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P01
Antioxidant defences are impaired in asthmatics with airway hyperresponsiveness, poor control and severe disease pattern

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Background
Dietary antioxidants are important in protecting against oxidative stress. We have previously demonstrated that circulating dietary antioxidant levels are reduced in asthma.

Objective
This study aimed to examine the variation in dietary antioxidant levels in asthma, according to airway responsiveness, asthma control and clinical asthma pattern.

Design
Induced sputum and peripheral blood were collected from 41 subjects with stable, persistent asthma. Airway responsiveness was assessed by hypertonic saline challenge. Asthma control was assessed using the Asthma Control Questionnaire. Clinical asthma pattern was determined using GINA criteria. Whole blood carotenoids (β-carotene, lycopene, α-carotene, β-cryptoxanthin, lutein/zeaxanthin) and tocopherols (α, δ, γ-tocopherol) were measured by HPLC. Plasma antioxidant potential (AOP) was determined by colorimetric assay (OxisResearch, Portland, OR, USA).

Outcomes
Asthmatic subjects with airway hyperresponsiveness (AHR) had reduced levels of β-carotene and α-tocopherol compared to those without AHR. Subjects with uncontrolled asthma had low levels of AOP compared to those with controlled or partly controlled asthma. Subjects with a severe persistent clinical asthma pattern had reduced levels of α-tocopherol compared to those with a mild to moderate asthma pattern.

Conclusion
Dietary antioxidant levels are impaired in asthma and this is worse in subjects with AHR, uncontrolled asthma or a severe persistent asthma pattern. This highlights the potential role for antioxidant supplementation in these subjects.

Funding
This study was supported by the CRC for Asthma and Airways.

P02
Using dual energy X-ray absorptiometry (DXA) to measure body composition in the Short-beaked Echidna (*Tachyglossus aculeatus*)

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Background
Changes in body fat mass and composition may be mediating agents for seasonal reproduction in the short-beaked echidna. Echidna do not appear to breed every year in the wild. It is possible that this is associated with the need to acquire sufficient energy reserves as fat stores at the start of each breeding cycle; when insufficient stores are available breeding may be suppressed.

Objective
The aim of the present study was to determine the body composition of echidna using DXA and to validate this method by the reference method of proximate chemical analysis.

Design
Echidna were opportunistically obtained as “road kill” over a 24-month period. As soon as practicable, the animals were frozen and stored to await DXA analysis. DXA analysis was performed on weighed and thawed cadavers using the small animal mode on a Norland XR36 DXA scanner. The cadavers were minced and underwent proximate analysis for dry matter, ash, crude fat and protein (as 6.25 x N), and body mineral content (BMC, as 2.63 x Ca) performed according to standard protocols. Body composition data (fat, fat-free mass (FFM) and BMC), determined by each method, were compared by concordance correlation and limits of agreement (LOA) analyses.

Outcomes

Eighteen echidna were obtained for analysis (5 M:13 F), ranging in weight from 1118 to 5517 g. Mean body fat content was 542±419 g/kg body-weight (not detectable in one animal) by DXA and 407.9±64.9 g/kg by chemical analysis. FFM were 2559±1004 g/kg and 2737±966 g/kg and BMC 89.3±34.5 g/kg and 90.3±38.5 g/kg for chemical analysis and DXA respectively. The two methods of analysis were highly correlated for all three measurement variables (r_c = 0.85_{fat}, 0.94_{FFM} and 0.70_{BMC}) with biases of 23 % for fat (LOA ± 64%, although the bias was not constant but proportional to fat mass), 6.7% (LOA ± 37%) for FFM and -1.1% (LOA ± 62%) for BMC.

Conclusion

Body composition of echidna can be measured by DXA, a method applicable to live, albeit anaesthetised, animals. The wide LOA indicate, however, that the methods cannot be used interchangeably.

P03

Adolescent females using common weight control techniques show biochemical evidence of reduced nutrition

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Background

A large proportion of teenage females regularly use weight control techniques. The effect of habitual dieting on adolescent health has not been widely studied.

Objective

This study aimed to identify possible adverse biochemical effects of regularly used weight reduction or control techniques in 14-17 year old females attending schools within the greater Sydney and Hunter Regions.

Design

This was a cross sectional study of 482 adolescent females aged between 14-17 years sampled from 7 schools across the greater Sydney and Hunter area Regions of Australia. Participants provided a fasting blood sample followed by morphometric analysis. Under supervision, participants completed a previously validated questionnaire which documented the type and frequency of their use of weight control techniques.

Outcomes

Adolescent females who often used weight control techniques had an average BMI of 22.5. Analysis of relevant blood markers showed that on average, females who often used weight control methods had significantly lower haemoglobin ($P < 0.05$), alkaline phosphatase ($P < 0.001$), bilirubin, albumin, total protein and calcium ($P < 0.05$), but higher levels of creatinine and potassium ($P < 0.05$).

Conclusion

The regular use of weight control techniques by healthy weight adolescent females results in a metabolically identifiable group whose results are consistent with subtle levels of chronic under-nutrition. This early negative biochemical divergence may predispose these children to adverse health outcomes, such as osteoporosis, during the later adult years.

P04

The SURYA study: quality of food intake reporting in a group of South Asian women in Auckland (NZ) – a comparison of dietary assessment methods

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Background

Dietary practices may play an important role in the incidence of type 2 diabetes and cardiovascular disease in the South Asian immigrant population in NZ. Nothing is known about the dietary intakes of this group in NZ, and measuring their dietary intakes is difficult due to their cultural practices embedded in food preparation and additions

Objective

To investigate how the addition of a qualitative dietary interview method could improve the quality of a 4-day estimated food record.

Design

Cross-sectional data was collected from 134 South Asian women, aged 20+ years, living in Auckland (NZ) who participated in the SURYA study focusing on diet, lifestyle and health. Dietary intake data were collected using 4-day estimated food records. These were checked, verified and corrected before analysis. To improve the quality of the dietary data, all women were recalled to complete a qualitative, in-depth dietary interview using a 24-hour recall method that included probes on food types, fat and sugar, regarding their 4-day food records. The two data sets were compared.

Outcomes

The median energy intakes from the record data compared to the combined data were 6852kJ vs. 7246kJ ($P \leq 0.01$), effect size: r=0.64. The fat, carbohydrate and protein intakes (g/day) increased significantly (r=0.64, 0.41, 0.60) when comparing record to combined data, however, when expressed as a percentage of energy, the differences for fat and carbohydrates were small to medium (r=0.32, 0.32), with no difference for protein. Both PUFA and MUFA (%E)

increased significantly (r=0.61, 0.78), however, there was no difference for SFA. These differences could be related to the type and amount of fats that were added in the preparation of dishes. Detailed data from the qualitative interviews revealed valuable information about the types of fat used. Similar changes were apparent for other dietary components.

Conclusion

To ensure that high quality data is used to assess health outcomes, it is essential that dietary data needs to be thoroughly checked when using self-reporting dietary assessment methods. This is especially important in population groups such as the migrant South Asian population who have different dietary practices than their host country (NZ).

P05

Estimating food intakes in Australia: validation of the CSIRO food frequency questionnaire (C-FFQ) against weighed dietary intakes

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Background

There is a dearth of knowledge about the foods that Australian adults eat and a need for a flexible, easy-to-use tool that can estimate usual dietary intakes.

Objective

The aim of this study was to validate a commonly used Australian CSIRO food frequency questionnaire (C-FFQ) against two 4-day weighed food records (WFR), as the reference method.

Design

Seventy four women, aged 31-60y, were enrolled from a free-living community setting. The C-FFQ, as the test item, was administrated before the WFR. Two 4-day WFR were administrated 4 weeks apart. Underreporting was established using specific cut-off limits and estimated basal metabolic rate.

Outcomes

After exclusion for under-reporting the final sample was 62. Correlations between protein intake from the WFR and urinary urea were significant. Overall agreement between FFQ and WFR was shown by 'levels of agreement' (LOA) and least products regressions. There was presence of fixed and proportional bias for almost half the nutrients, including energy, protein, fat and carbohydrates. For most of the nutrients that did not present bias, the LOA were >50 – 200%. Agreement was demonstrated for percentage dietary energy protein, fat; and carbohydrate; and absolute amounts of thiamine, riboflavin, magnesium and iron. However relative intake agreement was fair to moderate with ~70% of (selected) nutrients exact or within ± 1 quintile difference.

Conclusion

The C-FFQ is reasonable at measuring percentage energy from macronutrients, some micronutrients and is a valuable tool for ranking intakes by quintiles however it is poor at measuring many absolute nutrient intakes relative to WFR.

P06

New perspectives on dietary intake

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Background

Control of dietary intake is important for human health and animal productivity.

Objectives

To identify underlying metabolic and neural mechanisms regulating feed intake in monogastric animals and propose control strategies.

Design

Review literature relating to the control of feed intake in monogastric animals.

Outcomes

Dietary ingredients influence feed intake by (i) modifying the rate of removal of digesta from the gastrointestinal tract (GIT) and (ii) stimulating hunger or satiety responses in the brain. Mild distension of the GIT stimulates peristaltic activity and feed intake, but excessive distension induces satiety through vagal responses to the hypothalamus. Nutrients (fatty acids, partially hydrolysed protein, volatile fatty acids, methane) reaching the distal small intestine and colon stimulate the 'intestinal brakes' through release of specific GIT and pancreatic peptides, which reduce peristaltic activity and digesta flow, as well as acting directly on the hypothalamus to reduce long-term intake. Animals monitor their short-term energy status *via* adenosine monophosphate-activated protein kinase (AMPK) and mammalian target of rapamycin (mTOR). These kinases regulate the concentration of a key intake-controlling metabolite, malonyl-CoA, within the hypothalamus. Malonyl-CoA concentrations determine the relative release of orexigenic or anorexigenic peptides from the melanocortin system to alter feed intake. Animals also monitor long-term energy status (adiposity) *via* leptin, insulin, and ghrelin which affect malonyl-CoA concentrations, melanocortin activity, and feed intake.

Conclusion

These concepts help explain how dietary and non-dietary situations affect feed intake in monogastrics.

P07

Measuring energy intake of children and adolescents: A systematic review of dietary assessment methods validated using the doubly labelled water method

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Introduction

There are limited validated tools to assess dietary intake in paediatric populations.

Objective

To conduct a systematic review to evaluate the validity of available dietary assessment tools used to estimate the energy intake (EI) of children (aged 0-18 years) by comparison with total energy expenditure (TEE), measured using the gold standard doubly labelled water (DLW) method.

Design

Articles were searched for via online health related databases from 1975 to January, 2009 using keywords and hand-searching reference lists. Inclusion criteria identified studies in which: children and adolescents (0-18 years) were the participants; and the primary outcome was reported EI validated by comparison with TEE, as measured using DLW. Abstracts were reviewed and articles were checked for quality and critically appraised using standardised tools. Data was extracted from relevant articles included in the review.

Outcomes

A total of 975 articles were identified using the search strategies, of which 15 studies were identified for inclusion. Participants were aged from 0.5 to 18 years. A variety of dietary assessment methods were used to assess EI across the 15 studies; these included 24 hour multiple pass recall (24h MPR) and estimated food records (4 studies each), diet history methods and weighed food records (3 studies each), food frequency questionnaires (2 studies), tape records and a combination of weighed food records and estimated food records (1 study each).

Conclusions

No dietary assessment tool was found to be accurate at assessing EI of children 0-18yrs at the individual level when compared to EI estimated using DLW. At the group level, 24h MPR was found to provide the best estimate of EI in children, as it was deemed to be accurate in all studies utilising this method (4 out of 15 studies; mean limit of agreement -2.11 - +2.29 MJ/day). A limited number of validation studies which use DLW have been conducted internationally and within the Australian setting, highlighting the need for further research.

P08

Nutritional risk assessment - addition of fluoride to packaged water

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Background

Food Standards Australia New Zealand (FSANZ) routinely undertakes nutritional risk assessments of applications it receives requesting permission to add nutrients and biologically active substances to food. In 2006, FSANZ received an application seeking the voluntary addition of fluoride to packaged water available for sale in Australia and New Zealand. At the time, fluoride could not be added to these waters. The results presented here represent just one aspect of the comprehensive risk assessment that was undertaken for this application.

Objective

To identify any potential nutritional or public health risks associated with adding fluoride at the proposed range of 0.6-1.0 mg/L (total of naturally occurring and added fluoride). This range reflects the current fluoridation rates for municipal water supplies (0.6-1.0 mg/L) and recommended fluoridation targets.

Design

Dietary intakes were assessed to determine the intake of fluoride from food and water among the Australian and New Zealand populations. A comprehensive literature search was also performed to determine the health risks that would be associated with excessive fluoride intakes in Australia and New Zealand.

Results

When water is fluoridated at 0.6-1.0 mg/L, between 5% and 22% of 2-3 year olds, and between <1% and 5% of 4-8 year olds may exceed the Upper Level of Intake (UL) for fluoride set by the National Health and Medical Research Council (NHMRC). However, it was noted that the UL is based on the development of moderate forms of dental fluorosis. FSANZ's review of the available literature showed that even with the existing fluoridation of municipal water supplies (up to 1.0 mg/L), very mild and mild forms of dental fluorosis (considered to be a benefit rather than a health concern) are observed in around 10-25% of Australian and New Zealand children, while moderate dental fluorosis is rarely seen in Australia and New Zealand. These results indicated that the estimated exceedances of the existing UL were unlikely to be a public health concern.

Conclusion

The apparent disagreement between the intake estimates and the lack of a corresponding increase in the prevalence of moderate dental fluorosis indicates that the existing ULs for fluoride need review.

P09
Are obese or low meat-eating young females inadvertently reducing their iron deficiency risk through their hormonal contraceptive (HC) practices?

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Background
Reproductive-aged females are particularly at risk of developing iron deficiency, partly due to menstrual blood losses. Hormonal contraceptives (HC) may reduce menstrual blood volume and frequency and potentially reduce iron deficiency risk. However, low meat consumption and excess body fat may increase iron deficiency risk through lowered absorption or utilisation of dietary iron by the body.

Objective
To determine whether menstrual frequency and hormonal contraceptive practices differed between BMI category and regularity of meat consumption in female university students.

Design
A 20 item questionnaire was conducted in female Griffith University, Gold Coast students aged ≤ 25 years. All measures were self-report, including height and weight. Students were randomly selected from classes available on campus. Descriptive and chi-square analyses were conducted.

Outcomes
Two thirds (66.5%, 547/822) of respondents were on HCs. Over half of respondents (52.6%) ate red meat less than twice weekly (low meat) or were vegetarian (V) (low meat & V=448/850, low meat=398, V=50). Over half of respondents (54.9%, 449/818) were healthy weight, 10.4% overweight and 4.2% obese or morbidly obese. There was no association between menstrual frequency or HC use and BMI or lowered meat consumption ($p>0.05$). However obese respondents were less likely to be using HCs ($\chi^2=8.929$, $p=0.030$), and more likely to have been pregnant ($\chi^2=6.867$, $p=0.009$) and donated blood ($\chi^2=9.405$, $p=0.024$).

Conclusion
While HC use is commonplace amongst young female university students, young females with lifestyles that may increase their iron deficiency risk may not be more likely to reduce menstrual volume or frequency and subsequent iron loss through HC use.

P10
Dietary intake patterns and major sources of flavonoids in a representative sample of the Australian population

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Background
Flavonoids are an important category of non-nutrient food components with antioxidant and other potentially significant biological properties. Evidence from laboratory-based *in vitro* studies provide compelling evidence supporting the involvement of dietary flavonoid intake in human chronic disease risk. However, studies on associations between intakes of individual flavonoids and disease outcomes at the population level are scarce.

Objective
To identify patterns and sources of dietary intake of individual flavonoids in the Australian population.

Design
Data from the 24-hour diet recall questionnaire of the national nutrition survey (NNS95- involving a representative sample of 10851 subjects) were combined with USDA data on flavonoid content of foods to identify consumption patterns and key sources.

Outcomes
Black and green teas clearly were the dominant sources of the flavonols and flavan-3-ols. The largest flavonol sources comprised onion (isorhamnetin and quercetin), broccoli (kaempferol and quercetin), apple (quercetin), grape (quercetin), coffee (myrcetin) and beans (quercetin). Oranges (hesperetin and naringenin), lemon (eriodictyol), mandarin (hesperetin) and grapefruit (naringenin) were the major flavonone sources and parsley (apigenin), celery (apigenin and luteolin) and English spinach (luteolin) were the major flavone sources. Wine was the major anthocyanadin source (delphinidin, malvidin, peonidin and petunidin), with smaller amounts from cherry (pelargonidin and peonidin) and blueberry (delphinidin, malvidin, peonidin and petunidin).

Conclusion
The major dietary flavonoid sources for Australian adults are restricted to a relatively small number of key foods. Inter-age variations in flavonoid intake are particularly pronounced for naringenin and some anthocyanins. The complexity of consumption patterns for individual flavonoids indicates that the promotion of foods on the basis of antioxidant content (as a general phenomenon) oversimplifies the issue and potentially understates the contribution that vegetables and fruits make to good health.

P11
Consuming kiwifruit with an iron fortified breakfast cereal meal improves iron status in women with low iron stores

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Background
Ascorbic acid enhances iron absorption. It is less clear whether consuming ascorbic acid-rich foods (such as kiwifruit) with meals fortified with iron improves iron status.

Objective
To investigate whether the consumption of ZESPRI™ GOLD kiwifruit with an iron-fortified breakfast cereal meal would improve iron status in women with low iron stores.

Design
Seventy-three healthy women aged 18-44 years with low iron status (serum ferritin (SF)≤25µg/L, haemoglobin≥115g/L) were randomly stratified by SF concentration and age to receive an iron-fortified breakfast cereal (16mg iron as ferrous sulphate per 64g serve) and either two ZESPRI™ Gold kiwifruit (163mg vitamin C) (n=37) or a banana (0mg vitamin C) (n=36) at breakfast every day for 16 weeks. SF, haemoglobin, soluble transferrin receptor, and C-reactive protein were measured at baseline and end.

Outcomes
Results are reported as median [25, 75 percentile]. SF concentrations increased significantly from baseline to end in the kiwifruit group (18.0µg/L [11.5, 24.5] to 23.0µg/L [19.5, 29.0]; p=0.001) but not the banana group (16.5µg/L [10.0, 20.8] to 17.5µg/L [12.3, 22.8)]; p=0.086). The difference in changes from baseline to end between the two groups was significant (p=0.018). Soluble transferrin receptor concentrations decreased significantly in the kiwifruit group (2.9mg/L [2.5, 3.8] to 2.7mg/L [2.1, 3.0]; p<0.001) and did not change in the banana group (p=0.318). The difference in changes from baseline to end between the two groups was statistically significant (p=0.006). The difference in changes from baseline to end for haemoglobin concentrations between the two groups was not statistically significant (p=0.151).

Conclusion
The consumption of an iron–fortified breakfast cereal in conjunction with an ascorbic acid-rich food improved iron status in women with low iron stores.

P12
Effects of a high fat, high energy food challenge on mood, fatigue and gastrointestinal symptoms

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Background
As the rates of overweight and obesity continue to rise within the Australian population several studies have identified that high dietary fat intake may increase the risk of overweight and obesity. In addition to the potential effects on body composition, some research has shown that a high fat intake also causes an increase in symptoms of bloating, nausea and aspects of central fatigue.

Objective
To determine if a high fat/high energy (HFHE) meal results in a perceived increase in fatigue, mood and gastrointestinal symptoms.

Design
Subjects were randomized to receive a high fat/ high energy (HFHE) (n=19) or low fat/ low energy (LFLE) (n=10) food challenge. Subjects on the HFHE challenge consumed 200% daily energy requirement in 24 hours, including 50% energy from fat. Subjects on the LFLE challenge consumed 75% daily energy requirement in 24 hours, including 20% energy from fat. At the end of the 24 hour period, all subjects were asked to complete a visual analogue scale, describing their perception of symptoms including headache, bloating, constipation, bowel motions, diarrhoea, nausea, vomiting, fevers, chills, muscle pains, mood changes, concentration, tiredness and lethargy.

Outcomes
After the 24 hour food challenge there was a significant increase in bloating [5.3 (3.3-7.2) versus 0.1 (0.0-0.2), p<0.001], bowel motions [3.8 (0.00-6.6) versus 0.00 (0.00-0.25), p=0.003], diarrhoea [0.6 (0.00-4.8) versus 0.00 (0.00-0.01), p=0.016] and nausea [2.4 (0.4-6.1) versus 0.00 (0.00-0.05), p=0.001] in the HFHE versus LFLE diets respectively. There were no significant differences in symptoms in the obese versus non obese subjects who consumed the HFHE diet however there was a trend to more fatigue related symptoms in the non obese group.

Conclusion
This study has demonstrated that consumption of a HFHE diet over a 24 hour period is linked to a perceived increase in bloating, bowel motions, diarrhoea and nausea. There was a trend for increased fatigue related symptoms in the non-obese subjects, which will be investigated in a larger sample size.

Funding
NHMRC Project Grant

P13
Dietary glycemic index and glycemic load among Australian children and adolescents

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Background
Dietary glycemic index and glycemic load have been linked to risk of several chronic diseases. However there are no published data regarding the overall dietary glycemic index (GI) and glycemic load (GL) of Australian children and adolescents.

Objective
To assess the dietary GI and GL of participants of the 2007 Australian National Children's Nutrition and Physical Activity Survey (2007ANCNPAS), and identify the main food groups contributing to their GL.

Design
This is a secondary analysis of the 2007ANCNPAS. We have only included participants who provided two 24-hour recalls (*n* = 4655). The plausibility of the food intake data were assessed using the Goldberg cut-off for specific physical activity level (PAL), and 360 under-reporters and 100 over-reporters were excluded based on this method. Eleven participants who reported unusually high intakes of foods (e.g. 6 cups of rice in a meal) were also excluded. The final dataset included 4184 participants, of whom 51% were male. Glycemic indices of food items in the 2007ANCNPAS dataset were assigned based on published methods.

Outcomes
The weighted mean ± standard deviation (SD) dietary GI and GL of the study population were 54.1 ± 4.7 and 135.7 ± 44.3 respectively. No significant difference by sex was detected for dietary GI, but boys have a significantly higher dietary GL than girls ($P < 0.001$). There is an increasing trend of both dietary GI and GL with age (both $P < 0.001$). Participants born in Africa or Asia both have a significantly higher GI than children born in Australia and Europe. Preliminary analysis showed breads contributed more than 15% of the respondents' dietary GL, followed by breakfast cereals (9.4%), cereal grains and pasta (9.1%), sweetened drinks (6.5%) and potatoes (including chips) (5.8%). Around one-third of the top 20 foods contributing to GL were energy dense, nutrient poor (EDNP) foods.

Conclusion
A range of food items were contributing to the dietary GL of the respondents, including EDNP foods. The increasing dietary GI by age warrants further investigation.

P14
Composition of the milk of the marsupial quokka, *Setonix brachyurus*

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Background
The quokka is a medium-sized herbivorous marsupial (2.7 to 4.2 kg) belonging to the Macropodidae family. The gestation period in quokkas is between 25 and 26 days, and one young is usually produced from a pregnancy. The pouch young weighs about 0.3 g at birth which represents 0.01% of the adult body weight (3 kg).

Objective
The aim of this study was to investigate the composition of the milk of the quokka, *Setonix brachyurus*.

Design
The pouch young were separated from their mothers for a maximum of 20 mins. Milk was collected from captive quokkas after injection of oxytocin.

Outcomes
The concentration of protein in the milk averaged 60 g L^{-1} from 70 to 180 days post partum. The protein levels then began to increase, peaking at 120 g L^{-1} towards the end of lactation (300 days). The lipid and total solids content averaged 50 and 180 g L^{-1} from 70 to 180 days, increasing to 150 g L^{-1} and 250 g L^{-1} after permanent pouch exit (200 days). In contrast, the total carbohydrate concentration of the milk decreased from 80 to 20 g L^{-1} at 150 days. The concentration of free lactose started to decrease at 180 days from 30 to 10 g L^{-1}, and galactose and glucose began to rise from 1 to 9 g L^{-1} and 0.5 to 4.0 g L^{-1}, coincident with the decline in total carbohydrate.

Conclusion
Similar to other marsupials, the composition of the milk of the quokka is different from human milk in relation to the dramatic changes that occur during lactation and the level of concentrations of the major components.

P15
Nutritional risk assessment – LDL cholesterol lowering effects of tall oil phytosterols in a new food

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Background
Plant sterols are added to foods to lower serum LDL cholesterol levels. In 2008, FSANZ received an application seeking permission to add tall oil derived phytosterol esters to a new food product, reduced fat cheeses. Although plant

sterols are currently permitted in some foods in Australia and New Zealand, FSANZ requires evidence of consistency with stated purpose, such as a demonstration of a LDL cholesterol lowering effect in the relevant food matrix, before they are permitted to be added to that category of food. The literature shows that the ability of phytosterols to reduce LDL cholesterol can be affected by the food matrix and method of incorporation into foods because poorly soluble crystalline phytosterols decrease LDL cholesterol to a lesser degree or are ineffective. Therefore a component of the risk assessment was an examination of information relating to tall oil derived phytosterol esters when delivered in the proposed food.

Objective

To assess whether plant sterols mixtures added to reduced fat cheese are capable of lowering LDL-cholesterol.

Design

Owing to the previously conflicting findings in the published literature regarding the cholesterol lowering effects of plant sterols in reduced fat foods, a systematic literature review and meta-analysis was undertaken to determine the LDL-cholesterol lowering effects. The small number of studies in cheese products and conclusions from the food technology assessment focused the review on plant sterol mixtures in cheese and other dairy products, including reduced fat dairy products.

Results

All trials included in the review showed a post intervention decrease in LDL-cholesterol levels as well as a decrease in LDL levels in the phytosterol group when compared to the control group. The reductions in LDL cholesterol ranged from 2.50% to 13.80% from daily plant sterol amounts of 1 to 3.2 g/day.

Conclusion

These results support the use of tall oil derived phytosterol esters in new food product- reduced fat cheeses.

P16
Evaluation of the potential use of maca, a functional food, as a food ingredient through the study of interaction with various starches

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Background

Maca (*Lepidium meyenii*) is a South American plant which has long been used as a food for its nutritional value and medicinal properties. Maca contains free basic amino acids proven to balance hormonal activity and to alleviate fertility problems in both sexes. While there are several studies highlighting its nutritional importance, there are not many studies characterizing maca as an ingredient. As bakery products are prime targets for incorporation of maca, understanding its interactions with starch is of paramount importance.

Objective

The aim of this study is to evaluate maca and starch interactions in order to facilitate the use of this functional food as an ingredient in a range of applications used in the food industry.

Design

This study used four different starches (potato, corn, tapioca and wheat) as controls, with maca added at three different concentrations (3, 5 and 10% w/w). The effect of addition on the physical properties of the starches was then determined. The Water Absorption Index (WAI) in maca and the starches, with and without maca addition, heated at different temperatures (50, 60, 70, 80 and 90 °C) was also measured. The pasting profiles of starches and starch-maca mixtures, and compression tests were used to evaluate the effect of maca on gel formation and strength.

Results

Adding maca had a significant ($P<0.05$) effect by decreasing the WAI of starches at temperatures close to the starch pasting temperature. The viscosity of the starches decreased significantly ($P< 0.05$) when maca was added, including peak viscosity, breakdown viscosity, final viscosity, as well as consistency. Adding maca at 10% (w/w) also significantly decreased the strength of the potato, corn and wheat starch gels.

Conclusion

Interaction of maca with a number of commonly used starches showed that there were no detrimental effects on the starches' physical properties at low levels of addition. Therefore, the incorporation of an established functional food, such as maca, as a food ingredient is possible and should allow for a number of potential food applications. Such foods would benefit from the proven properties of maca without compromising the all important texture of the final product.

P17
The relationship between HFE genotype, iron and copper status in young women

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Background

Haemochromatosis is the most common cause of iron (Fe) overload and early screening for the gene (HFE) is important. Copper (Cu) is involved in Fe metabolism and low Cu status affects tissue Fe release. There are limited data on the prevalence of HFE in young women and also on the effect that it has on Fe and Cu status.

Objective

To determine the prevalence of HFE, and its relationship with Fe and Cu biomarkers in young women.

Design
Females (n=215; age 23.1±4.1y; BMI 21.7±3.0 kg/m^2; mean ± SD) were recruited to participate in a cross-sectional study. Dietary intake, HFE genotype (C282Y, H63D, S65C) and biomarkers of iron and copper status were determined.

Outcomes
The prevalence of the HFE genotype was identified, especially H63D and S65C, in 37% of the population. Mean concentrations of serum Cu and ferritin (Fn) were 16.3±5.7 µmol/L and 28.8±26.7 µmol/L in wild-type (WT) and 18.0±6.6 µmol/L and 31.0±27.1 µmol/L in HFE, respectively. Mean dietary Cu intake was 2.0±0.6 mg/day, and no differences were observed between HFE and WT. Low serum Fn concentrations were found in 29% of women with the HFE genotype and none had levels that are used to screen for HFE (Fn>150 µg/L). Transferrin saturation (TS) was higher in those with C282Y (31.2±13.3%) and H63D (34.2±18.9%) as compared to WT (24.1±9.7%). S65C genotypes had higher TS:Fn ratio than WT (5.8±4.7vs.1.4±1.1, P<0.001). TS was significantly correlated with serum Cu (r=-0.237, P<0.001), 15.8% of women with the HFE genotype had low Cu status (serum Cu<12 µmol/L), and serum Cu was significantly lower in S65C (12.1±6.7 µmol/L) than in WT (16.3±5.7 µmol/L).

Conclusion
A high prevalence of HFE genotype and iron deficiency rather than iron overload was found. TS was a more sensitive marker of the HFE mutation than SF. Therefore, some women with the HFE genotype had iron biomarkers that would be diagnosed as iron deficiency, and the effect of iron supplementation could be detrimental. Young women with HFE, especially those with S65C, may be at risk of copper deficiency.

P18
Coordinated regulation of zinc transporter mRNA expression in healthy males and females

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Disciplines of [1]Nutrition and Metabolism and [2]Molecular Biology, School of Molecular and Microbial Biosciences, University of Sydney, NSW 2006

Background
Zinc transporters are integral to the regulation of zinc homeostasis. The ZnT family of zinc transporters promotes cellular zinc efflux or its sequestration into intracellular vesicles. Conversely, Zip transporters facilitate extracellular or vesicular zinc influx into the cytoplasm. Although much recent progress has been made in the characterisation of zinc transporters, little is known about their expression patterns in healthy humans.

Objective
To investigate the expression levels of a range of zinc transporter mRNAs in the peripheral blood mononuclear cells (PBMCs) of healthy males and females using real-time PCR techniques.

Design
Forty healthy subjects (20 men, 20 women) were recruited and fasting blood samples collected. Plasma zinc concentrations were determined. Total RNA from PBMCs was isolated and transcribed into cDNA using reverse transcription. Quantification of the mRNA levels of ZnT1, ZnT5, ZnT7, ZnT8, Zip1, Zip3, Zip7, and Zip10 was conducted using Taqman real-time PCR. Results were expressed relative to 18S mRNA.

Outcomes
The age and BMI of the participants were 40.1 ± 12.8 kg (mean ± SD) and 24.2 ± 3.4 kg/m^2, respectively. Plasma zinc concentrations ranged from 10.5-16.8 µmol/L, with a trend towards lower plasma zinc levels in women compared to men (-1.1 µmol/L, P=0.06). Plasma zinc was correlated with ZnT1 in women (r=0.6, P=0.005) but not in men, with the relationship strengthening in women older than 40 y (r=0.9, P<0.001, n=10). In addition, plasma zinc was correlated with ZnT7 in women (r=0.45, P<0.05) and with Zip1 in older women only (r=0.7, P<0.05). ZnT1, ZnT7, and Zip1 mRNAs were expressed at levels approximately 2-4 fold higher than ZnT5, Zip3, and Zip10. ZnT1 was correlated with Zip1 in all cases (r=0.9, P<0.001) and with Zip10 only in men (r=0.9, P<0.001). ZnT8 mRNA expression was detected in only 10, predominantly younger (<30 y), subjects.

Conclusion
Zinc transporters are differentially regulated by age and gender, suggesting a role for steroidal hormones in the regulation of zinc metabolism. The positive association between ZnT1 and Zip1, which have reciprocal roles in zinc transport, provides insight into the coordinated control of zinc homeostasis in humans.

P19
Phenolic content of the mango variety, Tommy Atkins, imported into New Zealand

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Background
Mango (Mangifera indica L.) is an important tropical fruit and has widespread consumer appeal. The major countries producing mangoes are India, Mexico, Brazil, China, Thailand, Indonesia, Philippines, Vietnam, Egypt and Nigeria. Mango is recognised as a rich source of antioxidants, carotenoids, tocopherol, Vitamin C and phenolic compounds. Phenolic compounds in human diets are known to provide protection effect against chronic degenerative disease related to oxidative stress.

Objectives
This abstract reports on the total phenol content of the mango variety, Tommy Atkins, imported into New Zealand. The phenol profile of extracts from the peel, flesh and kernel were determined in order to provide information as to whether these mango components would be viable source of phenols for human consumption.

Design
Trays of mangoes from a major fruit importer were purchased and six mangoes were randomly selected. Each mango was photographed, colour on two sides recorded using a Hunter Colorimeter and then weighed. The total phenolic content of the peel, flesh and kernel was estimated the total phenolic content using the Folin-Ciocalteu method as described by Singleton et al (1999). A similar procedure was used to determine the total phenolic content of extracts obtained in Vietnam from freeze-dried Vietnamese mango varieties.

Outcome
The total phenolic content of the flesh, peel and kernel of the variety, Tommy Atkins, imported into New Zealand were 31.11 ± 5.65, 426.34 ± 69.74 and 1803.16 ± 234.06 mg Gallic acid equivalents (GaE)/100g of fresh sample, respectively. This demonstrates that average Tommy Atkins mango contains 2260.467 mg GaE/100g of fresh fruit if the entire mango was used. Freeze-dried samples of Vietnamese mangoes show a similar distribution of total phenols in flesh, peel and kernel, ranging from 253.32 ± 95.01 to 699.38 ± 206.15, from 822.30±163.60 to 4120.01± 1172.10 and from 6286.06±49.72 to 10664.07 ± 2077.29 mg GaE/100g of dry matter, respectively.

Conclusion
The results show that the mango flesh of Tommy Atkins variety imported into New Zealand is a good source of total phenols. The peel and kernel yield even greater amount of phenols and are considered as a potential commercial source of total phenols and antioxidants.

P20
The content of bioactive constituents as a quality index for Vietnamese teas

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Background
Vietnam is the seventh biggest tea producing country in the world. However, there is limited data on the composition of Vietnamese teas. The constituent catechins, caffeine, and theanine play an important role in its taste quality and in its human health-enhancing potential as an archetypal functional food.

Objective
The aim was to determine the bioactive constituents of Vietnamese green, black and oolong teas and compare them with teas from other countries, to provide a general measure of quality for Vietnamese teas.

Design
A total of 49 teas of 3 types (green, black and oolong) from Vietnam (3 types), China (green and oolong), Japan (green) and the Australian marketplace (black) were analysed. The teas (1g) were brewed in 100 ml of hot water for 20 min and analysed by HPLC to quantify the catechins, caffeine, and theanine, using L-tryptophan as an internal standard. The constituents were expressed in mg/g dry tea and the significance was taken to be $P<0.05$.

Outcomes
As expected, the Vietnamese green teas had higher catechins (70.3 mg/g) than the Vietnamese oolong teas (33.8 mg/g) and the Vietnamese black teas (11.6 mg/g). Caffeine did not differ between the 3 Vietnamese types of tea (20.7, 19.3 and 19.9 mg/g) and theanine did not differ between the Vietnamese green (50.2 mg/g) and black teas (50.9 mg/g) but it was lower in the oolong teas (32.2 mg/g). Vietnamese green teas had similar catechins and theanine to Chinese green teas (67.5 and 48.4 mg/g, respectively) but higher than Japanese green teas (59.8 and 43.1 mg/g, respectively). Caffeine was lower in Vietnamese green teas than in Chinese green teas (24.6 mg/g) and higher than in Japanese green teas (16.5 mg/g). Vietnamese oolong teas had lower catechins, higher theanine but similar caffeine compared to Chinese oolong teas (48.1, 22.2 and 18.3 mg/g, respectively). Vietnamese black teas had lower catechins and caffeine but higher theanine than Australian marketplace black teas (15.8, 22.4 and 24.9 mg/g, respectively).

Conclusion
Based on their bioactive constituents as a quality index, and despite some differences, the 3 types of Vietnamese teas were found to be comparable to their Chinese, Japanese and Australian marketplace counterparts.

P21
Development of a microwave-assisted water method for the extraction of green tea bioactive constituents

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Background
Tea is second only to water in terms of worldwide consumption and its popularity is increasing due to studies linking the bioactive components of tea with several health benefits. Extraction of these bioactives is therefore of interest. Among extraction methods, microwave-assisted extraction (MAE) has recently shown potential because of its energy efficiency and its high extraction capability with less solvent consumption.

Objective
The aim was to determine the optimal MAE conditions for extracting the bioactive constituents, catechins, caffeine and theanine, from dry green tea.

Design
The impact of four parameters on extraction efficacy, 1) pre-leaching time (0-180 min), 2) MAE time (0-6 min), 3) water to tea ratio (4:1-100:1 $ml g^{-1}$), and 4) tea particle sizes (normal tea vs tea ground to 850 µm or less) were studied

to maximise the efficiency of extraction. Water was added to the tea samples at various ratios of water to tea and kept at room temperature for different lengths of pre-leaching time followed by irradiation in a 800W microwave oven: initially 43 seconds on followed by 13 seconds off and then 3 seconds on and 13 seconds off for various lengths of time to maintain the temperature at 80^0C. The tea constituents were then analysed by HPLC.

Outcomes

The extraction of the green tea bioactive constituents, catechins, caffeine, and theanine reached a plateau after 1 h of pre-leaching and 2 minutes of MAE. For example, the extraction efficacy for catechins, caffeine and theanine was 89.9, 30.5, and 22.9 mgg^{-1}, respectively for MAE for 2 minutes compared to 93.5, 31.5, and 22.9 mgg^{-1}, respectively for MAE for 4 minutes which was not significantly different ($P > 0.05$). The extraction efficacy also increased when the ratio of water to tea was increased from 4:1 to 100:1 mlg^{-1}. However, an acceptable water saving extraction efficacy of 80% was achieved at a water to tea ratio of 30 mlg^{-1} compared to 100% at the 100:1 ratio. Grinding the tea to 850 µm or less also increased the extraction efficacy compared to unground normal tea.

Conclusion

The optimal conditions for MAE extraction from dry green tea were therefore found to be 1 h of pre-leaching, 2 minutes of MAE, a water to tea ratio of 30 mlg^{-1}, and tea particles of 850 µm or less.

P22
Determination of epigallocatechin gallate in human plasma using high pressure liquid chromatography with mass spectrometer detection

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Background

Greet tea (GT) is a widely consumed beverage around the world, especially in Asia. Increased consumption of GT has been linked with many health benefits which are primarily ascribed to epigallocatechin gallate (EGCG), its main flavonoid constituent. However, the bioavailability of EGCG in humans is low and its determination in plasma poses a significant challenge. In this respect, high pressure liquid chromatography (HPLC) coupled with detection by mass spectrometry (MS) offers superior sensitivity while also adding specificity.

Objective

The aim of the study was to develop and validate a method for measuring plasma EGCG levels after oral administration of pure EGCG in healthy humans using HPLC-MS.

Design

After adding 100 ng/ml of (+)-catechin as an internal standard (IS) to lithium heparin-anticoagulated plasma (200 µl), EGCG and IS were extracted into ethyl acetate (1 ml, 3 times). After drying with N_2 and dissolution in 15% (v/v) acetonitrile and 20% (w/v) vitamin C, chromatographic separation and detection were achieved using a Prodigy 250 x 4.6 mm, 5µ ODS(3) 100Å column (Phenomenex). A gradient of two mobile phases consisting of 0.2% (v/v) formic acid (A) and acetonitrile (B) was run at a flow rate of 1ml/min and a HPLC system equipped with an MS electrospray ionisation detector (Finnigan Surveyor, Thermo) set in negative polarity mode with the cone voltage at 75 volts and the probe temperature at 629ºC, was used to quantify the EGCG.

Outcomes

The retention times for IS (11.3 min) and EGCG (22.3 min) were well apart with no background interference from plasma and the limit of detection for EGCG was 15.6 ng/ml. A standard curve of the peak area ratios of EGCG/IS (31.3 to 1,000 ng/ml EGCG) was linear (R^2=.995) and used to determine EGCG concentrations in human plasma samples. The intra- and inter-assay coefficients of variation were <5 and <6%, respectively. The accuracy was >86% for a low concentration (62.5 ng/ml) and >97% for a high concentration (500 ng/ml).

Conclusion

A HPLC-MS method was successfully developed to determine the low plasma EGCG concentrations seen in healthy humans after oral administration of EGCG.

P23
Maternal probiotic supplementation prevents stress induced unfavourable alterations in the balance of the enteric microflora

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Background

Exposure to early life stress results in predisposition of individuals to functional gastro-intestinal disorders (FGD) such as irritable bowel syndrome (IBS) later in life. A common feature of FGDs is disruption of the normal balance of the gut microbiota. Previous studies have indicated that neonatal administration of probiotics can prevent the impaired integrity of the gut microbiota.

Objective

The objective of this study was to determine whether maternal probiotic intake can act prophylactically to prevent the alterations in the balance of the enteric microflora induced by neonatal stress.

Design

Treatment rats received a probiotic combination of *Bifidobacterium lactis* Bb12 and *Propionibacterium jensenii* 702 during pregnancy and lactation via drinking water daily. Controls rats had equal access to water without the

probiotics added. After birth, pups were subjected to intermittent neonatal maternal separation (NMS) for 3 h per day from postnatal day (PND) 2 to 14 or left undisturbed (NS). Faecal samples were then collected at PND 24 or 25 and microbial composition of the samples were analysed by plating on selective agar plates.

Outcomes

Faecal samples of neonates born to non-probiotic treated mothers demonstrated significantly higher counts of Enterobacteriaceae and *Bacteroides* spp when exposed to NMS compared to the NS pups ($p < 0.05$). A significant decrease in *Lactobacilli* and *Bifidobacteria* spp. was also observed in this NMS group ($p < 0.05$). The faecal samples from neonates born to mothers treated with probiotics and subjected to NMS had significantly lower counts of Enterobacteriaceae and *Bacteroides* spp and significantly higher counts of *Lactobacilli* and *Bifidobacteria* spp than the NMS neonate group born to the non-probiotic treated mother ($p < 0.05$).

Conclusion

Our findings suggest that maternal supplementary probiotics can restore an unbalanced flora resulted from early life stress. Early life stress is a common event in neonatal life and prophylactic treatment with probiotics may be an avenue for therapeutic intervention against the development of FGDs.

P24

Development of probiotic goat's milk ice cream and effect of packaging materials on product quality

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Background

Goat's milk is considered as a good nutritional source with higher digestibility and lower allergenic properties compared to cow's milk. Varieties of probiotic ice creams are gaining popularity due to health promoting effects of probiotics. Development of probiotic ice cream is technologically challenging due to instability of probiotics in frozen products. Although significant packaging effects on quality of some fermented products have been observed, study of the influence of the packaging materials on microbial, physico-chemical and sensory qualities of probiotic ice cream has been limited.

Objective

To produce goat's milk ice cream as a delivery vehicle for probiotic bacteria *Lactobacillus acidophilus* (LA), *Bifidobacterium lactis* BB 12 (BB 12) and newly identified potential probiotic *Propionibacterium jensenii* 702 (PJ 702), and to evaluate the microbial, physico-chemical and sensory qualities of the product.

Design

Chocolate flavoured goat's milk ice cream was produced with probiotic PJ 702, LA and BB 12 and packed in 3 different types of packaging: glass, polyethylene and polypropylene. Stored products at -20 ^{o}C were assessed for viability of probiotics over 8 months using spread plate techniques in triplicate. Physico-chemical properties were measured according to standard methods. Sensory qualities were assessed using nine point hedonic scales.

Outcomes

All the probiotic strains were able to maintain higher viability levels (above 10^7cfu/g) regardless of the packaging. Packaging materials had a significant effect on first dripping times ($P<0.05$) whereas acidity, pH, total solids, fat and ash levels did not demonstrate significant differences ($P>0.05$) after one week of production at the storage. The product received a high score for overall acceptance regarding sensory characteristics.

Conclusion

Different packaging materials do not have a significant effect on viability of the tested probiotics, sensory qualities and most of the physico-chemical properties at -20 ^{o}C. Newly identified potential probiotic PJ 702 is suitable for the development of probiotic goat's milk ice cream due to their higher viability over the shelf life.

P25

A study on stability of the novel probiotic *Propionibacterium jensenii* 702 in orange juice

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Background

Probiotics have been increasingly included in commercial dairy based products. Development of non-dairy probiotic foods may, however, suit consumers who are allergic to milk components, suffer from lactose maldigestion or do not like dairy products.

Objective

The aim of this study was to examine the stability of the novel probiotic *Propionibacterium jensenii* 702 in orange juice either alone or in paired combination with probiotic *Lactobacillus* strains.

Design

Propionibacterium jensenii 702 either alone or in paired combination with *Lactobacillus reuteri* ATCC 55730 or *Lactobacillus rhamnosus* GG was added to a commercial orange juice either with pulp or without pulp. The probiotic orange juices were then refrigerated (4 °C) for one month. Viable probiotic cells were counted on agar plates at different time points during the storage.

Outcomes

Our results showed that there was no difference between stability of *P. jensenii* 702 (alone or in the presence of the probiotic *Lactobacillus* strains) in orange juice with pulp and without pulp. *P. jensenii* 702 remained at almost consistent levels during the study. In combinations, viable counts of *P. jensenii* 702 decreased gradually but remained at levels higher than 10^6 CFU/mL throughout the storage.

Conclusion

Orange juice could be an ideal carrier for *P. jensenii* 702. However, sensory properties of the product and effect of this food matrix on functional properties of the probiotic should be further investigated.

P26

In vitro antimicrobial effect of spices on probiotic bacteria

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Background

Spices are a new source of functional flavouring agents due to the presence of antioxidant and antimicrobial activity against enteric pathogens. Probiotic bacteria that provide a number of health benefits via the gut may be influenced by the incorporation of spices as functional food ingredients. However, there is little information on their efficacy against commercial probiotic bacteria present in dairy-based foods.

Objective

To determine the *in vitro* antimicrobial activity of different spices against commercial strains of probiotic bacteria.

Design

Five spices were selected based on their known antimicrobial activity against *E. coli* or *S. aureus*. All spices were independently solvent extracted using acetone, methanol and ethanol. Each solvent extract was then rotary evaporated to obtain the antimicrobial extract. The Kirby Bauer disc diffusion method and the agar well diffusion method were used to test the antimicrobial activity of each extract of each spice against probiotic organisms (*Bifidobacterium animalis* subsp *lactis* , BB-12, *Lactobacillus acidophilus*) using the enteric pathogens, *E. coli* or *S. aureus*, as controls. Data was statistically analysed using ANOVA at the 95% confidence interval ($p<0.05$).

Outcomes

According to the size of the zone of inhibition (Kirby-Bauer method), clove (was the most effective spice against all bacteria including probiotics (Bb12, 15 ±0.5mm; LA4461, 9.7± 0.6mm) based upon all extracts tested ($p<0.05$). Cumin, cardamom, cinnamon and nutmeg were not active against the probiotics (Bb12, 6.0 ± .0.6mm; LA4461, 6.0 ± .0.6mm) compared with clove. Cinnamon and nutmeg had significantly less activity against the probiotics compared with the enteric pathogens ($p< 0.05$).

Conclusions

Most spices tested (clove, cumin and cardamom) exhibited activity against the enteric pathogens and were less active against the probiotic strains. Nutmeg, cumin and cinnamon were the least active against all bacteria which could allow for their use in dairy-based foods containing probiotics. Further research of other spices and other extraction procedures is required to confirm the suitability of spices functioning with probiotics in dairy-based products.

P27

Anti-cancer properties of Illawarra plum in colon cancer cells

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Background

There is increasing resistance of colorectal cancer to chemotherapy, therefore cancer prevention and treatment by non-toxic chemicals is an alternative strategy. The anti-oxidants present in fruit have many health benefits including prevention of cancer development. The native Australian bush fruit Illawarra plum has a high content of anthocyanin-rich phenolics, with an anti-oxidant capacity at levels higher than other fruit.

Objective

To investigate the effect of Illawarra plum on colon cancer and non-cancer colon cells.

Design

Cells were treated with varying doses of Illawarra plum extract (up to 48 h). Cell proliferation was measured with the MTT assay, and morphology and cell cycle was assessed with microscopy and flow cytometry. DNA damage was assessed by measuring telomere length. The ability of Illawarra plum to prevent oxidative damage was assessed in the non-cancer cell line by pre-treating cells with plum extract for 24 h and then challenging with hydrogen peroxide for 60 min, which was followed by the MTT assay.

Outcomes

The MTT assay and microscopy showed Illawarra plum extract to have anti-proliferative properties in only the cancer cells, with growth suppressed in a dose- and time-dependent manner. There was also a decrease in telomere length, a cell cycle delay in G2/M phase and an increase in cells in the pre-G1 peak. Microscopy also showed that plum changed the morphology and size of cancer cells. Pre-treatment of non-cancer cells with plum reduced the toxicity induced by hydrogen peroxide.

Conclusion

This study has shown that Illawarra plum is able to reduce the proliferation of colon cancer cells and alter their morphology, but is not cytotoxic to healthy colon cells.

P28
Resveratrol prevents hydrogen peroxide induced cytotoxicity

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Background
Trans-resveratrol (trans-3,4',5-trihydroxystilbene) (RESV) is a naturally occurring polyphenol molecule present in many plants, nuts and fruits (including grapes). Currently, there is no data reported on the anti-inflammatory effects of trans-resveratrol in bronchial epithelial cells (BECs) in asthma associated with RV infection.

Objective
To investigate the ability to enrich BECs with RESV and determine if this can occur without significant toxicity. We then sought to determine if this treatment reduced the effect of oxidative stress following exposure to hydrogen peroxide (H_2O_2).

Design
Human BECs (Calu-3 cells) were grown to confluence. BECs were treated with 10, 25, 50 and 100 µM. RESV uptake by the cells was measured by HPLC. Cell viability was assessed by Trypan blue exclusion. Cells were then enriched with RESV (50 µM) for 1 hr, and then treated with H_2O_2 (0.001, 0.01, 0.1 %) for 2, 6 and 24 hr. RESV was dissolved and diluted in 0.1 % DMSO/medium. Cell viability was assessed by lactate dehydrogenase (LDH) release in to the supernatant and by flow cytometry with Annexin V-PE staining.

Outcomes
RESV was not detected in BECs enriched with 10 and 25 µM. Treatment with RESV 50 µM and 100 µM led to 0.49 to 0.56 ug/ml uptake of RESV at 1, 2, 4 and 6 hr. BECs showed no cytotoxicity with RESV up to 100 µM as measured by Trypan blue exclusion. Pretreatment of BECs with RESV (50 µM) reduced toxicity from exposure with H_2O_2 with prevention of LDH release and improved cell viability.

Conclusions
A dose of 50 µM was optimal for increasing intracellular levels without inducing toxicity. Pretreatment of BECs with RESV prevented BECs toxicity from exposure to an oxidative stress in the form of H_2O_2.

P29
Development of a nutritional basis for feeding the Australian Defence Force

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Background
Members of the Australian Defence Force (ADF) are fed according to a 'ration scale' which is designed to meet the 'worst case' situation—the nutritional requirements of young, active, males. However, not all ADF members are equally active, and females generally have lower nutritional requirements than males, so there is the potential for more food to be made available than is needed. DSTO-Scottsdale was requested to devise ration scales that more efficiently satisfy the demonstrated nutritional requirements of ADF members.

Objective
To devise ration scales that provide appropriate food entitlements to ADF members based on gender, age and level of physical activity.

Design
The results of doubly-labelled water studies to determine the energy expenditures of ADF members were used to devise Military Recommended Dietary Intakes (MRDIs) applicable to four sub-groups of ADF members—adult males, adult females, adolescent males and adolescent females—also taking into account five levels of physical activity. An adaptation of a program used to assess the draft Nutrient Reference Values (NRVs) for Australia and New Zealand was then used to determine food entitlements to meet the MRDIs.

Outcomes
The revised ration scales provide 12.5, 14.5, 16.5, 19.5 and 25 MJ per person per day respectively for the five activity categories. The percentages of energy derived from protein, fat and carbohydrate respectively vary according to activity category, ranging from 15–20:25–35:50–55 (category 1) to 11–16:21–31:58–63 for category 5 (Special Forces selection). The MRDIs for thiamin, riboflavin, niacin, vitamin B6 and sodium are somewhat higher than the corresponding civilian NRVs; all other MRDIs are identical to the NRVs.

Conclusion
The new ration scales will ensure that troops are fed according to their nutritional requirements. This has the potential to reduce wastage and to impact positively on nutritional status of ADF members, including reduced levels of overweight/obesity, together with the flexibility to allow caterers to better meet the nutritional requirements of the group of defence personnel being fed.

P30
The cost of healthy eating for pregnant and breastfeeding women in Otago, New Zealand

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Background
Having access to sufficient, safe and nutritious food is important all New Zealanders, but it assumes an even greater importance for women when they are pregnant or breast feeding. There are a number of barriers to accessing a healthy diet; these include food cost, availability and affordability within the family budget.

Objective
The aim of this present investigation was to determine whether or not the recommended nutritional guidelines for pregnant and breast feeding women set out by the New Zealand Ministry of Health (MOH) are realistically affordable for women in today's economic climate.

Design
Using the Ministry of Health guidelines for healthy eating in pregnancy and breastfeeding sample menus (MOH 2008) a shopping list was developed and priced at three Dunedin Supermarkets and one rural Otago general store. The final costs were compared to the University of Otago (2008) estimated food costs for adult Dunedin women to determine whether the guidelines are affordable. In addition the number of foods available for purchase in each location provided data on the accessibility of the food.

Outcomes
The cost of purchasing the food in all locations was prohibitive when compared to the University of Otago estimated costs and only 65% of the food items were available for purchase in the rural location. The cost was also expensive when compared to household estimated expenditure by Statistics NZ.

Conclusion
This study provides information for midwives and other health professionals working with women during pregnancy and breastfeeding about the affordability of healthy eating. There is a challenge to consider not only the guidelines but the circumstances facing the woman. Of further concern is the difficulty for woman in rural locations to have access to the foods recommended in the sample menus from the Ministry of Health.

Further research is required into the actual barrier to health, particularly during pregnancy and breast feeding, so that guidelines can be met.

P31
Nutritional status, micronutrient concentrations and length of stay in an elderly rehabilitation unit

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Background
Protein energy under-nutrition is associated with delayed wound healing and increased length of hospital stay (LOS), but less is known about the effects of micronutrient deficiencies on hospital outcomes.

Objective
To investigate the nutritional status of vitamins B12, D and folate and their relationship with LOS

Design
Cross sectional study of elderly patients (n=146, age >60 y) admitted to an aged care rehabilitation unit over 2 periods of 8 weeks in 2005 and 2006. Nutritional assessment was performed with the Mini Nutritional Assessment (MNA) Tool and biochemical screening assessed the status of protein, vitamin B12, vitamin D and folate.

Outcomes
Nineteen percent (19%) of patients were malnourished and 61% were at risk of malnutrition as determined by the MNA. Forty nine subjects (36%) had serum vitamin B12 concentrations <220 pmol/L and 80 subjects (60%) had serum vitamin D <50 nmol/L, whilst only 8 subjects (6%) had serum folate <6.8 nmol/L. LOS in rehabilitation was related to the concentration of vitamin B12 but not vitamin D, folate, albumin or MNA score. Overall, subjects with vitamin B12 concentrations <220 pmol/L had a small increase in LOS (16 ± 16.7 vs 15 ± 13.4 d (median ± SD), respectively, (Mann Whitney p=0.009). However, subjects without diagnosed malnutrition as determined by the MNA and vitamin B12 <220 pmol/L had a longer LOS compared to those with B12 levels ≥220 pmol/L (median 18 ± 18.5 vs 15 ± 10.3) d respectively, (Mann Whitney p=0.008).

Conclusions
The present study highlights high levels of malnutrition and deficiencies of vitamin B12 and vitamin D in an elderly rehabilitation population. Vitamin B12 concentrations <220 pmol/L were associated with longer LOS, particularly in the subset of subjects who were without diagnosed malnutrition as determined by the MNA. The present study supports the need for routine nutritional screening.

P32
Food acquisition patterns in newly-arrived African refugees

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Background
Resettlement by refugees in a new country requires adaptation to different cultural and food environments. Lack of availability and accessibility to traditional foods, differences in taste of food and disconnection with traditional culture intensifies and accelerates a form of nutrition transition which renders humanitarian immigrants particularly susceptible to chronic disease risk.

Objective
To document the food neighbourhoods, food acquisition patterns, and dietary habits of newly arrived refugees to identify opportunities for food-based nutrition education intervention.

Design
Ten humanitarian migrants (belonging to separate households) who had arrived from sub-Saharan Africa in the preceding 12 months were recruited to this study through snowball sampling. Subjects maintained a 7-day travel diary recording details of all occasions of travel outside their homes. The purchase, consumption and acquisition of food was recorded within these diaries. A series of 24hr diet recalls also were collected independent of the travel diary to determine usual food intake.

Outcomes
Despite low socio-economic status, this study population seemed not to live in food deserts, having access to major grocery retailers and fruit and vegetable retailers within 2km of their homes. Participants usually frequented the nearest major grocery retailer to their domcilei. However, the independent grocer used was not necessarily the closest, showing possible ulterior motives for the choice of these types of shops. Those living within 1km from a major grocery retailer reported higher consumption of vegetables, compared to those living further away. No significant difference ($p<0.05$) was found between dietary intake and duration of stay. There was a dichotomy between ethnic African food prepared at home (eaten either at home or elsewhere) and at friends' homes, and "Australian" food eaten at training programs and other public events attended by subjects.

Conclusion
Training programs and other formal meeting occasions were the major access points to local Australian food habits, and may represent an important potential setting to influence the trajectory of dietary acculturation.

P33
Process evaluation of a primary school garden-enhanced nutrition curriculum

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Background
Despite evidence of the health benefits of consuming fruit and vegetables, national data indicate many children do not meet current intake recommendations. There is some evidence that school gardens may positively impact on food preferences and intake relating to fruit and vegetable consumption, but limited process data exists to evaluate and inform future interventions.

Objective
To determine the feasibility and acceptability of a primary school-based nutrition curriculum with garden-based activities from the perspectives of key stakeholders (students, parents and teachers).

Design
Quasi-experimental trial with 3 groups (i) garden + nutrition curriculum and (ii) nutrition curriculum only study arms and (iii) control group.

Outcomes
Self report questionnaires and interview data from students, parents and teachers. Results demonstrated that there was an increase in children's interest in fruit and vegetables and positive perceptions about vegetables and the garden-based learning experiences. Parents of students in the garden-enhanced group reported positively about the impact of the program on their children's attitudes and preferences of fruit and vegetable intake and dietary behaviours. All teachers found the nutrition curriculum and integrated garden experiences to be a rich educational experience for their class and believed the integrated approach to the program maximised student achievement of outcomes.

Conclusion
A school-based garden program appears to be a feasible and acceptable approach to enhance a nutrition curriculum in primary schools relating to fruit and vegetable intake. The school garden as an experiential learning approach was highly valued by students, teachers and parents alike.

P34
Scenario Based Learning interactive – an innovative approach to nutrition teaching

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Background
Equipping Nutrition graduates with the necessary skills to enable them to assess client's needs and offer meaningful advice is a challenge. Tradition teaching methods (e.g. lecturing to a group) may help students to gain knowledge but this approach is limited in its ability to teach students the essential higher learning skills, such as, how to apply that knowledge. Scenario Based Learning interactive (SBLi) is a computer-based teaching tool that actively engages students in the learning process. This relatively new tool has been used and assessed for a number of disciplines but the evaluation of its use within a Nutrition setting has not been formerly presented.

Objective
This paper presents an example of a problem-based interactive case-study which has been prepared using freely available SBLi software. It describes how the interactive SBLi approach can be used to engage students in higher levels of learning and it presents data on student's perceptions of this novel teaching tool within a Nutrition setting.

Design
A scenario-based interactive case study exploring the relationship between body size and health outcomes was designed to be used by third-year internal Nutrition students. Fifteen students were asked to complete the SBLi case-study and were then invited to evaluate it. Three main aspects were evaluated through a series of questionnaire statements; learning benefits; the teaching/learning approach; the scenario template. The students were asked if they strongly agreed (SA), agreed (A), were unsure (U), disagreed (D) or strongly disagreed (SD) with statements made relating to each of these areas. Each aspect was evaluated using two, three or five statements.

Outcomes
The majority of the students reacted positively to this teaching approach (80% SA/A; 6.5% D. P = <0.01). Most agreed or strongly agreed that the higher-learning objectives were met (93.5% SA/A; 4.5% D. P = <0.01) and most found this approach user-friendly (85% SA/A; 2.5% D. P = <0.01) as well as interesting and engaging (75% SA/A; 15% D. P = <0.01). None of the students strongly disagreed with any of the statements.

Conclusion
This study showed that most of the students questioned reacted favourable to the SBLi approach and most felt that the learning objectives were achieved. The potential for this innovative teaching tool is unlimited. Within a Nutrition setting, it could be used not only for student learning (for both internal and extramural student) but could be adapted for use with school groups or within a wider community setting.

P35
Neighbourhoods and fruit and vegetable consumption: a mediating analysis

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Background
Within Australia individuals rarely meet the dietary recommendation for daily intakes of fruits and vegetables. Determinants of dietary behaviours have traditionally been linked to individual characteristics such as socio-economic position however there is a growing amount of evidence showing that areas in which people live are also likely to influence dietary behaviours. This is because certain residential environments may not support healthy decisions due to healthy foods being less accessible, costing more or being of poorer quality.

Objective
To explore whether consumption of fruits and vegetables vary by area-socioeconomic characteristics and whether this association is mediated by food store access and fruit and vegetable availability and price.

Design
Details of fruit and vegetable consumption and the food environment were collected as part of the SESAW study comprising of 1,567 women from 45 suburbs within Melbourne. All Melbourne suburbs were initially ranked according to its Socio-Economic Index for Areas (SEIFA) score which were sorted into septiles. Fifteen suburbs were randomly selected from highest, middle and lowest septile ensuring a greater exposure gradient in relation to area socioeconomic characteristics. Additional data was collected on the location of greengrocers and supermarkets and within these the availability and price of fruit and vegetable items. Consumption of fruit and vegetables were analysed in relation to the area-socioeconomic measures with the mediating role of the food environment explored.

Outcomes
Women in the most socioeconomically disadvantaged areas were less likely to consume two or more servings of vegetables per day compared to those in the least disadvantaged areas (OR 0.43; 95% CI 0.29 - 0.62). No significant associations were found for fruit consumption. The association with vegetable consumption was not significantly attenuated by food store access, the availability and price of vegetables within suburbs or the opening hours of supermarkets and greengrocers.

Conclusion
Area-level differences in vegetable purchasing were not attributed to features of the food environment. It may be that other unmeasured area-level variables are important here (eg the quality of fresh produce) or that these

associations are explained by other individual factors (eg food preference, attitudes and/or perceptions).

P36
Influence of nutritional messages front of pack on consumers' perception of soup

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Background
Major food industries are taking steps to decrease salt (NaCl) contents of their products. Although consumers may not be able to taste small reductions of NaCl, nutritional information such as "now reduced in salt", or a healthy choices logo (e.g. Tick logo) may alter consumer's expectation and perceived taste perception of salt reduced products.

Objective
The present study investigated whether consumers' expectations and actual taste perceptions are influenced by health information which is placed front of pack.

Design
Participants (n=46) tasted 4 identical soups in a monadic fashion. Each soup was presented with a different "health" label: 1) "now with reduced salt", 2) "healthy choices logo", 3) "healthy choices logo" + "now with reduced salt",4) no additional information about the salt contents. Participants were asked to report expected liking, desire and salt intensity before tasting the soup. After tasting the soup they were asked to report actual liking, desire and salt intensity.

Outcomes
The presence of health labels front of pack generated a lower expected liking, desire and salt intensity than when no such labels were present (all P-values<0.05). When participants actually tasted the soups, soups presented with the label "now with reduced salt" were perceived as less salty than the remaining soups (p<0.05). Health conscious participants judged the health-labels as more credible and expected to like soups with health-labels more than participants who were less health conscious P<0.05).

Conclusion
The potential negative effect of health-labels on consumer's expectations should be taken into account when placing health information front of pack

P37
A parent-led home-based intervention to increase Australian children's liking of vegetables

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Background
When considering explanations for the low levels of children's vegetable consumption, taste preferences are often highlighted as a significant barrier.

Objective
The aim of this study was to determine the effectiveness of a parent-led intervention based on taste exposure on increasing vegetable liking and consumption in young children.

Design
The study was conducted in three cohorts over 9 months; data collection is complete for cohorts 1 and 2 and cohort 3 (n = 55) is currently underway. In cohorts 1 and 2, 129 parents and children (79 boys, 50 girls) aged 44 to 84 months (M = 61.2, SD = 9.7) were randomised to 3 groups: control, exposure, and exposure + sticker reward. A trained fieldworker conducted taste test assessments in the home. Based on the taste assessment with 6 parent-selected vegetables, the 4th ranked vegetable was assigned the target vegetable, and was offered everyday for 14 days. Hedonic ratings were assessed on a 4-point scale at baseline, 2 weeks (post-intervention), 4 weeks and 3 months.

Outcomes
Post-intervention (2 weeks) liking increased significantly for all groups, $F(1, 79) = 44.5$, $P < 0.05$. There was a trend ($P = 0.08$) indicating greater mean improvement in both intervention groups (exposure: 2.12±.17 and exposure + sticker reward 2.24±.17) compared with the control (1.62±.15). Improvements in liking were maintained at the 3 month follow-up. Results for the full sample will be presented and will include findings for other outcome measures including child vegetable consumption.

Conclusions
Taste exposure is a very simple strategy and preliminary results indicate that parents can use this technique to help improve their children's liking of vegetables relatively quickly (2 weeks) and the changes in liking are maintained in the medium-term.

This project has been facilitated by HAL in partnership with AUSVEG and has been funded by the vegetable levy. The Australian Government provides matched funding for all HAL's R&D activities.

P38

The use of table and cooking salt in Australian adults

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Background

Dietary sodium, the major source being salt, is a modifiable risk factor in the development of cardiovascular disease. Salt intake of Australian adults is above dietary recommendations. Approximately 15-20% of dietary salt intake comes from salt added at the table and during cooking.

Objective

To determine the frequency of and the demographic characteristics associated with discretionary salt use.

Design

A cross sectional survey conducted in shopping centres within Metropolitan Melbourne. Participants completed a questionnaire assessing discretionary salt use and attitudes to salt intake. Participants were classified as salt users if they added salt always or sometimes at the table and/or during cooking, non-salt users were defined as those that never add salt either at the table or during cooking.

Outcomes

Four hundred and seventy four valid surveys were collected (65% female, 77% Caucasian, 64% holding a university qualification). Eighty nine percent of respondents were classified as salt users and 11% as non-salt users. Of the salt users 52% reported that they always or sometimes add salt during cooking and at the table, with a greater number of respondents reporting that they always add salt during cooking (29%) than at the table (12%). Those of Asian descent and younger respondents aged 18 – 24 years were more likely to be salt users (χ^2=12.31, df=2, p<0.001; n χ^2=19.2, df=5, p<0.01). Despite the high level of salt use, 56% of respondents believed their own daily salt intake would be at or below the 6 g/d guideline set by the National Heart Foundation.

Conclusion

Discretionary salt use remains high. To successfully reduce population dietary salt intake public health campaigns are urgently required and must target both discretionary salt use and high salt commercial products. Such campaigns should be targeted at younger age groups and should be appropriate for all ethnic backgrounds to raise the awareness of the risks of a high salt diet on health.

P39

Digit span improvement following long chain omega-3 polyunsaturated fatty acids supplementation: A preliminary study

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Background

Neurocognitive deficits are reported in participants with juvenile Bipolar Disorder (JBD) including digit span. Digit span is an indicator of short-term auditory memory, working memory, concentration and attention. Long-chain omega-3 polyunsaturated fatty acids (LCn-3PUFA) are important to brain development and functioning, however, their effects on neurocognitive function are not clear.

Objective

To examine the effectiveness of LCn-PUFA supplementation on digit span ability in children and adolescents with JBD.

Design

Fifteen participants with JBD (9-18 yr) consumed LCn-3PUFA supplements containing 360 mg day^{-1} eicosapentaenoic acid (EPA) and 1560 mg day^{-1} docosahexaenoic acid (DHA) for 6 weeks in an open-label preliminary study. Digit span and red blood cell (RBC) LCn-3PUFA concentrations were assessed prior to and following supplementation.

Outcomes

Digit Backwards (2.3 ± 0.45 vs 3.2 ± 0.46, p = 0.010) and Scaled Overall Digit Span (11.1 ± 0.70 vs 12.1 ± 0.72, p = 0.046) significantly improved following supplementation. RBC DHA was significantly positively correlated to longest digit span backwards (r = 0.84, p < 0.001) and overall digit span scaled scores (r = 0.62, p = 0.010).

Conclusions

Supplementation with LCn-3PUFA was associated with improvements in neurocognitive functioning. Further studies should examine other neuropsychological outcomes in a larger sample in a randomised controlled trial (RCT) and whether cognitive deficits associated with JBD can be prevented.

P40

Milk production from birth to 57 days of lactation in pump-dependent preterm mothers

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Background

Studies on improving milk production in pump-dependent preterm mothers have focused on comparing milk output using different pumping schedules, suction patterns, and pump features. Morton J et al. from Stanford University recently reported that by combining manual techniques with electric pumping from the first post-partum day, mothers of preterm infants can attain and sustain high milk production levels.

Objective

To determine whether milk output during initiation of lactation (secretory activation) predicts milk output during an established phase of lactation and whether there is a dominant breast in these mothers.

Design

A retrospective analysis of milk production data generated from 2004-06, for mothers with babies born < 31weeks of gestation and having a birth weight of <1.5 kg who were recruited at Stanford University Medical Centre. Maternal milk production was recorded from each breast from post-partum day 1 to 57.

Outcomes

There was large variation in milk production between mothers. Median milk production ranged 207.0 (IQR=240.2) mL/24 h at day 5 to 507.0(IQR=403) mL/24 h at day 14 and finally to 768.0(IQR=437.8) mL/24 h at day 57. Across all women, there were no significant differences in milk production between the left and right breast ($p = 0.4486$), although many women (37%) had consistently higher volumes from one breast. Most importantly, there was an association between early and late milk production, with higher milk output at day 5 post-partum being predictive of higher milk output at day 14 ($p < 0.001$) and at day 57 ($p < 0.001$).

Conclusion

Even though breast dominance either varies with individual mothers or may be absent in some mothers, there are no significant differences in overall milk production between the left and right breast. Milk production by day 5 is predictive of milk output at day 14 and 57 post-partum. We therefore conclude that there should be a concerted effort to improve milk production by day 5 in order to ensure continuous high milk production volumes.

P41

Effects of acute energy restriction on antropyloroduodenal motor, plasma cholecystokinin, appetite and energy intake responses to small intestinal lipid in the obese

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Background

The presence of nutrients in the small intestine modulates gastrointestinal function and suppresses appetite and energy intake. There is evidence from studies conducted in animals and healthy lean humans that previous patterns of energy intake, including excess and restriction, may affect these parameters.

Objective

To assess the hypothesis that in the obese acute energy restriction would enhance antropyloroduodenal (APD), plasma cholecystokinin (CCK), appetite and energy intake responses to small intestinal lipid.

Design

Eight obese males (aged 50±1 yr; BMI 34±1 kg/m^2) were studied on two occasions immediately before, and after, a four-day very-low calorie diet (VLCD; 70% reduction of daily energy requirements). On both study days, APD motility, plasma CCK and appetite perceptions were measured during a 120-min intraduodenal infusion of 10 % Intralipid® at 2.86 kcal/min. Immediately after the infusion, energy intake at a buffet meal was quantified.

Outcomes

Following the VLCD, basal pyloric pressures (mean values between *t*=0–120 min; visit 1: 3±1 mmHg, visit 2: 6±1 mmHg) and the number (visit 1: 1078±17, visit 2: 1402±20) and amplitude (visit 1: 39±3 mmHg, visit 2: 51±5 mmHg) of isolated pyloric pressure waves were greater, and numbers of antral (visit 1: 694±29, visit 2: 212±11) and duodenal (visit 1: 2989±91, visit 2: 1910±66) pressure waves were lower ($P<0.05$ for all), during the infusion period. In contrast, there was no difference in plasma CCK concentrations between visits. Following the VLCD, hunger was less (area under the curve; visit 1: 1226±808, visit 2: -933±363 min.mm), and energy intake was reduced (visit 1: 4378±691, visit 2: 3634±701 kJ) ($P<0.05$ for both), in response to lipid.

Conclusion

These observations indicate that the sensitivity of the small intestine to lipid is modified following a four-day VLCD, resulting in enhanced gastrointestinal motor responses and reduced hunger and energy intake. It is possible that the change in sensitivity to lipid may be mediated, at least in part, by an increased sensitivity to the gastrointestinal effects of CCK, in the absence of any differences in plasma concentrations.

P42

The ability of Kiwifruit to promote tight junctions in an intestinal cell line model

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Background

Kiwifruit have been identified as having positive effects on digestive and gut health. ZESPRI® GOLD Kiwifruit (*Actinidia chinensis* "Hort16A") exhibit antimicrobial and prebiotic activity *in vitro* and the green variety (*Actinidia deliciosa* "Hayward") can promote laxation in humans, particularly the elderly. In addition a ZESPRI® GOLD Kiwifruit puree has been shown to boost gut-associated adaptive immune responses in a mouse model. There are other factors that influence gut health including aspects of inflammation that may affect the integrity of the gut epithelium, and both green and ZESPRI® GOLD Kiwifruit have previously been shown to inhibit the production of the major pro-inflammatory cytokines from cells of the immune system.

Objective

Intrinsic to the protective function of an intact gut epithelium is the formation of intercellular tight junctions between the cell membranes of adjacent epithelial cells. The aim was investigate whether kiwifruit could contribute to an intact intestinal epithelial barrier, when it has been disrupted by an inflammatory insult.

Design

Water and solvent (ethyl acetate) extracts of green and ZESPRI® GOLD Kiwifruit were tested for their ability to protect tight junctions in human Caco-2 intestinal epithelial cell monolayers from disruption by the pro-inflammatory cytokines tumour necrosis factor α (TNFα) and interferon γ (IFNγ). This protection was measured by effects on trans-epithelial electrical resistance (TEER) across the Caco-2 cell monolayer, as tight junction disruption is associated with a reduction in TEER.

Outcomes

The ZESPRI® GOLD solvent extract significantly reversed the TEER reduction induced by TNFα/IFNγ and therefore the epithelial barrier breakdown caused by these cytokines.

Conclusions

This result suggests that ZESPRI® GOLD Kiwifruit may contribute to an intact epithelial barrier, and adds to our knowledge of the effects of kiwifruit on gut health.

P43

Effects of added nucleotides on Toll-like receptor expression in hand reared dairy calves

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Background

Nucleotides are semi-essential micronutrients whose primary function is to provide the structural units of the nucleic acids DNA and RNA. The intestinal mucosa and immune system have low capacity for *de novo* synthesis of nucleotide. Dietary supplementation of nucleotides in species other than calves such as, rats, pigs, and humans has led to increased intestinal integrity, improved intestinal morphology and reduced diarrhoea.

Objective

To evaluate whether supplementation with nucleotides can improve innate immunity of hand reared dairy calves through altering mRNA expression of Toll-like receptors (TLR) and 3 downstream genes in Peyers patches (PP) and mesenteric lymph nodes.

Design

Two treatment groups of Friesian bull calves (16 calves / group) were fed from 5 d of age on commercial milk replacer (CMR) plus 2 g/day of nucleotide preparation (Group N) or CMR without additives (Control). Eight calves per treatment were killed at 14 and at 21 d and samples collected from jejunal and ileal PP, areas of jejunum without PP (JNP) and mesenteric lymph nodes. RT-PCR was used to determine mRNA expression of TLR2, TLR4 and 3 downstream genes relative to GAPDH and β-actin expression.

Outcomes

There was a significant fold increase ($P < 0.05$) in TLR4 mRNA expression in jejunal PP (JPP) of 3 week old calves fed N compared with those at 2 weeks of age. A significant decrease ($P < 0.05$) in mRNA expression of TLR2, MyD88, TRAF6 and NF-κB was observed in JPP and mesenteric lymph nodes of 2 and 3 weeks old group N calves compared to Control calves. However, N appeared to increase mRNA expression of TLR2, TLR4, MyD88, TRAF6 and NF-κB in JNP at 3 weeks of age.

Conclusion

The result of the experiment indicate that the function of the TLR cascade of neonatal calves was influenced by N supplementation. This suggests that innate immune function can be modified by dietary nucleotides.

P44

Dietary arabinoxylan reduces amino acid digestibility in pigs consuming a high meat Western-style human diet

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Background

Arabinoxylan (AX) is the major soluble non-starch polysaccharide in wheat grains and is a by-product of flour fractionation after gluten and starch have been removed. The potential health benefit of dietary AX in high protein Western diets is being investigated. However there is no information available on the influence of AX on protein digestion in this diet.

Objective

The main aim of this study is to use a porcine model to evaluate the effect of dietary AX on amino acids digestibility in a Western diet.

Design

Two highly digestible Western-style human diets (250g crude protein/kg diet) containing barbecued rump steak, with and without a wheat extract containing 27% AX, were fed to two groups of grower pigs (n=5). Celite (as a source of acid insoluble ash, AIA) was added to the diets as an indigestible marker. At the end of the four week trial, all pigs were euthanized and digesta samples were taken from eight sections of the gastrointestinal tract (GIT) for dry matter (DM), AIA, nitrogen and amino acids analysis, and digestibility calculations.

Outcome

Digestibility of DM, nitrogen and amino acids were significantly ($P<0.01$) reduced in all sections of the GIT in pigs that received the AX supplemented diet.

Conclusion

Arabinoxylan decreased amino acid digestibility. The relationship between changes in protein and amino acid digestion, and the health benefits of AX in the human diet require further exploration.

P45

Nutrient intake of *Bos indicus* x heifers during the first and second trimesters of gestation affects liveweight and plasma concentrations of IGF-1 of male progeny

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Background

Insulin like growth factors (IGF)-1 and -2 and their binding proteins (IGFBP) are regulators of bovine postnatal growth. The concentrations of IGF and IGFBP in the postnatal period are influenced by maternal nutrient intake during gestation in several species, however little is known in this regard in the *bovine*.

Objective

To determine the effects of heifer nutrient intake during early- and mid-gestation on progeny: (1) circulating concentrations of IGF-1, -2 and total IGFBP (tIGFBP) and (2) growth pathway from birth until age 628 d.

Design

Male progeny (n = 33) of composite-breed beef heifers fed 76.29 MJ ME and 1.37 kg CP/d (H**/-**) or 62.54 MJ ME and 0.41 kg CP/d (L/-) from 0 to 92 d of gestation; 82.43 MJ ME and 1.40 kg CP/d (-/H) or 63.14 MJ ME and 0.38 kg CP/d (-/L) from 93 to 180 d of gestation and 71.45 MJ ME and 1.06 kg CP/d from 180 d to parturition, were monitored from birth until 628 d. Calves grazed native pastures until 401 d after which they were fed a corn (*Zea mays*) silage based ration before entering an intensive feedlot finishing yard at 512 d for 116 d. Circulating concentrations of IGF-1, -2 and tIGFBP were measured at birth, 29, 65, 94, 191, 379 and 628 d and liveweight recorded at regular intervals. Castration occurred at 153 d and weaning at 191 d.

Outcomes

IGF-1 was greater in HL compared to LL ($P = 0.03$) from 29 to 191 d whilst at 628 d, IGF-2 concentration was greater in H/- animals ($P = 0.04$). L/- was associated with an approximate 5% increase in liveweight during the post-weaning period until 522 d ($P = 0.04$). There were no effects of maternal nutrient intake during gestation on plasma concentrations of IGF-1 or tIGFBP in the post-weaning period.

Conclusion

This study, to our knowledge, has demonstrated for the first time that there is a permanent effect of heifer nutrient intake during the first trimester of gestation on circulating concentrations of IGF-1 and -2 and post-weaning liveweight of male progeny.

P46

Trehalose may be an ideal early-feeding substrate for broiler chickens

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Background

In the commercial hatchery, broiler chicks are hatched over a wide time window, sometimes of up to 36 hours. More time is lost to get the chicks to the farms, so that overall, it may take up to three days for chicks to have access to feed or water. The chicks lose weight and may not recover enough to achieve their maximum potential growth. Chicks could benefit from early access to feed and water.

The objective of the study was to assess the loss in weight as a result of feed and water deprivation over 36 hours and to evaluate the suitability of some substrates for early-feeding of broiler chicks.

Design

In the first of two experiments, broiler chicks were either provided access to feed and water within 8 hours of hatch or held for 36 hours before gaining access. The birds were also fed on a commercial diet or a similar diet supplemented with palatinose or trehalose at the rate of 10 g/kg. In experiment 2, the two carbohydrate sources (10 or 20 g/kg diet) were further compared with an antibiotic, zinc-bacitracin (50 ppm). The diets were fed for 21days, followed by assessment of gross response, nutrient digestibility, development of the intestinal mucosa and activities of intestinal and pancreatic enzymes.

Outcomes

Holding chicks resulted in weight loss of up to 11 %. In experiment 1, feed intake was significantly increased ($P<0.001$) as a result of early access to feed. The 21d live weight of birds was improved ($P<0.001$) through supplementation with trehalose but not palatinose. In experiment 2, feed intake was similarly improved ($P<0.01$) and birds on the trehalose-supplemented diet were up to 7 % heavier than the control birds but this was not significant. There were no significant differences between the groups in the other variables that were assessed.

Conclusions

Trehalose may hold some promise as an early-feeding supplement for broiler chickens, but this would require further investigations.

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Compared to wine, grape seed extract significantly increased the gas production of pig small intestine microbiota *in vitro*

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Background

The *in vitro* cumulative gas production technique, indicates the kinetics of the fermentation process by a specific inoculum. Gut fermentation plays a critical role in break-down of nutrients such as non-digestible carbohydrates, as well as of plant secondary derived compounds. Both grape seed extract (GSE) and red wine have been recognized to contain rich sources of phenolic compounds. Previous work has tested the break-down of metabolites from polyphenols using faecal microbiota. This study compared the cumulative gas production between GSE and wine polyphenols using pig ileal microbiota, as a model for the human microbiota.

Objective

To compare how GSE and wine affected the *in vitro* fermentability of starch using pig ileal microbiota.

Design

GSE (Maganatural-AZ ® GSE, Polyphenolics, Madera, CA, USA) and Australia Shiraz wine (purchased from a wine supplier, South Australia) were prepared as follows: GSE solution (250 µg/mL), neat wine sample (PW), a diluted wine (DW) sample (with the same total phenolic content as the 250 µg/mL GSE solution), and eight blanks were tested for cumulative gas production over 72 h (n=4 each). The medium, test substance, and Gelose 80 (starch as energy source for the bacteria) were added to 60 mL serum bottles. Ileal fluid (2.5mL) from pigs fed a standard diet, was used as inoculum.

Outcomes

The gas production values for the GSE samples were significantly ($P<0.05$) higher than those for PW, and DW. The rates of gas production also appeared to be faster after 15 h for GSE compared with the other two. No gas was produced for any of the blank samples, except for BL2 (positive control).

Conclusion

These data demonstrate that *in vitro*, GSE produced significantly more total gas when compared with wine samples. Most gas would have come from the starch substrate, so it is possible either that the GSE stimulated those bacteria which were starch-degrading, or that the PW and DW inhibited their activity. These results suggest that grape derived polyphenols may affect gut fermentation. Further investigation of GSE is in progress.

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Dietary ruminant milk and soy solids differentially affect body growth in the interleukin-10 gene-deficient mouse model of intestinal inflammation

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Background

Inflammatory Bowel Diseases (IBD) are immune mediated diseases characterised by chronic intestinal inflammation. Ruminant milks form an important part of the human diet, but IBD patients are often advised to avoid dairy products and may substitute soy products. Milk and soy are reported to contain bioactive molecules with antibacterial, anti-inflammatory, and other immunomodulatory actions, which may be of use in IBD.

Objective

The aim of this study was to determine whether diets containing ruminant milk or soy solids reduce intestinal inflammation in interleukin-10 gene-deficient (*Il10*$^{-/-}$) mice.

Design

Il10$^{-/-}$ mice (15 per treatment) and C57BL/6J (control) mice (9 per treatment) were fed diets containing 40% sheep or cow milk, soy solids, or one of two control diets (milk-free modified-AIN76A or standard AIN76A) from 4 to 11 weeks of age. Weight and food intake were measured throughout the experiment, and intestinal tissue was taken for histopathological evaluation of inflammation. Colon weight was recorded as an additional measure of inflammation.

Outcomes

By 8 weeks of age, the average liveweight of *Il10*$^{-/-}$ mice on the cow milk diets stopped increasing, in contrast to that of the other groups. This effect was not explained by a difference in feed intake. While average colon weight was higher for *Il10*$^{-/-}$ mice versus C57s for each diet, the difference was much smaller for the cow milk diets. This could be a consequence of reduced growth rather than reduced severity of inflammation.

Conclusion

Diets incorporating ruminant milk and soy solids differentially affected the growth of *Il10*$^{-/-}$ mice. Analysis of histopathology will determine whether the diets also differentially affected intestinal inflammation.

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Increased rumen biohydrogenation of omega-3 and omega-6 fatty acids in silage compared with fresh forage

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Background

Preliminary evidence indicates the ratio of omega-6:omega-3 fatty acids is higher in silage compared with fresh forage. The availability of fatty acids from feedstuff for animal production is dependent on both the concentration of fatty acid and the lipid form in which it is contained. Fatty acids in storage lipid (triglyceride and phospholipid) are less available for biohydrogenation in the rumen compared with free fatty acids.

Objective

To examine changes in ruminal biohydrogenation of omega-3 and omega-6 fatty acids in silage compared with fresh forage and the relationship with lipid form.

Design

Silage was produced from an oat/pea mix. Total lipid was extracted from fresh forage and silage using the Folch procedure and individual lipid classes were separated using solid phase extraction (SPE). Biohydrogenation of fatty acids in rumen fluid over 24 hr was estimated using a modified first stage of the two-stage Tilley and Terry digestibility assay. Fatty acids were determined quantitatively by gas chromatography.

Outcomes

The proportion of total lipid as phospholipid was significantly lower and the proportion as free fatty acid was significantly higher in silage compared with fresh forage. More α-linolenic acid (C18:3n-3) and linoleic acid (C18:2n-6) from fresh forage escaped rumen biohydrogenation compared with silage. The proportion of fatty acid escaping biohydrogenation was inversely related to the proportion of fatty acid as free fatty acid.

Conclusions

The release of C18:3n-3 and C18:2n-6 as free fatty acid following ensiling is associated with a decrease in escape from rumen biohydrogenation and may result in less being available for metabolism to LCn-3PUFA and subsequent incorporation into meat. Future studies will examine the effects of different methods of silage production on fatty acid concentrations in silage and subsequent LCn-3PUFA concentrations in meat.

P50
Physiological validation of glycemic load (GL) in 13 iso-energetic mixed meals

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Background
Dietary glycemic load has been introduced to estimate the overall glucose response evoked by a serving of food. However, it has not been validated in the context of mixed meals of varying macronutrient content.

Objectives
To investigate the association between calculated GL of mixed meals and the observed glucose responses in healthy subjects.

Design
In this crossover design study, we investigate the glucose responses of 13 meals tested by two groups of healthy subjects (each group n = 10 or 11). The meals were iso-energetic (2000 kJ) but varied in macronutrient content and GL values. The reference white bread with 2000 kJ portion was also tested in both groups of subjects. Capillary blood samples were taken at regular internals over a two-hour session and assayed for glucose concentration. The observed glycemic responses of 13 mixed meals were compared with calculated GL, GI, macronutrient and fiber content.

Outcomes
The GL and GI were found to correlate strongly with the observed glucose responses to 13 mixed meals (Pearson correlations of r = 0.78, P = 0.002 and r = 0.58, P = 0.039) whereas macronutrients and fiber showed weak relations (P values>0.05). In stepwise linear regression model, only GL was significant and by itself accounted for 31% of the variance in the observed glucose responses of individual subjects.

Conclusion
The findings support the concept of glycemic load as a measure of overall glycemic response. In the context of composite meals of similar energy but varying macronutrient content, the glucose response evoked by meals is best predicted by glycemic load while macronutrients have limited value.

P51
Validation of fingertip whole blood against common blood biomarkers of omega-3 status in a dose-response intervention

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Background
Blood levels of long chain (LC) ω-3 PUFA may indicate risk for cardiovascular disease. LC ω-3 PUFA levels in whole blood from the fingertip could be a useful tool for assessing LC ω-3 status if validated against commonly measured blood parameters. The ability of fingertip whole blood to reflect changes in dietary LC ω-3 PUFA intake through a dose-response intervention has not been previously investigated.

Objective
We aimed to validate fingertip whole blood against venous erythrocytes (RBC) and plasma as a measure of LC ω-3 PUFA status in healthy women after supplementation with four different doses of fish oil.

Design
30 subjects provided fasting venous and fingertip blood samples before and after an 8-week double-blind, randomized intervention with 0, 0.35, 0.7 or 1.0 g/day LC ω-3 PUFA from DHA-rich tuna oil and/or placebo capsules. Blood fatty acids were analysed using direct transesterification (RBC, plasma) or a modified method (fingertip whole blood) followed by gas chromatography.

Outcomes
There was a strong linear relationship between fingertip whole blood LC ω-3 PUFA levels and those of RBC (R^2=0.83-0.88, P<0.0001), and plasma lipids (R^2=0.82-0.94, P<0.0001). Correlations between LC ω-3 PUFA dose and changes in LC ω-3 PUFA levels ranged from R^2=0.54-0.57 (P<0.0001) for all three biomarkers, indicating large variability between individuals in response to LC ω-3 supplementation. Fingertip whole blood EPA + DHA levels (mol %) were unchanged after 0 g/day, and rose from a mean baseline of 3.2±0.1% to 3.8±0.3%, 5.2±0.3%, and 5.6±0.4% after 0.35, 0.7 and 1.0 g/day respectively. Similarly, erythrocyte EPA + DHA levels rose from a mean baseline of 4.9±0.2% to 5.0±0.4%, 5.4±0.3%, 6.9±0.2% and 7.4±0.4% after 0, 0.35, 0.7 and 1.0 g/day respectively.

Conclusion
Fingertip whole blood corresponds well with common blood measures of LC ω-3 status, and displays similar sensitivity to changes in dietary LC ω-3 PUFA intake in a dose-response intervention.

P52
^{13}C NMR study of molecular interactions between bile salt micelles and cereal non-starch polysaccharides

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Background
Soluble fibre polysaccharides have been demonstrated to reduce serum cholesterol in humans. Interactions between soluble fibres such as (1,3:1,4) beta glucans and bile salt micelles in the digestive tract are an important contributing factor to the lowering of serum cholesterol. These interactions serve to reduce the reabsorption of bile salts with consequent increase in amounts excreted in the faeces. In order to produce further bile, cholesterol is catabolised in the liver, eventually leading to a reduction in serum levels. Despite the importance to human health, the nature of the interaction(s) between bile salt micelles and soluble fibre polysaccharides is not well-defined.

Objective
As a test of one of three hypotheses, we have investigated the direct molecular complexation of bile salt micelles and (1,3:1,4) beta glucan and arabinoxylan.

Design
^{13}C NMR titration experiments were used to study molecular interactions between both purified bile salts and whole pig bile, and different concentrations of both barley (1,3:1,4) beta glucan, and wheat arabinoxylan.

Outcome
Systematic chemical shift changes for bile resonances in the presence of increasing polysaccharide levels provide the first convincing evidence for molecular level interactions with both polysaccharides. Marked line broadening of bile resonances is observed in the presence of arabinoxylan but not (1,3:1,4) beta glucan, showing different effects of the two polymers on the physical micro-environment of bile salt micelles.

P53
Bovine Muc1 inhibits binding of enteric bacteria to Caco-2 cells

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Background
Impeding bacterial adhesion to intestinal epithelial receptors by the consumption of natural food components is an attractive strategy for the prevention of microbial related gastrointestinal illness. It was hypothesised that Muc1, a highly glycosylated mucin present in cows' milk, may be one such food component.

Objective
Purified bovine Muc1 was tested for its ability to inhibit binding of common enteric bacterial pathogens to Caco-2 cells grown *in vitro*.

Design
A range of monosaccharides, representative of the Muc1 oligosaccharide composition, were also tested for their ability to prevent binding of *Escherichia coli* and *Salmonella typhimurium* to Caco-2 cells.

Outcomes
Muc1 caused dose-dependant inhibition of binding of *E. coli*, *S typhimurium*, *Staphylococcus aureus* and *Bacillus subtilis* to Caco-2 cells. This inhibition was more pronounced for the Gram negative compared with Gram positive bacteria. It was also demonstrated that Muc1, immobilised on a membrane, bound all these bacterial species in a dose-dependant manner, although there was a greater interaction with the Gram negative bacteria. Monosaccharide inhibition of bacterial binding was structure dependant with sialic acid, L(-) fucose and D(+) mannose significantly inhibiting binding of both Gram negative species. N-acetylglucosamine and N-acetylgalactosamine significantly inhibited binding of *E. coli* whilst galactose, one of the most abundant Muc1 monosaccharides, showed the strongest inhibition against *S. typhimurium*. Treatment with neuraminidase significantly decreased the inhibitory properties of Muc1, further demonstrating the importance of sialic acid in adhesion inhibition.

Conclusion
It is concluded that bovine Muc1 prevents binding of bacteria to human intestinal cells and may have a role in preventing the binding of common enteropathogenic bacteria to human intestinal epithelial surfaces.

P54
Employee engagement: a strategy for supply chain sustainability in the food industry

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Background
Management of food supply chain is one of the most complicated industries in the world. Throughout the supply chain process quality, food safety and speed are important aspects in the food industry. Similarly management of the key stakeholders within the supply chain has become an important factor for organization to maintain supply chain sustainability.

Objective
Specifically the study is designed to achieve the following three main objectives.
1. Is to determine whether organisations could develop strong people engagement strategies to improve the economic advantage of people within the service organisations.

2. Is to investigate the opportunities of friendship management style by introducing friendship circles as a path to improve people engagement within service supply chain environments.
3. Is to establish the importance of developing an internal service supply chain model (within the organisation).

Design
A mix of qualitative and quantitative research approach was carried out for the study to establish research objectives.

Outcomes
The study revealed that engaged workforce are productive, self motivated, innovative, support each other for results and fervent about their work. It was also noted that engaged employees' helps to build a strong link with external supply chain stakeholders.

Conclusion
Supply chain is a process that adopts different management styles in different environments. Therefore, it is important to build a common approach to improve supply china sustainability. Benchmarking best management practices, processes and systems helps to maintain sustainability within the internal and external supply chain. The current economic environment reminds strategic decision makers within supply chains to maximise supply chain opportunities by sharing resources, knowledge, systems and processes and even people for better sustainability.

P55
Gene expression profiling in skeletal muscle during high protein weight loss

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Background
To date, no investigations have examined whether a high-protein diet reduces proteolytic pathways and enhances synthetic pathways compared to a high-carbohydrate diet in overweight or obese subjects. Evidence exists to indicate that in females the substitution of carbohydrate with protein in low-fat diets may be more effective in promoting weight loss and has been shown to have beneficial effects on body composition and cardiovascular disease risk factors. However, the genes that regulate these effects remain largely unknown.

Objective
To conduct a pilot study to determine the gene expression changes in skeletal muscle using Affymetrix Exon microarrays, to identify changes in biological processes following an energy-restricted diet with varying protein and carbohydrate macronutrient contents. Also, to assess gene expression changes as a result of calorie restriction compared to changes as a result of weight loss.

Design
14 overweight and obese females (mean age 52 yrs, mean BMI 33 kg/m^2) were randomised to either a high-protein (HP) or standard-protein (SP), energy-restricted diet. Weight, body composition, waist circumference, lipids, glucose, insulin, and insulin sensitivity (OGGT) were assessed. At baseline, week 2 and after 12 weeks of energy restriction a skeletal muscle and subcutaneous adipose tissue biopsy was collected for microarray and PCR analysis.

Outcomes
The HP and SP diets resulted in a mean weight loss of 7.54 (± 2.73) and 6.46 (± 4.76) kg respectively. Fat mass and total percentage fat was significantly reduced in both diet groups, however there was no statistical difference between the HP and SP diets. There was a trend (P=0.06) for participants in the HP group to retain more lean muscle mass than those in the SP group. Microarray data is currently being assessed to determine the pattern of gene expression changes during high protein weight loss.

Conclusion
It appears that high-protein, energy-restricted diets spare lean muscle mass. However, the genes that regulate these effects are yet to be explored. Using microarrays we hope to examine the patterns of gene expression changes during calorie-restriction and weight loss.

P56
Arabinoxylan reduces diet-induced colonocyte DNA damage in pigs

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Background
Arabinoxylans are a major fibre component of whole wheat, contributing up to 10% of grain weight. They raise large bowel SCFA in rats and have potential as prebiotics. However knowledge of their other nutritional attributes is limited.

Objectives
To determine whether an arabinoxylan-enriched wheat extract 1) improves large bowel fermentation patterns to lower colo-rectal cancer risk and 2) protects colonocytes from diet-induced genetic damage

Design
Two groups of five pigs were fed a Western-type diet containing cooked red meat with or without a 10% wheat arabinoxylan extract for four weeks. At termination, colonocyte DNA damage was assessed by Comet assay and colonic digesta concentrations of short chain fatty acids (SCFA), phenols and p-cresol were measured.

Outcomes

Consumption of the arabinoxylan fraction lowered colonocyte DNA damage ($p<0.05$), increased total SCFA ($p<0.05$) and lowered the p-cresol concentration ($p<0.05$) in the digesta relative to the control (high-risk) diet.

Conclusion

This study suggests that an arabinoxylan-enriched wheat fraction can significantly improve biomarkers of large bowel health indicating a potential for reducing the risk of colorectal cancer.