluting solution, was capable of being fragmented and it interfered with the peak resolution. This is a major finding as ascorbic acid is the most commonly used anti-oxidant for folate analysis.

Conclusion - LC-MS/MS successfully separated and quantified folates in food samples.
Posters

A novel method of measuring gas exchange in ruminant animals
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Background - Techniques for measuring gas exchange in ruminant animals have usually required elaborate chambers in which animals stay for extended periods. Drawbacks to using chambers are that they do not allow the measurement of acute changes in respiration caused by experimental intervention. We investigated PowerLab exercise physiology system (ADinstruments Pty Ltd, Sydney) with modifications for use in sheep to measure acute, real time measurements of gas exchange in sheep fed different nutritional planes.

Objectives - To establish if PowerLab exercise physiology system was suitable for measuring gas exchange in sheep and to determine the effects of plane of nutrition on oxygen consumption.

Design - Three merino lambs (28.8 ± 0.8 kg) and three cross bred lambs (30.2 ± 1.0kg) were allocated to a 72 h fast, maintenance or ad libitum diet, in a 2x3x3 (breed, treatment, time) Latin square design. Gas exchange was taken at 0700, 0800, (animals fed at 0900, no measurement) 1000, 1100, 1200, 1400, 1600, 2000, 0100 and 0600 h, for a period of 15min. Heart rate and core temperature were also measured at these times. Respiration gases were collected in a mixing chamber and sampled continuously for carbon dioxide and oxygen concentration; expired minute volumes were measured using a spirometer. Data was then analysed using Chart software (ADinstruments Pty Ltd, Sydney).

Outcomes - Prior to feeding (0700 and 0800) average oxygen consumption did not differ between the planes of nutrition (8.1 ± 0.6 vs 8.7 ± 0.7 and 12.3 ± 2.3 mL/min/kg SEM) for fasted, maintenance and ad libitum fed lambs, respectively, P>0.05, data shown as mean ± SEM). Oxygen consumption in the fasted animals did not change (P>0.05) throughout the 24 h period. In maintenance fed lambs oxygen consumption increased (P<0.05) to 192% and peaked at 197% of pre feeding levels, 3 h and 5h respectively, post feeding. Ad libitum post feeding oxygen consumption increased (P<0.05) 73% from pre-feed levels within 1 h and oxygen consumption remained (P>0.05) elevated, peaking 7 h after feeding at 207% above pre-feeding levels. Heart rates and core temperature generally increased in a similar pattern to oxygen consumption in maintenance and ad libitum fed animals and remained low in 72 h fasted animals.

Conclusion - The use of PowerLab exercise physiology system is an excellent tool for measuring differences in oxygen consumption in sheep allocated to various planes of nutrition.

Heterotrophic Australian thraustochytrids as alternate sources of long-chain polyunsaturated fatty acids
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Background - Demand for fish oils rich in omega-3 long-chain polyunsaturated fatty acids (ω3 LC-PUFA), particularly docosahexaenoic acid [DHA, 22:6ω3], is increasing, but most wild fish stocks are fully or over exploited. Marine single-cell oils (SCO) rich in DHA are produced commercially overseas using a heterotrophic dinoflagellate (Cryptothecodinium cohnii) and two microheterotrophs known as thraustochytrids (Schizochytrium sp. and Ulkenia sp.). SCO provide an alternative source of LC-PUFA for incorporation in foods or use as nutraceuticals. Thraustochytrids can be grown heterotrophically using fermentor technology on a large scale with high growth rates and culture density.

Objectives - To isolate and characterize new Australian heterotrophic microorganisms capable of LC-PUFA production for potential use in animal feeds, food and nutraceuticals.

Design - We isolated and characterised the fatty acid profiles of 29 new strains from a range of aquatic habitats within cool-temperate and sub-tropical regions. A subset of the strains was further characterised by sequence comparison of their 18S rDNA genes.

Outcomes - In most strains DHA was the dominant LC-PUFA and comprised an exceptionally high 61% of total fatty acids in one strain. This strain had a simple fatty acid composition with low levels of eicosapentaenoic acid (EPA, 20:5ω3) and docosapentaenoic acid (DPA(6), 22:5ω6) present. Other strains also contained moderate amounts of EPA and DPA(6) (10-15%). Several strains contained moderate levels of the ω6 PUFA, arachidonic acid (AA, 20:4ω6). In one strain, AA was the major LC-PUFA (20% of total fatty acids) and was twice as abundant as EPA. In several strains a series of odd-chain C_{15}-C_{19} saturated fatty acids together with unusual odd-chain C_{19}-C_{23} PUFA were identified by GC-MS of 4,4-dimethyloxazoline (DMOX) derivatives. This is the first report of these odd-chain PUFA being detected in thraustochytrids. The new Australian strains cover a large portion of known biodiversity of this group of microorganisms. They are also a source of novel genes for LC-PUFA synthesis.

Conclusions - The discovery and isolation of these strains provides Australian researchers and industry with a timely opportunity for SCO production.
**Posters**

**Alternate sources of long-chain omega-3 oils**

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**Background** - Long-chain (≥C\(_{20}\)) omega-3 polyunsaturated fatty acids [LC-PUFA, e.g. EPA, 20:5(n-3) and DHA, 22:6 (n-3)] have health benefits against coronary heart disease, inflammatory diseases such as rheumatoid arthritis, hypertension and other disorders, and are essential for infant nutrition (e.g. brain and retina development). Omega-3 LC-PUFA also have beneficial effects against some cancers as well as various mental disorders such as schizophrenia, ADHD and Alzheimer’s disease. Presently fish oils are the main commercial source of the beneficial omega-3 LC-PUFA. However, global fish stocks have been reported to be unsustainable, indicating a need for new sustainable and commercially viable sources of such oils. In addition, fish do not synthesise these oils, rather microalgae and other marine microorganisms (e.g. thraustochytrids and some bacteria) are the primary source of omega-3 LC-PUFA which are incorporated in higher marine animals, and ultimately in humans through consumption of seafood.

**Design** - A strategic research program to isolate and characterize omega-3 LC-PUFA producing marine microorganisms and their genes, and to transfer the genes to model and crop plants has been designed to allow the possibility of achieving sustainable production of new and alternate sources of omega-3 LC-PUFA.

**Objectives** - Microalgae and related heterotrophic organisms are a renewable resource and are amenable to high density culturing in fermentors for biomass production. They are also a source of novel genes for PUFA biosynthesis which may be transferred to terrestrial crop and oil-seed plants. A cross-CSIRO Flagship project aims to isolate, characterize and transfer new LC-PUFA genes from Australian microalgae to land plants.

**Outcomes** - Our research has surveyed a wide range of microalgal classes for their PUFA profiles. Very recently a suite of desaturase and elongase genes have also been successfully transferred to the model plant *Arabidopsis*, with EPA (3.2%) and DHA (0.9 %) having been produced in oil seeds, the latter for the first time. In addition, several strains of heterotrophic microalgae have been isolated that produce high levels of omega-3 LC-PUFA (e.g. up to 60% DHA).

**Conclusions** - Omega-3 LC-PUFA oils from higher plants and single cell oils offer alternative sources of these essential PUFA for use in human nutrition, biomedical applications and aquaculture and other feeds.

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**Post prandial glucose and insulin responses to test meals and insulin sensitivity after weight loss on a very low carbohydrate diet compared to low fat high carbohydrate diets**

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**Background** - It is speculated that high fat very low carbohydrate diets (VLCARB) may impair insulin sensitivity.

**Objective** - To compare, under isocaloric conditions, the effects of VLCARB and low fat high carbohydrate test meals on post prandial glucose and insulin responses before and after weight loss on these dietary patterns.

**Study Design** - Eighty three subjects, (mean ± SD) 48 ± 8y, total cholesterol 5.9 ± 1.0mmol/L, BMI 33 ± 3kg/m\(^2\) were randomly allocated to one of 3 isocaloric weight loss diets (6MJ) for 8 weeks and on the same diets in energy balance for 4 weeks. Diets were Very Low Fat (VLF) (10% fat, 3% saturated fat), Low Fat High Unsaturated Fat (HUF) (30% fat, 6% saturated fat) and VLCARB (61% fat, 20% saturated; 4% carbohydrate). Isocaloric test meals (MTT) of the respective dietary compositions as well as a 75g oral glucose challenge (GTT) were performed over 3 hours at the beginning and end of the study on 2 separate days.

**Outcomes** - Weight loss was (mean ± SEM) 8.0 ± 0.6kg (n=24), 6.7 ± 0.7kg (n=22) and 6.4 ± 0.6kg (n=21) on the VLCARB, VLF and HUF diets respectively (P=0.10) and no difference in fat mass loss. There was a significant effect of diet on the test meal glucose response (P=0.016) with the VLCARB meal provoking a lower glucose response than the VLF meal (P=0.014) and the HUF meal (P=0.054). This effect was strengthened if adjustment was made for the differences in baseline insulin AUC as a covariate (P=0.005). The VLCARB meal also induced an insulin response that was substantially lower compared to HUF and VLF meals (both P<0.001).

**Conclusion** - Although apparent glucose tolerance did not change with weight loss on VLCARB, the insulin response to both the glucose load and the test meals was lowered suggesting improvements in insulin sensitivity.
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Influence of high protein snack foods on satiety, food intake and glucose and insulin response: a single blind cross over study
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Background - There is evidence that replacement in the diet of refined carbohydrate and fat with fibre and protein results in greater satiety and improvement in glucose and insulin profile. It is less clear whether the macronutrient composition of individual foods as snacks have any meaningful impact on these metabolic parameters and satiety.

Objective - To determine whether the consumption of high protein snack bars (800KJ) (HP) can make a meaningful impact on reducing food intake and diurnal glucose and insulin patterns compared to a conventional iso caloric high fat high refined carbohydrate snack bar (HFC) in overweight women.

Study Design - Twenty three women aged 42 ± 8y (mean±SD) and BMI 30 ± 4kg/m² were randomized in a single blind cross over study with 2 treatments: high protein snack bar consumed mid morning and mid afternoon compared with an isocaloric high fat snack bar mid morning and mid afternoon after consuming a standard high carbohydrate breakfast. Blood samples were taken hourly from 8am to 5pm and ad libitum food intake was assessed by the amount of food consumed at a buffet lunch and weighed food records after 5pm.

Outcomes - The overall diurnal glucose response was significantly lower ($P=0.014$) on the day of the HP bar intervention (a morning and afternoon HP bar). The overall diurnal insulin response was also significantly lower ($P=0.012$) during the HP bar intervention. These results were due to the lower post prandial response and lower food intake at the buffet lunch which was a tray of food items consumed ad libitum. Peak glucose levels were also 16% lower after the morning HP bar ($P<0.001$). The morning HP bar also reduced the energy intake at the buffet lunch meal by 5% (4657 ± 1025KJ vs 4901 ± 1186KJ, $P<0.05$). Total daily intake of energy was lower but not significantly so after the HP snack bar intervention. Consuming the HP bars was associated with a lower total fat and higher protein and dietary fibre intake.

Conclusions - Snacks with a higher protein and lower carbohydrate composition can reduce food intake at the next meal by 5% and significantly lower peak glucose level by 14% and peak insulin levels by 12 % when replaced isocalorically for conventional snack bars.

How do women change osteoporosis preventive behaviours in their children?
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Background - There is increasing evidence that chronic diseases such as osteoporosis have their beginnings in childhood, but there is limited information about how best to address lifestyle changes in children. In an randomised controlled trial of bone density feedback to improve osteoporosis preventive behaviours in premenopausal women, we found that feedback to mothers resulted in them reporting changing calcium intake and physical activity levels in their children. However, the approaches the mothers took to changing these behaviours in their children were not known.

Objective - To describe strategies and approaches used by mothers to change their children’s calcium intake and physical activity levels, in order to inform the development of practical and efficacious health promotion strategies.

Design - We sampled 39 mothers who participated in the feedback study and undertook semi-structured interviews with them in which they were asked about measures they took to change osteoporosis preventive behaviours in their children. The data were coded thematically and analysed using NVIVO software.

Outcomes - Mothers described a variety of specific dietary changes they made to increase their children’s calcium intake. They also described general approaches to improving both calcium intake and physical activity behaviours such as: raising awareness of the importance of calcium intake; making sure calcium rich foods were accessible; assessing their children’s likes and dislikes and working within these; role modelling; information provision; and taking a balanced approach to attempting behaviour change. Physical activity change was also addressed by encouraging activities that they could do with their children. The majority of mothers described the importance of a having a balanced diet and lifestyle in general, rather than specifically for osteoporosis.

Conclusion - Mothers described a variety of approaches to changing lifestyle behaviours in their children. This information from mothers’ experiences will inform the development of interventions for lifestyle change in children.
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**Effect of ‘pre-dinner drinks’ on postprandial glycemia and insulinemia in lean young adults**

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**Background** - Moderate alcohol consumption has been associated with decreased incidence of type 2 diabetes and cardiovascular disease. Alcohol has been shown to have beneficial effects on glycaemia when consumed with a meal but little is known about its effect when consumed as a ‘pre-dinner’ drink.

**Objective** - The present study aimed to determine how two standard drinks of alcohol (20 g), consumed one hour before a meal, would affect the glycaemic and insulinemic responses to that meal.

**Design** - Eighteen young, healthy volunteers (8M, 10F) participated. Each subject consumed three types of alcoholic beverages (435g beer, 180g white wine and 54g gin with 200g diet tonic water) as well as two reference water drinks in random order one hour prior to a high glycaemic index meal. A standard breakfast was consumed at 8 am, followed by the ‘pre-dinner’ drinks at 10 am and the standard lunch meal at 11 am. Blood samples were taken at baseline then 15, 30, 45, 60, 90 and 120 minutes after the lunch meal.

**Outcomes** - Taking the average plasma glucose incremental area under the curve (iAUC) after water as 100, the iAUC for beer, wine and gin were 67 ± 5 (mean ± SEM), 75 ± 6 and 78 ± 4, respectively (all differences P <0.001). The mean peak blood glucose for the meal after beer (8.3 ± 0.2), wine (8.5 ± 0.2) and gin (8.6 ± 0.2) were significantly lower (P <0.001) than after water (9.3 ± 0.2). Conversely, plasma insulin iAUC for the meal after beer (106 ± 5), white wine (111 ± 11) and gin (133 ± 10) were all higher than after the reference drink and this difference was significant between water and gin (P = 0.028).

**Conclusion** - The study suggests that ‘pre-dinner’ drinks lower the glycaemic response to a meal by increasing insulin secretion and/or insulin sensitivity. Reducing glucose ‘spikes’ and overall postprandial glycemia may be one mechanism by which alcohol consumption reduces risk of type 2 diabetes and cardiovascular disease.

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**Effect of yeast β-glucan on serum lipids and leptin levels in the diet-induced obese rats**

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**Background** - β-glucan are present in a variety of living systems, including fungi, yeasts, algae, bacteria and higher plants. The effect of β-glucan on blood lipids have been studied in hyperlipidemic or obese humans and animals, however, the results on hypolipidemic effects are controversial.

**Objective** - To investigate the yeast β-glucan is able to decrease adiposity and post-prandial lipaemia in obese rats induced by high fat diet, thus clarifying whether supplementation of yeast β-glucan has anti-obesity effect.

**Design** - To determine whether the yeast β-glucan have the hypolipidemic effects, 4 wk old Sprague Dawley male rats fed high fat diet(40% of calories as fat) for 6 wks to induce obesity, and subsequently fed 1% or 5% yeast β-glucan for further 6 wk. For the comparison, normal CON group (11.7% of calories as fat) fed AIN-76A diet.

**Outcomes** - Supplementation with yeast β-glucan resulted in a significant reduction of food efficiency ratio (FER), white fat (visceral and peritoneal fat) mass, serum triglyceride, total cholesterol, free fatty acid, and leptin level. The adipocyte size of rats fed high fat diets was significantly higher (P<0.05) by 198% than that of CON group at 16 weeks of age. Adipocyte size was significantly reduced (P <0.05) by 1% yeast β-glucan diet (157%) and 5% yeast β-glucan diet (135%).

**Conclusions** - The present results show that yeast β-glucan supplementation to the diet is beneficial for the suppression of diet-induced obesity and hyperleptinemia, and also suggest that food intake controlling effect of dietary glucan would an interesting tool in the control of obesity.
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Decrement of adipocyte size and prevention of hyperleptinemia by garlic in high fat diet-induced obese rats

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Background - Garlic (Allium sativum Linn) is used in conventional allopathic therapies for cancer and diabetic-related vascular diseases. Obesity is often related disturbances of lipid metabolism that lead to an increase in serum triglyceride and cholesterol levels, which are involved in the development of cardiovascular disease. The adipose tissue hormone leptin has been proposed to be involved in the regulation of food intake.

Objective - To investigate the addition of garlic powder diet prevent the potential adverse effects on adiposity and dyslipidemia of this diet. We investigated the effects of garlic on the lipid and leptin metabolism in rats fed high fat diet.

Design - To determine whether the garlic have the hypolipidemic effects, 4 wk old Sprague Dawley male rats fed high fat diet(40% of calories as fat) for 6 wks to induce obesity, and subsequently fed Hangihyung and Nangihyung garlic supplemented high fat diets (w/w) for further 4 wk. For the comparison, normal CON group (11.7% of calories as fat) fed AIN-76A diet.

Outcomes - Supplementation with Hangihyung garlic resulted in a significant reduction of body weight gain, brown and white fat (visceral and peritoneal fat) mass. The adipocyte size of rats fed high fat diets (14.31 ± 3.11 µm, mean ± SD) was significantly higher (P <0.05) than that of CON group (7.67 ± 2.14 µm) at 14 weeks of age. Adipocyte cell size was significantly reduced (P <0.05) by Hangihung garlic diet (11.28 ± 2.09 µm). Serum triglyceride, free fatty acid and leptin level was significantly reduced by Hangihyung garlic supplementation

Conclusions - The present results show that Hangihyung garlic supplementation to the diet is beneficial for the suppression of diet-induced obesity and hyperleptinemia.

Evaluation of three bioelectrical impedance analysers to assess body composition in overweight and obese males

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Background - The use of bioelectrical impedance analysis (BIA) to assess body composition is increasing. Originally BIA instruments determined impedance to conductance of a single frequency current (usually 50 kHz), but newer instruments are increasingly using a spectrum of frequencies in their analysis.

Objective - To determine the validity of measurements of fat mass (FM), fat-free mass (FFM) and percent body fat (BF%) in overweight and obese males assessed using single or multiple frequency BIA analysis by comparison with dual-energy x-ray absorptimetry (DEXA).

Design - Forty-three healthy overweight or obese males participated (age 18-65; BMI 25-42 kg/m²). The BIA examined were the multi-frequency Impedimed SFB7, Version 6 (Imp-MF), the single-frequency Impedimed SFB7, Version 6 (Imp-SF) and the single-frequency Tanita Ultimatescale™ (Tanita). Validity was assessed by comparison against DEXA (GE Lunar Prodigy) using regression and limits of agreement analysis.

Outcomes - All three BIA units showed good relative agreement with DEXA, Imp-MF (FM, r² = 0.81; FFM, r² = 0.81; BF%, r² = 0.69, P<0.001)), Imp-SF (FM, r² = 0.65; FFM, r² = 0.76; BF%, r² = 0.40, P<0.001), Tanita (BF%, r² = 0.44, P<0.001). Absolute agreement between Imp-MF and DEXA was poor as indicated by large bias and wide limits of agreement (Bias ±1.96SD; FM, -6.6 ± 7.7 kg; FFM, 8.0 ± 7.1 kg; BF% -7.0 ± 6.6 %). Imp-SF and Tanita had lesser bias, but wide limits of agreement (Imp-SF, FM -1.1 ± 8.5 kg, FFM 2.5 ± 7.9 kg, %BF -1.7 ± 7.3 %; Tanita BF% 1.2 ± 9.5 %).

Conclusion - Compared with DEXA, body composition measured by Imp-MF produced large bias and wide limits of agreement. While Imp-SF and Tanita had lower bias the limits of agreement were still large. The use of BIA as an alternative to DEXA for clinical measurements in overweight or obese populations is limited.
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**Comparison of the effects of a high-fat diet enriched with peanuts and a low-fat (NCEP) diet on blood lipid profiles**

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**Background** - Diets rich in monounsaturated fatty acids (MUFA) favourably affect serum lipids. The peanut (Arachis hypogaea) is a seed from the legume family Fabaceae which is a high fat food that has a fatty acid profile dominated by MUFA (P:M:S ratio 1:2.2:0.7). The peanut is popularly considered to be a nut and accounts for about two-thirds of all nuts consumed in the USA.

**Aim** - A comparison of the effects of two isocaloric diets: a high MUFA diet enriched with 50g of peanuts per day (PE diet, 35-40% dietary energy [E] as fat) and the National Cholesterol Education Program diet (NCEP diet, fat <30%E, SFA 8-10%E, cholesterol <300mg/day) on blood lipid profiles and low density lipoprotein (LDL) oxidation rates.

**Design** - Sixteen subjects (12 female, four male) followed the NCEP diet for 4 weeks, then the PE diet for 4 weeks. LDL susceptibility to copper induced oxidation was characterised by the lag time (min), the level of conjugated dienes (CD; \(\mu\)mol/g protein) after oxidation and the maximal rate during the propagation phase (\(\mu\)mol/min/g protein).

**Outcomes** - Both diets significantly reduced total cholesterol (TC) and LDL cholesterol (LDL-C, \(P<0.01\)). High density lipoprotein cholesterol (HDL-C) levels fell on the NCEP diet (\(P<0.01\)), but were preserved on the PE diet. Triglycerides (TG) fell on the PE diet only (\(P<0.01\)). Both the MUFA diet and the Low-Fat diet decreased oxidation of LDL (\(P<0.01\)), another potential anti-atherogenic effect. The MUFA diet enriched with peanuts was at least as effective as the NCEP low-fat diet in decreasing TC and LDL-C, with a smaller impact on HDL-C concentrations and a more favourable effect on TG levels.

**Conclusion** - Peanuts can be included in a cholesterol lowering diet to add taste texture and thereby improve long term adherence.

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**Effects of simvastatin on blood lipids, vitamin E, coenzyme Q levels and left ventricular function in humans**

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**Background** - Statin therapy has been reported to reduce antioxidants such as vitamin E and coenzyme Q(10) and there are indications that this reduction may cause impairment of left ventricular function (LVF).

**Objective** - To determine the influence of simvastatin on LVF and serum vitamin E and coenzyme Q(10) levels in humans.

**Design** - The effect of simvastatin on left ventricular function and coenzyme Q(10) levels in 21 (11 male, 10 female) hypercholesterolaemic subjects (mean age = 56 years) with normal LVF was assessed over a period of six months. Subjects were re-tested after a one month wash-out period (seven months). Echocardiography was performed on all subjects before commencement of simvastatin (20 mg /day), and at one, three, six and seven months after initiation of treatment. Fasting blood samples were also collected at these intervals to assess lipids, apoproteins, vitamin E and coenzyme Q(10).

**Outcomes** - Serum lipids showed the expected reductions. Plasma vitamin E and coenzyme Q(10) levels were reduced by 17 +/- 4% (\(P<0.01\)) and 12 +/- 4% (\(P<0.03\)) at six months. However, the coenzyme Q(10)/LDL-cholesterol ratio and vitamin E/LDL-cholesterol ratio increased significantly. Left ventricular ejection fraction (EF) decreased transiently after 1 month, while no significant change was observed at 3 and six months. Other markers of left ventricular function did not change significantly at any time point.

**Conclusion** - Despite reduced plasma vitamin E and coenzyme Q(10), 20 mg of simvastatin therapy is associated with a significantly increased coenzyme Q(10)/LDL-cholesterol ratio and vitamin E/LDL-cholesterol ratio. Simvastatin treatment is not associated with impairment in left ventricular systolic or diastolic function in hypercholesterolaemic subjects after six months of treatment.
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Effect of iron supplementation on biomarkers of iron status and serum zinc
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Background - In view of the importance of iron deficiency anemia (IDA) as a common nutritional and public health problem in developing countries, this study was undertaken to investigate the effect of iron supplementation on haematological and biochemical indices of iron status and serum zinc.

Design - The study was performed on 80, ID and IDA students matched for age, sex, initial Hb level and Fe status who were randomly allocated to a treatment group receiving daily iron supplements (150 mg ferrous sulfate tablets containing 50 mg of elemental iron) and a placebo group, during a 2-month period. In addition to haematological and biochemical iron status indices, serum zinc was measured at the beginning and at the end of the supplementation period. Independent and paired t-test, Chi-square and Mc Nemar tests were used for statistical analysis.

Outcomes - The result showed that prescription of ferrous sulfate to IDA subjects compared to the placebo group caused increases of 2.1 g/dl in Hb concentrations (P<0.001), 6.2% in hematocrit (P<0.001), 7.6 fl in MCV (P<0.02), and 10.4 ng/ml in SF (P<0.05). The increases in ID subjects compared to the placebo group were 0.8% in hematocrit (P<0.02) and 18.8 ng/ml in SF (P<0.01). There was no significant decrease in mean serum zinc concentrations during iron supplementation.

Conclusion - Iron supplementation was effective especially in IDA subject. To clarify the exact effect of ferrous sulfate on hematological and biochemical iron status indices in individuals with ID, further studies are needed. Serum zinc alone is known to be a poor index of zinc status, therefore more sensitive indices must be used in studies that are aimed at determining the effect of iron supplementation on body zinc status.

Protein digestion in rainbow lorikeets, Trichoglossus haematodus
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Background - Rainbow lorikeets are nectarivorous birds whose natural diet is low in protein and relatively high in free amino acids. Protein metabolisability (PM) of egg white (EW) protein is lower in rainbow lorikeets (6.9%) than whole egg protein in white leghorn roosters (13.9%).

Objective - (1) To determine whether PM of other sources of protein fed to lorikeets is higher than that of EW. (2) To compare the general proteolytic activity (GPA) (pepsin) of the proventriculus of the rainbow lorikeet and a granivorous bird, the domestic chicken, Gallus gallus domesticus L.

Design - (1) Five lorikeets were fed one of three diets, an EW diet, an EW and casein hydrolysate (CH) diet and a commercial “lorikeet and honeyeater” (L/H) feed (Wombaroo Food Products, Glen Osmond, SA). Lorikeets were kept in metabolism cages for 3d for feed intake measurements and excreta collection. Samples were freeze dried and analysed for nitrogen. (2) The GPA of the proventriculus of three lorikeets and three chickens was measured using haemoglobin as a substrate.

Outcomes - (1) The PM (mean ± SD, n = 5) was 4.3 ± 2.6% for the EW diet, 5.6 ± 2.5% for the EW/CH diet and 7.3 ± 3.2% for the L/H feed. The PM for the EW diet was not significantly different from the EW/CH diet and L/H feed (P>0.05). (2) The GPA of the proventriculus of lorikeets at pH 1.0 was significantly lower (P<0.01) than that of the chicken at each incubation period.

Conclusions - (1) The results of the feeding experiments with lorikeets confirm that PM of artificial protein sources is low. (2) The GPA of the proventriculus of lorikeets is lower than that of the chicken. This may contribute to the low PM by lorikeets.
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Development and application of a liposome delivery method to enhance the bioavailability of antioxidants and evaluate cytotoxicity in colon and breast cancer in vitro models

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Background - Traditionally, when assessing highly insoluble compounds on in vitro cell culture models, chemicals such as tetrahydrofuran, dimethyl sulfoxide (DMSO) and ethanol have been applied as vehicles to enable delivery of experimental treatments. Liposomes have recently gained interest as potential delivery systems for hydrophobic and hydrophilic compounds as they mimic the transport of fat-soluble vitamins in vivo. Liposomes are vesicles consisting of a phospholipid bilayer surrounding an aqueous interior. Researchers investigating plant-derived micronutrients have previously used this concept to improve the bioavailability of both non-polar and polar antioxidants, avoiding solvent concentrations which would cause cytotoxicity.

Objectives - In this study, several antioxidants, known to be abundant and/or specific to mangoes, were assessed to determine their growth-inhibitory effects on breast cancer (MCF-7) and colon cancer (HT-29) cell lines. Additionally, the potential cytostatic and cytotoxic effects of β-carotene, quercetin and mangiferin were compared using the two in-vitro delivery methods.

Design - Antioxidant delivery was firstly achieved by dissolving test compounds in DMSO and adding to the culture medium at a concentration of 50µg/mL. Alternatively, using a method adapted from Stivala and colleagues (European Journal of Biochemistry, 2000; 267, 2290-2296), antioxidants were entrapped in liposomes (antioxidant/ phospholipid ratio of 0.1). Treatments commenced 24hr post-seeding and continued for 96hr. To ensure stable antioxidant concentrations throughout the study, the treatment media was changed after 48hr. Cell viability was measured using the MTS assay and a Student’s t-test was used to determine significant outcomes (P <0.05).

Outcomes - When mangiferin and quercetin were dissolved in DMSO vehicle, only quercetin was effective in altering cell number (P <0.01). However, when β-carotene, quercetin and mangiferin were incorporated into liposomes all significantly altered the proliferation of both colon and breast cancer in vitro cell models (P <0.01).

Conclusion - This research highlights the importance of appropriate delivery methods when assessing chemicals that are either insoluble in DMSO or are otherwise soluble but have impaired or limited biological uptake. Further, these findings demonstrate the effectiveness of bioactive chemicals commonly found in mango, in altering the proliferation of breast and colon cancer cell lines.

Characteristics of a high-glycaemic index diet in patients with existing cardiovascular disease

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Background - Recent evidence suggests that the inclusion of low glycaemic index (GI) foods in the diet may be protective against cardiovascular disease via either increased HDL-cholesterol concentrations¹, reduced inflammatory response in the endothelium², or both mechanisms.

Objective - To describe the nutritional characteristics of patients with existing cardiovascular disease who were consuming a low versus high GI diet.

Design - As part of baseline data collection for the LIPID trial, 1,077 participants also agreed to complete a semi-quantified FFQ investigating intakes of more than 170 foods. All foods which contributed significantly to dietary carbohydrate intake were allocated a GI value where available. Total dietary GI was calculated by determining an individuals average daily glycaemic load and dividing by the average total carbohydrate consumed in grams per day. Patients were classified into 4 groups according to their quartile of dietary GI, and the relationship between nutrition variables and GI was investigated by regressions of individual patient nutrition variables on GI quartile medians.

Outcomes - There were significant positive relationships between dietary GI and dietary energy, fat and carbohydrate intakes, and significant negative relationships between dietary GI and protein and alcohol intakes. Dietary GI was also significantly positively related to mono- and poly-unsaturated fat intakes, but not to saturated fat intake.

Conclusion - These data indicate that those patients with existing cardiovascular disease who tended to eat a diet that was higher in GI were also consuming more energy, less alcohol, more dietary carbohydrate and more dietary fat (including more mono- and poly-unsaturated fats), at the expense of dietary protein intake.

References
Posters

Equine water kinetics as influenced by age and temperament
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Background - Australian horses are worked in hot conditions, including as stock horses on properties and in demanding equestrian events. Provision of adequate water is essential for good performance and for welfare reasons. However, there is limited information about the water requirements, body water content and water turnover of horses under Australian environmental conditions, or the effects of age and temperament on these.

Design - During winter in southern Queensland, 15 Australian Stock Horses (5 weanling; 5 yearling; 5 mature), were housed in stables for 51 days (3 periods of 17 days), and water intake and kinetics were measured. Body water content and water turnover were determined using deuterium oxide. Each horse was assigned a temperament rating of 1 (calm) to 3 (very nervous).

Outcomes - There was no significant age-related difference in drinking water intake, with the horses consuming (mean ± SD) 29.35 ± 0.53 L water/day. Weanlings had the highest (P = 0.003) fractional water turnover rate (0.134/day), compared to yearlings (0.109/day) and mature horses (0.102/day). Horses assigned a temperament rating (TR) of 3 had the highest drinking water intake (34 L/day), and a significantly higher fractional water turnover rate (0.130/day) than TR 1 or 2 horses (P = 0.021).

Conclusion - Australian Stock Horses use water at similar rates to those of other breeds, but it should be noted that this experiment was conducted in late winter/spring, when water loss for thermoregulation was at a minimum. Nervous horses use significantly more water than calmer animals.
Posters

High glycemic index carbohydrate mediates an acute proinflammatory process as measured by NF-κB activation
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Background - Some high-carbohydrate diets may increase the risk of cardiovascular disease (CVD) by promoting hyperglycemia, oxidative stress, endothelial dysfunction and low-grade inflammation. In this context, the classification of carbohydrates according to their postprandial effects (ie the glycemic index, GI) may be relevant to prevention and management of CVD.

Objectives - The present study was designed to detect differences in postprandial NF-κB activation (an acute inflammatory marker) in mononuclear cells and nitrotyrosine levels (a marker of oxidative stress) after high vs low GI meals in 10 lean, young, healthy European Caucasian subjects (5 male, 5 female) matched for age, BMI, waist circumference, diet and physical activity.

Design - A 50 g portion of a high GI (white bread) was compared with an isoenergetic, macronutrient-matched portion of a low GI food (pasta) consumed in random order after an overnight fast. Glycaemia, insulinemia, NF-κB and nitrotyrosine levels were determined at 0, 60, 120 and 180 min and quantitated using the area under the curve (AUC).

Outcome - Glycemia and insulinemia were within the normal range but 3- and nearly 4-fold higher respectively after the bread meal compared with the pasta meal. As hypothesised, the NF-κB response was 3-fold greater after the bread meal (mean ± SEM: 69 ± 16 optical density (OD) · h) compared with the pasta meal (23 ± 4.7 OD · h). Nitrotyrosine levels increased after the bread meal (0.67 ± 0.49 nmole/L) and decreased after the pasta (-0.81 ± 0.30 nmole/L) but the difference did not reach statistical significance.

Conclusion - The present study shows that high GI carbohydrate, but not low GI carbohydrate, mediates an acute proinflammatory process as measured by NF-κB activity. Blunting postprandial glycemia via low GI carbohydrate may lower CVD risk.

References

Displacement of adhered enteropathogens from human mucus by selected lactobacilli
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Background - A probiotic has been defined as a viable microbial food supplement which beneficially influences the health of the host (1). Adhesion to and colonization of the mucosal surfaces are possible protective mechanisms against pathogens through competition for binding sites and nutrients or immune modulation.1

Objectives - The aim of this study was to assess the ability of selected Lactobacillus strains to displace pathogens from human intestinal mucus, providing a basis for the selection of new probiotics with the ability to competitively exclude intestinal pathogens.

Design - The Lactobacillus strains included in this study have been pre-selected on the basis of their resistance to acid and bile and their ability to induce the production of pro- and anti-inflammatory cytokines.2 An intestinal mucus model3 was used to assess the displacement of pathogens by the selected Lactobacillus strains.

Outcomes - The levels of pathogen displacement varied between 15 and 68% depending on both the pathogen and the lactobacilli used, indicating the need of a case-by-case characterization of each probiotic strains.

Conclusion - Selection of probiotics that inhibit or displace a specific pathogen can be based on further assessment, product development and human clinical interventions on prevention or treatment of infection caused by that pathogen.

References
Posters

Serum amino acid analysis by gas chromatography
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Background - Accurate amino acid analysis is crucial in defining protein function and quality. However, the diverse chemistry of amino acids makes fast, accurate quantification of all amino acids challenging. Moreover, analyses of amino acids in physiological samples are further complicated by the increased number of compounds that must be separated. Gas chromatographic techniques offer advantages in resolution, sensitivity, speed and cost reduction. However, the development of satisfactory gas chromatographic procedures has been hindered as amino acids are not sufficiently volatile to permit direct analysis and must be converted into volatile derivatives prior to gas chromatography. A gas chromatography amino acid analysis kit (EZ:Faast® amino acid testing kit, Phenomenex, USA) is a new procedure for a rapid clean-up, derivatisation and analysis of amino acids and related compounds in physiological fluids. The analysis is completed in 15 minutes.

Objective - To evaluate the EZ:Faast® gas chromatographic kit as a suitable procedure for serum amino acid analysis.

Design - Six replicates of a mixed standard amino acid solution and five replicates of horse serum samples were extracted and derivatised following the instructions in the EZ:faast® kit for accuracy and precision calculations, respectively. Five replicates of serum samples with added tryptophan standard were prepared to calculate tryptophan recovery.

Outcomes - The accuracy results in our study were < 9% for all amino acids determined. The precision results were < 5% for most amino acids. Tryptophan recovery was 93%.

Conclusion - The advantages of the EZ:faast® technology are easy sample clean-up, derivatisation and fast, cost-effective analysis. The disadvantages of the procedure are that arginine, methyl histidine, citrulline and taurine cannot be analysed.

The relationship between apparent ileal digestible amino acid and crude protein content of canola meal
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Background - Provision of adequate levels of essential amino acids is very important in the compilation of diets, especially for monogastric animals. Numerous studies conducted by Bryden and his colleagues¹ ² found that formulating diets based on digestible amino acid values was superior to those based on total amino acids. Amino acid analysis and digestible amino acid determination are too costly and time consuming for routine investigation in the feed industry and it would be helpful if the apparent ileal digestible amino acid content of a feedstuff could be deduced from its total crude protein content, which is routinely determined.

Objective - To investigate the relationship between the total crude protein and total amino acid content, digestible crude protein and digestible amino acid content of Australian canola meals.

Design - Male broilers at 35 days of age were allocated to pens with 7 birds per pen. Eleven canola meal samples with total crude protein contents ranging from 266 to 394 g/kg canola meal (air dry basis) were collected from a various sources, grown in Victoria, New South Wales, prepared by solvent extracted or expeller. Canola meals were incorporated as the sole source of dietary protein in experimental diets. The dextrose proportion varied in experimental diets so that the diet contained approximately 200g/kg crude protein. Celite, a source of acid insoluble ash, was added (20 g/kg) to all diets as an indigestible marker. Each experimental diet was fed to three pens of 6 birds per pen for 5 days. At the end of trial all birds were sacrificed and the digesta from the lower portion of the ileum was collected and pooled with the contents of the other birds from the same group. Freeze-dried digesta were analysed for crude protein, amino acids and acid insoluble ash.

Outcomes - There were strong and significant (P<0.01) positive correlations between total crude protein and apparent ileal amino acid contents except for HIS (P=0.016), SER (P=0.047) and LYS (P=0.133). There was no correlation between total crude protein content and apparent digestible lysine content which is probably due to the fact that lysine is the most labile to processing.

Conclusion - Total crude protein content of canola meal is a reasonable indicator of apparent ileal amino acid content for broiler chickens.

References
Posters

The nutritional effects of different mulberry varieties on biological characters in silkworm

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Background - Growth and development of silkworm Bombyx mori L. were applied at this experiment. An experiment was conducted with some breeded mulberry varieties [including Kenmochi (KM), Kairyonase (KN), Ichinose (I), Shinichinose (SI)] and a local variety in two different rearing seasons (spring and autumn). Each treatment was fed by leaves of one mulberry varieety but no other ingredients. In order to determine the relationship between nutrient elements (protein, nitrogen, potassium, phosphore, moisture, fibre, ash etc) and larvae performance, the nutrient composition of the leaves was analyzed. Rearing was conducted under standard conditions and biological characteristics were recorded. The data were analyzed using a complete randomized design (CRD) model with factorial arrangement by means of SAS statistical programme and Duncan new multiple range (DNMRT).

Outcomes - Summary of the results is shown in following table.

<table>
<thead>
<tr>
<th></th>
<th>Larval mortality (%)</th>
<th>Moulting duration (hr)</th>
<th>Nutrition duration (hr)</th>
<th>Larval duration (hr)</th>
<th>Silkworm Varieties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Difference Autumn Spring Difference Autumn Spring Difference Autumn Spring Difference Autumn Spring</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>T1</td>
<td>3.1ns</td>
<td>7.5c</td>
<td>10.6a</td>
<td>-9.1**</td>
<td>110.0a</td>
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<tr>
<td></td>
<td>-2.0ns</td>
<td>5.8c</td>
<td>3.7a</td>
<td>4.6ns</td>
<td>95.0c</td>
</tr>
<tr>
<td>T2 (SN)</td>
<td>-43.8**</td>
<td>48.3ab</td>
<td>4.4a</td>
<td>5.3ns</td>
<td>94.3c</td>
</tr>
<tr>
<td></td>
<td>-22.1**</td>
<td>26.6b</td>
<td>4.5a</td>
<td>0.0ns</td>
<td>102.0b</td>
</tr>
<tr>
<td></td>
<td>-42.3**</td>
<td>53.3a</td>
<td>11.0a</td>
<td>0.8ns</td>
<td>97.6bc</td>
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<tr>
<td></td>
<td>-21.4</td>
<td>28.3</td>
<td>6.8</td>
<td>0.3</td>
<td>99.8</td>
</tr>
</tbody>
</table>

Means followed by different letters are significantly different at the 5% level (P<0.05) by DNMRT.

Conclusion - Different kinds of mulberry varieties and rearing seasons have significant effects on silkworm characteristics (P<0.01). Biochemical analysis of mulberry leaves also showed these varieties had different percentage of nutrients (such as proteins, moisture etc). DNMRT indicated that Shinichinose and Kinase varieties are suitable for late autumn rearing, but Ichinose variety is the best variety in spring rearing (P<0.05). Most studied characters showed better performance (P<0.01) in spring than autumn.

References

Suspect mycotoxicoses in horses, cattle and dogs

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Background - Mycotoxins are secondary fungal metabolites that are produced by fungi in field crops, on pastures or in stored commodities. There are many mycotoxins and when ingested can give rise to an array of clinical signs depending on the toxin ingested, the dose and the duration of exposure.

Objective - To describe three separate cases of mycotoxicoses in horses, cattle and dogs that occurred in the Upper Hunter Valley region of New South Wales.

Outcomes - Case 1: Three foals about 2-3 months of age showed variable signs of incoordination and ataxia but were otherwise clinically normal except for one foal which had diffuse cutaneous oedema. The mares were still suckling the foals, which were observed from time to time suck at grass heads. One foal died from misadventure, the others recovered uneventfully after removal from the paddock, which contained paspalum pasture infected with ergots of Claviceps paspali, the cause of paspalum staggers as exhibited by the foals. Case 2: A dairy herd that had been milking normally suddenly reduced milk production. The cows became sensitive to touch when milked. Some cows in the herd exhibited increased respiration rate and panting when moved. Examination of the batch of barley that the cows had been fed as part of a concentrate diet, showed the presence of the ergots of Claviceps purpurea. Toxins within the ergot are known to cause bovine hyperthermia, which was exhibited by the cows. Case 3: Cattle dogs presented in an excited state with severe muscle tremors and signs of ataxia. The second dog had eaten the vomitus of the first dog and subsequently developed similar clinical signs. Both animals had increased respiration rate but other neurological and clinical tests were normal. A third dog also presented with much milder clinical signs. The animals were sedated overnight and subsequently recovered. The clinical presentation by the dogs suggested an intoxication. A thorough investigation of the food and surrounds, in which the dogs were kept identified only one possible source of intoxication and that was mouldy food that had come from a refrigerator. The food was heavily infested with Penicillium crustosum, a fungus known to produce the tremogenic mycotoxin penitrem A. The clinical signs of the dogs were consistent with penitrem A intoxication.

Conclusion - Mycotoxins are natural food contaminants that can enter the animal food system through stored grain, standing pastures or from poorly stored food. The clinical signs displayed by animals will vary considerably and in some situations quickly dissipate when the source of the toxin is removed.
Posters

Improved heat tolerance of cattle by dietary supplementation with osmolytes

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Background - When exposed to hot conditions grain-fed cattle will reduce dry matter intake (DMI) resulting in reduced average daily gain and feed:gain efficiency. Reducing the detrimental effect of heat stress is necessary for maintaining optimum cattle performance and welfare. Feeding osmolytes such as polyols, betaine, free amino acids, and combinations of urea and methylamines to cattle during summer may be beneficial. Osmolytes help maintain cellular water balance, protecting cells and tissues from dehydration and osmotic inactivation.

Objective - To investigate the effect of dietary supplementation with an osmolyte product (Bos Koolus®) on heat tolerance of cattle.

Design - Eight Angus steers (550 ± 25 kg) were used to test the effect of adding a mix of osmolytes (7.6 kg/t) to a feedlot finisher ration. The steers were housed in individual stalls for 11 d in a climate controlled unit and exposed to 5 d of hot conditions (HOT) (32 °C dry bulb temperature, 66 % relative humidity). Prior to HOT the steers had 4 d exposure to thermoneutral conditions (TN), and following HOT a further 2 days of TN. Rectal temperature (RT), respiration rate (RR) and individual DMI were measured.

Outcomes - The steers fed the osmolyte diet had lower (P<0.05) RT (39.5 ± 0.01 °C) compared to the control group (39.9 ± 0.01 °C). Mean RT of the osmolyte fed steers during HOT was 39.6 °C and for the control group the mean was 40.1 °C (P<0.001). The RR of the osmolyte fed steers was lower (P < 0.05) compared to the control group at 77 ± 1.1 breaths per minute (bpm) and 81 ± 1.1 bpm respectively. Mean RR were lower (P<0.05) for the osmolyte fed steers on days 3 and 4 of HOT at 92 bpm and 102 bpm respectively. The DMI of the osmolyte fed steers was greater (P<0.001) than the control group at 5.74 kg/d and 4.93 kg/d respectively.

Conclusion - The data suggests that steers fed an osmolyte supplement were more heat tolerant than those fed the control diet.

Methionine requirement and cell-mediated immunity in chicks

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Background - In addition to the requirement for growth, methionine has been shown to have beneficial effects on the immune status of animals.

Objective - To determine the methionine requirements for growth and the cellular immune response in broiler chicks.

Design - One-day-old Ross broiler chicks were divided on the basis of body weight uniformity and randomly assigned to 5 groups (with 5 replicate pens of 7 birds each). Birds were housed in temperature and air controlled floor pens with free access to feed and water. From day 1 to 21 one group of chicks was fed a methionine-deficient basal diet (3mg/kg methionine), whereas the four other groups received the basal diet supplemented to a digestible methionine content of 4.5, 6.0 and 7.5 mg/kg. In addition to weekly body weight measurements, at three weeks of age, a cellular immune response was elicited by an intradermal injection of phytohemagglutinin (PHA-P) and measured after 24h.

Outcomes - Diets supplemented with digestible methionine (4.5, 6.0 and 7.5 mg/kg to the diet) were found to be significantly (P<0.001) effective in improving the cellular immune response of broiler chicks as compared with basal diet (0.30% methionine). In contrast, methionine supplementation did not significantly affect body weight gain.

Conclusion - It is concluded that dietary methionine content markedly influences cellular components of an immune response indicating that immune cell proliferation may be sensitive to a range of intracellular sulfhydryl compounds interlinked to methionine metabolism, including glutathione and cysteine. It was demonstrated that the methionine requirement for cellular immune response is greater than that required for optimal growth.
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