PROCEEDINGS OF THE NUTRITION SOCIETY OF NEW ZEALAND

Volume 36

Auckland 2012

PROFESSOR SALLY POPPITT

MURIEL BELL LECTURE

Fonterra Chair in Human Nutrition, The University of Auckland - New Zealand

Professor Sally Poppitt has recently been appointed to the Fonterra Chair in Human Nutrition at the University of Auckland where she is the founding director of the Human Nutrition Unit, a residential nutrition intervention facility. She also holds a joint appointment at the New Zealand Centre of Research Excellence (CORE) for Food and Nutrition within the Riddet Institute. Her research has been focused on the prevention and treatment of conditions arising from poor nutrition including overweight and obesity, metabolic dysregulation, and diabetic and cardiovascular risk. Prior to arriving in Auckland Sally held a 5 year Mead Johnson research fellowship at the Medical Research Council and University of Cambridge Dunn Nutrition Unit in the UK, and also spent 3 years at the Dunn's tropical nutrition research centre in West Kiang, The Gambia on the tip of West Africa.

YESTERDAY, TODAY AND TOMORROW IN OBESITY RESEARCH – IS THERE LIGHT AT THE END OF THE TUNNEL?

MURIEL BELL NOV 2012

S. POPPITT[1]

[1]The University of Auckland

At the end of 2011 we hit a population landmark of 7 billion people on the planet, and it's clear that the nutrition problems that we now face are changing just as rapidly Yesterday's global crisis of undernutrition has been joined by the escalating problem of overconsumption, overweight and obesity – and we are truly in a time of 'nutrition transition'. A review of the greatest recent discoveries and greatest future challenges in nutrition elected controlling obesity and its accompanying metabolic dysregulation as the primary challenge for the coming 30 years[1]. Over the past 30 years we have learned that the control of body weight really is as simple as matching food intake to expenditure – yet how to achieve this in our current 'obesigenic' environment is far from simple. There is little doubt that controlling eating behaviour and food intake is central to the control of body weight, but it is a complex psychological as well as physiological drive. Hunger and a strong desire to eat has developed over 40,000 years of human evolution where an unpredictable food supply was a life and death event. We now find ourselves in a new environment where the need to suppress intake is uppermost, we have few physiological mechanisms with which to tackle this, and we might also ask "does anyone really eat because they are hungry anymore?" Currently we have few solutions to the problem. Today's most

successful treatment for obesity is bariatric surgery, both invasive and expensive, which achieves better longterm outcomes than current diet and exercise strategies. Whether we can reverse the obesity trend without significantly changing our environment is debatable, and a major challenge for tomorrow.

[1]*Katan MB et al. Which are the greatest recent discoveries and the greatest future challenges in nutrition? European Journal of Clinical Nutrition 2009;63:2-10.*

DOCTOR COLIN BELL

Technical Officer (Noncommunicable Diseases)
Western Pacific Regional Office, World Health Organization

Dr Colin Bell is based in Suva, Fiji where he provides support for 22 Pacific Countries and Territories in NCD prevention and control. A major achievement during his time with WHO was coordination of the 2010 Pacific Food Summit in Vanuatu. Prior to joining WHO, Colin was Director of 'Good For Kids, Good For Life' – a large intervention and research program that aimed to prevent overweight and obesity in children in the Hunter New England region of NSW, Australia. Colin is recognized for his expertise in obesity and chronic disease prevention and has worked on a number of successful population and community-based programs in Australia and New Zealand over the last 15 years. He has a conjoint appointment as Associate Professor with the School of Medicine and Public Health, University of Newcastle, Australia. He obtained his PhD in Community Health from the University of Auckland and has a MSc in Human Nutrition from the University of Otago, New Zealand.

SCALING UP NUTRITION IN THE WESTERN PACIFIC REGION

Abstract is unavailable

PROFESSOR CATHERINE FIELDS

Professor of Nutrition Alberta Institute for Human Nutrition and Alberta Diabetes Institute – Canada

Professor Catherine Fields' research programme centres on the effect of nutrition on the immune system. Current areas of research include: the role of polyunsaturated fats in development of the immune system and in the treatment of inflammation in metabolic syndrome and type 2 diabetes, the effect of dietary nutrients on the gut associated immune system, the use of specific lipids in the prevention and treatment of cancer and the modulation of immune function and tumour metabolism and the association between nutritional status and maternal mental health and the neuro-physical development of infants.

THE ROLE OF SPECIFIC FOOD COMPONENTS ON IMMUNE DEVELOPMENT

C.J. FIELD[1], R.L. JACOBS[1], J.M. CURTIS[1] AND R.C. BELL[1]

[1]University of Alberta, Canada
Email: Catherine.field@ualberta.ca

Infant survival depends on the infant's ability to respond effectively and appropriately to environmental challenges from infectious agents while ensuring tolerance to compounds in the diet and microflora. The critical period for development of the acquired immune system (T and B lymphocytes) occurs in the postnatal period. Our research group studies the role of food components on the development of immunity. We have established that small changes in the intake of the long chain polyunsaturated fatty acids (LCPUFA), docosahexaenoic acid and arachidonic acid, and choline can have a significant impact on the development of the infant's immune system. Our work in infants, rodent and piglet models has demonstrated that changing the amount of these food components in the maternal/infant diet can change the type, maturation, activation and function of immune cells present in key immune sites in the body. For example, feeding a small amount of LCPUFA (similar to that found in breast milk) to formula-fed infants altered immune cell fatty acid composition, proportions and Th1 cytokine response, moving the infant's immune response in the direction of exclusively breast-fed infants. When added to the diet of artificially reared rodents LCPUFA modified the ability of immune cells to produce a tolerance response to potential dietary antigens, suggesting these fatty acids have a role in reducing the risk of allergic responses to food proteins. Our

recent work has suggested that both the amount and the form of choline (phosphatidylcholine compared to free choline) in the diet of lactating rodents influences the content and composition in breast milk and the ability of the offspring to respond to immune challenges. Our research demonstrates that modifying the composition of the diet during early postnatal life can support and promote immune development in the infant.

PROFESSOR ANDREW SINCLAIR

Professor of Nutrition
School of Medicine,
Deakin University -
Australia

Professor Andrew Sinclair is currently the Chair of the Australian Academy of Science, National Nutrition Committee and an Editor of the British Journal of Nutrition and on the Editorial Board of the Elsevier journal, Prostaglandins, Leukotrienes and Essential Fatty Acids, and a Fellow of Australian Institute of Food Science and Technology (2001) and a Fellow of the Nutrition Society of Australia (2003).

Professor Sinclair is an active researcher in a range of areas related to fatty acid metabolism in man and animals and the composition of foods (lipids and fat soluble vitamins). His latest research interests are in the role of essential nutrients in brain function (zinc, DHA, DPAn-3), lipidomic analysis of brain regions and omega 3 fatty acid metabolism in fish and mammals.

DOCOSAPENTAENOIC ACID (DPA) - THE ICEBERG OF LONG CHAIN OMEGA 3 FATTY ACIDS

A.J. SINCLAIR[1], K.M. LINDERBORG[2], E. MILLER[1], A. LARSEN[1], G. KAUR[3], P.J. MEIKLE[4] AND D. CAMERON-SMITH[5]

[1]Deakin University
[2]University of Turku
[3]Victoria University
[4]Baker IDI
[5]The University of Auckland
Email: andrew.sinclair@deakin.edu.au

Background: The study of the metabolism of docosapentaenoic acid (DPA, 22:5n-3) in humans has been limited by the lack of availability of pure DPA and the fact that DPA is found in combination with eicosapentaenoic acid (EPA, 20:5n-3) and docosahexaenoic acid (DHA, 22:6n-3) in natural products.

Objective: To compare the postprandial incorporation of DPA and EPA into chylomicrons in female volunteers.

Design: Pure (98%) DPA and EPA were incorporated in meals served to healthy female volunteers, n=10, in a double blind cross over study. High pressure liquid chromatrography/mass spectrometric and gas chromatographic methods were used to study the chylomicron triacylglycerol (TAG) molecular species and fatty acid composition of chylomicron TAG and phospholipids (PL).

Outcomes: Both EPA and DPA were incorporated into chylomicron TAG, while only EPA was incorporated into chylomicron PL. Lipidomic analysis of the chylomicron TAG revealed the dynamic nature of chylomicron TAG. The main

TAG species that EPA and DPA were incorporated into were EPA/18:1/18:1, DPA/18:1/16:0 and DPA/18:1/18:1. There was very limited conversion of either DPA and EPA to DHA and no retroconversion of DPA to EPA during the 5 hour postprandial period.

Conclusion: Contrary to expectations, EPA and DPA showed different patterns of incorporation in the chylomicron TAG and PL and molecular species of TAG.

Source of funding: Equateq Ltd (UK) is acknowledged for the generous provision of the pure supplements. Meat and Livestock Australia and Deakin University Strategic Research Centre for Molecular Medicine are acknowledged for financial support. Osk. Huttunen Foundation and Finnish Food Research Foundation are acknowledged for support to Dr Linderborg. Finally we wish to acknowledge and thank Dr Andrew Garnum (Deakin University) and the study participants.

PROFESSOR MANOHAR GARG

Chair in Nutritional Biochemistry and Director of the Nutraceuticals Research Unit University of Newcastle - Australia

Professor Manohar Garg occupies a Chair in Nutritional Biochemistry position and is the Director of the Nutraceuticals Research Unit at the University of Newcastle. Recently he has also been appointed as a Resident Fellow of the Riddet Institute (National Centre of Research Excellence) at the Massey University in New Zealand. A recognised world authority on fatty acid nutrition; anti-inflammatory, anti-aggregatory and anti-oxidant benefits of bioactive nutrients, in particular resveratrol, carotenoids, phytosterols, omega-3 fatty acids, he has fostered strategic alliances with the food industry to develop functional foods. He is currently serving as an Immediate Past President of the Nutrition Society of Australia; served as President and President Elect of NSA between 2007-2011. He is Associate Editor for the international journals: Journal of the Science of Food and Agriculture AND Progress in Lipid Research.

FATTY DIETS AND INFLAMMATION: WHAT MATTERS - QUANTITY AND/OR QUALITY?

M.L. GARG[1]

[1]University of Newcastle, Australia
Email: manohar.garg@newcastle.edu.au

Inflammation is a physiological response to injury, infection or irritants. It is part of the host's defense mechanism and plays a role in tissue repair processes so helping to restore homeostasis at affected sites. Inflammation involves interactions amongst many cell types and production of a number of chemical mediators. However, when inflammation becomes chronic, it can damage the host tissue and mediate the development of a number of diseases, including rheumatoid arthritis, Crohn's Disease, ulcerative colitis, asthma, dermatitis and even atherosclerosis and cancer.

High fat diets have been shown to increase inflammation in laboratory rodents and human studies. However, a high fat diet can also lead to obesity, which itself is associated with infiltration of inflammatory cells into adipose tissue, resulting in higher concentrations of pro-inflammatory mediators in tissues and in the systemic circulation. Thus it is difficult to disentangle the effects of a high fat diet per se and of high fat-induced obesity on inflammation. Moreover, high fat diets are often rich in saturated fatty acids which may directly induce inflammation via activation of toll like receptor 4 (TLR4) mediated signalling pathways. Therefore, pro-inflammatory effects of a high fat diet may be a result of the saturated fatty acid burden rather than the fat quantity. Consequently whether a high fat meal/diet is pro-

inflammatory, may very much depend upon its fatty acid composition. Indeed there was no change in CRP, IL-6 or tumor necrosis factor (TNFα) in obese subjects intervened with a low fat diet or a high monounsaturated fat diet. Furthermore, postprandial inflammation has been shown to be much lower when olive oil instead of butter was included in the test meal. Omega-6 fatty acids appear to be neutral in terms of their effect on inflammation while omega-3 fatty acids, especially EPA and DHA have been shown to be anti-inflammatory. These actions are mediated by formation of signalling platforms termed rafts in the cell membrane, activation of the anti-inflammatory transcription factor peroxisome proliferator activated receptor (PPAR)-γ and inhibition of activation of the pro-inflammatory transcription factor NFκB. Data from subgroups of the Physicians' Health Study and the Nurses' Health Study showed inverse correlation between dietary intake of EPA+DHA and concentrations of CRP, ICAM-1, VCAM-1 and E-selectin. Numerous supplementation studies have shown that omega-3PUFA lower the concentrations of pro-inflammatory mediators (CRP, IL-6, TNF, IL-18, ICAM-1, VCAM-1, and E-selectin).

It is apparent that multiple mechanisms, presently not fully integrated, are involved in the interaction of fatty acids with inflammatory cells to create a complex picture. Future work may focus on novel anti-inflammatory lipid mediators like resolvins and protectins.

ASSOCIATE PROFESSOR SPENCER PROCTOR

Associate Professor
Alberta Institute for Human Nutrition and Alberta Diabetes Institute – Canada

Dr Spencer Proctor trained as a physiologist and cardiovascular scientist in both Australia and Canada. He was appointed to the Alberta Institute for Human Nutrition at the University of Alberta in 2004 and founded the Metabolic and Cardiovascular Diseases (MCVD) Laboratory. Dr Proctor's research program spans a unique continuum of expertise in the areas of nutrition, metabolism, physiology, behaviour, food health and chronic disease. Main research interests include: Absorption/ metabolism of dietary lipids in health and relationship to cardiovascular risk; the interaction of lipids with arterial vessels during atherosclerosis and insulin resistance and novel bio-activity of dietary fatty acids and impact to the Metabolic Syndrome.

UNDERSTANDING THE IMPLICATION OF RUMINANT TRANS FATS TO HEALTH AND INDUSTRY

Y. WANG[1] AND S.D. PROCTOR[1]

[1]University of Alberta, Canada
Email: spencer.proctor@ualberta.ca

The CODEX Alimentarius definition of trans fatty acid (TFA) has been widely accepted in establishing nutritional guidelines and legislatorial regulations to reduce TFA consumption. Notably, conjugated linoleic acids (CLA) have been excluded from the CODEX TFA definition based on accumulating evidence implying health benefits on weight management and cancer prevention. However, evidence has also associated supplemental CLA with negative health outcomes (particularly in high doses) including increased sub-clinical inflammation and oxidative stress. These observations have lead some countries to deliberate the recommendation of supplemental CLA as a food ingredient, while at the same time raises questions regarding the definition of TFA itself. Here we present a perspective of the most recent pre-clinical and clinical literature on the health implications of CLA, as well raise as issues for discussion including: the distinction between CLA derived from ruminant food versus supplemental sources; the differential bioactivity between major CLA isomers (i.e. cis-9, trans-11 versus trans-10, cis-12 CLA); and the discretionary health effect of trans-11 18:1 (vaccenic acid, predominant ruminant TFA in dairy) from industrial TFA. It could be viewed that the current definition of trans fat, while accurately encompasses the mandate to reduce dietary intake of deleterious partially hydrogenated vegetable oil,

appears limited and remains open to interpretation. New insights into the health effects of individual CLA isomers as well as iTFA versus rTFA raise important questions for regulatory bodies, the primary product sector and public health. Ongoing observations support neutral or beneficial health outcomes with moderate rTFA consumption.

ASSOCIATE PROFESSOR DONNA VINE

Associate Professor
Alberta Institute for Human Nutrition and Alberta Diabetes Institute – Canada

Dr Donna Vine has a PhD (from Perth, Western Australia) in the field of dietary fatty acids and lipid metabolism and has gone on to specialized in the areas of pharmaceutical sciences and lipid transport modelling. Dr Vine is currently an Associate Professor and co-Director of the Metabolic and Cardiovascular Diseases Laboratory (Division of Nutrition at the University of Alberta, Edmonton, Canada) and has been one of the first to contribute to the study of the effect of dietary fats on lipid transport and metabolism pathways in chronic disease. Most recently Dr Vine has begun to explore dietary improvements and pharmaceutical interventions to understand the etiology of the metabolic complications of PCOS in animal models.

ABSORPTION AND BIOACTIVITY OF VACCENIC ACID ON DYSLIPIDAEMIA AND THE METABOLIC SYNDROME

Y. WANG[1], M.M. JACOME SOSA[1], M. R. RUTH[1], Y. LU[1], J. SHEN[1], M.J. REANEY[1], S.L. SCOTT[1], M.E.R. DUGAN[1], H.D. ANDERSON[1], C.J. FIELD[1], S.D. PROCTOR[1] AND D.F. VINE[1]

[1]University of Alberta, Canada
Email: donna.vine@ualberta.ca

Introduction: Evidence suggests neutral to beneficial health effects of certain trans fatty acids from natural ruminant sources. Trans11-18:1 (vaccenic acid, VA), the most predominant ruminant TFA in our food supply and precursor to conjugated linoleic acid, has been shown to improve atherogenic dyslipidemia and hepatic steatosis in animal models. Recently we assessed the intestinal bioavailability of various VA sources including synthetic free fatty acid (FFA) and natural ruminant triglyceride forms, as well as the mechanistic pathways that mediate VA's bioactivity to improve dyslipidemia and cardio-metabolic outcomes.

Results: Studies reveal VA from a triglyceride source has greater intestinal bioavailability in-vivo compared to VA provided in FFA form. In-vivo, feeding of VA (1% w/w) results in increased mRNA and protein expression of PPAR-γ in the intestinal mucosa of JCR:LA-*cp* rats, a model of the metabolic syndrome. VA binds avidly to peroxisome proliferator activated receptors (PPAR)-α and PPAR-γ in-vitro, with similar affinity compared to commonly known PPAR agonists. We have further confirmed that VA treatment

suppresses cardiomyocyte hypertrophy in-vitro in a PPAR-γ dependent manner.

Conclusion: The activation of PPAR-α and -γ dependent pathways provides a mechanistic pathway associated with VA improvements in blood lipids during conditions of hyperlipidemia and the metabolic syndrome. Our data also supports the consideration of differential reporting of industrially-produced versus natural trans fatty acids on food nutrient labels.

DOCTOR HELEN EYLES

Research fellow and public health nutritionist
National Institute for Health Innovation, The University of Auckland - New Zealand

Dr Helen Eyles doctoral work was centered on the SHOP trial, a large randomised controlled trial of the impact of price discounts and tailored nutrition education on supermarket food purchases. She was recently (2011) awarded a Heart Foundation of New Zealand post-doctoral fellowship to undertake a programme of research in the field of food reformulation. She is the Principle Investigator of Nutritrack, a branded food composition database for New Zealand. Her specific research interests include: Public health nutrition, processed foods and food reformulation, front-of-pack nutrition labels, menu-labelling, portion sizes, food pricing, and use of incentives to promote healthier eating.

TYPICAL FOOD PORTION SIZES CONSUMED BY NEW ZEALAND CHILDREN AND DIFFERENCES BY AGE, GENDER, AND ETHNICITY

H. EYLES[1], Y. JIANG[1], AND C. NI MHURCHU[1]

[1]*The University of Auckland*

Background: There are currently no data regarding typical food portion sizes pertaining to children in New Zealand.

Objective: To estimate typical food portion sizes consumed by New Zealand children and investigate differences by age groups (5-6, 7-10, and 11-14 years), gender, and ethnicity (Māori, Pacific, NZ European and Others (NZEO)).

Design: Micro data from the 2002 National Children's Nutrition Survey (n=3,275) were used to estimate population averaged food portion sizes (g) for 110 commonly-consumed foods; weighted regression analyses were conducted to investigate differences across important demographic sub-groups.

Results: Mean food portion sizes varied according to food group (from 5g for chewing gum to 338g for homemade soup). Portion sizes generally increased with age, and were larger for boys than girls, particularly for beverages. The largest mean differences (95% CI) in food portion sizes between Māori and NZEO children were for: flavored milk (100 (28,173) g; p=0.01); soft drink (41 (15,66) g; p=0.00); and fruit juice (37 (2,71) g; p=0.04); all larger for Māori). Corresponding differences between Pacific and NZEO children were: canned and processed fruit (85 (30,139) g; p=0.00); whole potato or kumara (59

(33,85) g; p=0.00); and soft drink (43 (10,75) g; p=0.00); all larger for Pacific).

Conclusions: There are important age, gender, and ethnic differences in the food portion sizes consumed by New Zealand children. Beverages (particularly soft drinks) provide key opportunities for targeted portion size interventions which if effective, have the potential to reduce obesity and related health inequalities in New Zealand.

ASSOCIATE PROFESSOR WELMA STONEHOUSE

Associate Professor in Human Nutrition Massey University - New Zealand

Welma's research over the past 20 years has focussed on nutritional strategies for improving heart health and more recently cognitive health. To date Welma has published close to 60 papers in the peer-reviewed scientific literature.

CRACKING NEW FRONTIERS ON THE HEALTH BENEFITS OF NUTS

W. STONEHOUSE[1]

[1]Massey University Albany
Email: w.stonehouse@massey.ac.nz

The scientific evidence supporting the inclusion of nuts in our daily diets is continuously evolving. A beneficial association with coronary heart disease (CHD) through cholesterol lowering effects has been recognised for two decades, but new evidence shows benefits beyond cholesterol lowering effects. The aim of this review is to provide an overview of the heart protecting effects of nuts (tree nuts and peanuts). Nuts are nutrient-dense foods with a complex matrix of several bioactive components that may act synergistically to confer heart protecting effects. Recent epidemiological evidence has shown inverse associations between nut consumption and type 2 diabetes, hypertension, metabolic syndrome and body mass index. A pooled analysis of 25 nut intervention trials showed dose-response reductions in total cholesterol, LDL-C, LDL-C/HDL-C ratio and TC/HDL-C ratio. In addition, triglyceride levels were reduced in subjects with hypertriglyceridemia. However, the cholesterol lowering effects of nuts seem to be blunted in obese subjects. Nuts may also favourably affect other emerging CHD biomarkers such as LDL oxidation, inflammatory markers and endothelial function. Nuts are high fat energy-dense foods creating concern for weight gain. However, no nut intervention study to date has shown an increase in body weight. In fact, increased nut consumption has been inversely associated with weight gain. This effect may be due to the satiation and satiety

properties of nuts, increased energy expenditure and reduced net metabolizable energy. The inclusion of a serving of nuts per day as part of an overall healthy diet is recommended for its heart protecting effects without compromising body weight.

PROFESSOR PHILIP BAKER

Director of the National Research Centre for Growth and Development (NRCGD) and Professor of Maternal and Fetal Health
The Liggins Institute, The University of Auckland - New Zealand

Professor Baker graduated from the Nottingham University (UK) and was subsequently awarded a Doctorate in Medicine. He then completed his training as an obstetrician scientist in the UK and USA. He has held leadership posts in the UK and Canada, and is currently Director of the National Research Centre for Growth and Development (NRCGD) and Professor of Maternal and Fetal Health at the Liggins Institute.

NUTRITION IN PREGNANCY – FROM TEENAGERS TO THE ARCTIC

P. BAKER[1], L. POSTON[2], AND G. SHARMA[3]

[1]The University of Auckland
[2]Kings College London, United kingdom
[3]Edmonton, Alberta, Canada
Email: Philip.baker@auckland.ac.nz

Two Nutrition in Pregnancy initiatives will be introduced:

Objectives of the About Teenage Eating (ATE) Study were to assess micronutrient intake and blood biomarkers prospectively in pregnant adolescents and determine associations with pregnancy outcome. Pregnant adolescents (n = 500) were recruited from 2 UK inner city populations. Dietary intake was assessed with three 24-h dietary recalls, and micronutrient status assessed by measurement of third trimester blood biomarkers. Pregnancy outcomes included small-for-gestational age (SGA) birth and preterm delivery. Median iron and folate intakes were lower than recommended. Folate and vitamin B-12 status were lower in smokers, despite no differences in dietary intake. 52% had iron deficiency anemia, and 30% serum 25-hydroxyvitamin D concentrations <25 nmol/L. SGA birth was higher in subjects with poor folate status and low folate intakes. Risk of SGA birth was higher in subjects with low food iron intake. Poor micronutrient intake and status thus increase risk of SGA births in pregnant adolescents.

Aboriginal women in N. Canada have twice the overall population risk of maternal mortality, and we are assessing dietary factors for maternal health in the Arctic. In these remote communities, financial and emotional burdens of poor

maternal health are significant; the health care system is challenged by high service delivery costs, limited human resources, and isolation. With communities of Inuvik, NT and Arviat, NU, our project will include all non-pregnant women aged 15-49 yrs, and all women who will be/ become pregnant. We will:

- Collect formative research data through in-depth interviews to identify protective/risk factors (eg access to healthy/traditional foods, sport facilities, healthcare)
- Identify prevalence of known risk factors [eg dietary intake (energy, % energy from fat, vitamin and mineral intake, consumption of high-fat, high-sugar foods), physical activity, body composition, obesity prevalence, smoking, alcohol consumption, quality of housing].
- Determine access and utilization of healthcare during pregnancy, and potential associations between dietary/lifestyle factors and pregnancy outcomes.
- Present the data to the communities to develop a nutritional, environmental, and lifestyle intervention program.

PROFESSOR ELAINE RUSH

Professor of Nutrition
AUT University - New Zealand

Professor Elaine Rush has research expertise in the areas of body composition, physiology, energy expenditure, physical activity, nutrition and lifecourse health. Her research projects include Project Energize in the Waikato, the health and growth of children whose mother's had gestational diabetes, the longitudinal Pacific Island Families study and longitudinal studies in India.

GROW, GLOW AND GO: ENERGIZED CHILDREN LEAD THE WAY!

E. RUSH[1] AND S. MCLENNAN[2]

[1]AUT University
[2]Sport Waikato
Email: Elaine.rush@aut.ac.nz

"Project Energize", funded by the Waikato District Health Board, is a through-school initiative to improve nutrition and physical activity, childhood obesity rates and cardiovascular risk factors in all primary schools in the WDHB area of New Zealand. The programme, contracted to Sport Waikato since 2005 now engages actively with 244 schools and 44000 children through the interactions with 27 "Energizers". Energizers are assigned 8-12 schools each and act as a "one stop shop" to support activities that promote and coordinate improved nutrition and physical within schools. The overall cost is $45 per child each year.

In March 2011, 2665 7 year old and 2589 10 year old children (36% Māori) had physical measurements of height, weight, waist, body fat by bioimpedance, blood pressure and time to run 550m. Compared with control children, from the Waikato, measured in 2006 (7 year old) and 2004 (10 year old) substantial differences were seen in weight (-0.5 kg 7yo, -2kg 10 yo), body mass index (-0.4, -0.6 kg/m2 and waist (2, 4cm). In 2011 compared with control data, the prevalence of obesity and overweight was 3% less in both age groups. The 2011 Energize children ran 550m, 20s faster compared to Canterbury children measured between 2001 and 2007.

Support provided by the Energize is multifaceted. One activity (of hundreds), that is popular and practical, is the sandwich race where children learn about

how to make a healthy sandwich using Grow, Glow and Go foods. Long term national and regional statistics for body size and nutrient intake will reflect the success of visionary programmes. Translation of "brand" Energize into other settings is under investigation.

DOCTOR SUSAN JACK

Public Health Medicine Registrar Public Health South, Dunedin - New Zealand

Susan is a medical graduate of the University of Otago with a Diploma in Paediatrics from The University of Auckland and Master of Public Health and Tropical Medicine from James Cook University, Australia.

Following working as a house officer and paediatric registrar, Susan relocated to Phnom Penh Cambodia where she worked from 1994 with an NGO "Servants to Asia's Urban Poor". Initially supporting services in a Government District Hospital in the poorest area of Phnom Penh, the NGO then developed community health and development programs amongst the urban poor.

In 2004 the NGO localised and Susan began doing consultancy work for the World Health Organization and USAID health programmes.

From 2007 to 2010 Susan worked for the WHO Cambodia office in the area of child survival, nutrition, maternal and newborn health.

Susan's PhD research was on "Combating anaemia and micronutrient deficiencies among young children in rural Cambodia through in-home fortification and nutrition education" (Good Food for Children Study) with the National Nutrition Program, Ministry of Health and other partners.

EFFECT OF SPRINKLES ON REDUCING ANAEMIA IN YOUNG CHILDREN IN CAMBODIA: A CLUSTER-RANDOMIZED EFFECTIVENESS TRIAL

S. JACK[1], K. OU[1], M. CHEA[1], L. CHHIN[1], R. DEVENISH[1], M. DUNBAR[1], C. EANG[1], K. HOU[1], S. LY[1], M. KHIN[1], S. PRAK[1], R. REACH[1], A. TALUKDER[1], L. TOKMOH[1], S.L. DE LA BARRA[1], P. HILL[1], P. HERBISON[1] AND R. GIBSON[1]

[1]University of Otago
Email: susan.jack@otago.ac.nz

Whether anaemia could be significantly reduced by delivery of micronutrient powders (Sprinkles) through government health services in Cambodia was uncertain. In this cluster randomized controlled effectiveness study we evaluated the effectiveness of daily micronutrient Sprinkles mixed with complementary foods in infants (N = 3112) from aged 6 to 11 months along with infant and young child feeding (IYCF) education, compared to IYCF education alone. We followed 1350 randomly selected children at 6 monthly intervals to aged 24 months via biomarkers and anthropometry to establish whether any observed effects on anaemia, deficiencies of iron, vitamin A, and zinc, and growth were sustained.

Sprinkles plus IYCF education versus IYCF education alone reduced any anaemia at 12 months by 24% (haemoglobin (Hb) < 110 g/L, Rate Ratio (RR) 0.76, 95% CI 0.64 to 0.89, P = 0.001) and moderate anaemia (Hb < 100g/L) by 57% (RR 0.43, 95% CI 0.33 to 0.56, P < 0.001). At later follow ups

there were no significant differences in any anaemia between groups. Iron deficiency was reduced by 57% (RR 0.43, 95% CI 0.32 to 0.58, P < 0.001) and iron deficiency anaemia (IDA) and non-IDA were reduced for moderate anaemia at aged 12 months. We found a significant increase in mean serum zinc (0.44 µmol/L, 95% CI 0.04 to 0.83, P = 0.028) but no difference in zinc and vitamin A deficiency, or growth at any time.

Sprinkles reduced anaemia, and increased mean serum zinc in Cambodian infants. These effects were in addition to IYCF education alone, but did not persist beyond the intervention period.

Funding: A2Z, USAID; Cambodia Health Sector Support Projects I & II; WHO Cambodia; GAIN.

DOCTOR NICOLE ROY

Team Leader and Principal Scientist, Food Nutrition & Health Team Food & Bio-based Products Group - New Zealand

Dr Nicole Roy is a Principal Scientist and the Science Team Leader of Food Nutrition & Health AgResearch Grasslands in Palmerston North. Nicole leads an large research team examining the role of nutrients in maintaining and restoring intestinal health using animal models of human metabolism and combining a range of physiological and "omics" techniques. Her experience includes large NZ research collaborations including the leadership of projects funded by MBIE. Nicole is also an Adjunct Senior Lecturer and Associate Investigator at the Riddet Institute and supervises 8 PhD students as part of this role. Nicole is also the KBBE NZ Food & Health Theme Leader.

BIOMARKERS OF PATHWAYS TO MONITOR BIOLOGICAL EFFECTS OF DIETARY N-3 POLYUNSATURATED FATTY ACIDS

N.C. ROY[1, 2,3], M.P.G. BARNETT[1,2], J.M. COONEY[2,4] AND C. GLADINE[5]

[1]AgResearch Grasslands Research Centre, New Zealand
[2]Nutrigenomics New Zealand
[3]Massey University Palmerston North
[4]The New Zealand Institute for Plant and Food Research
[5] INRA, UMR 1019 Nutrition Humaine, France
Email:nicole.roy@agresearch.co.nz

Scope: Dietary n-3 polyunsaturated fatty acids (n-3 PUFAs) affect many biological processes through various mechanisms, including regulating the expression of target genes. This has been characterised in several tissues. However, the complex biological pathways underlying their effects are still under investigation.

Methods and results: We showed that dietary eicosapentaenoic acid (EPA) reduced colonic inflammation in the interleukin-10 gene-deficient mouse model of human inflammatory bowel disease (IBD). This was associated with increased expression levels of fatty acid beta-oxidation genes (microarrays), antioxidant enzyme genes and proteins (2D-GE and LC/MS proteomics), and xenobiotic metabolism genes and proteins. Additionally, decreased expression levels of immune response and inflammatory genes and proteins were observed [1, 2]. The PPARα pathway appears to be a key mechanism for the anti-inflammatory activity of EPA

[1, 2]. A further on-going study using the same mouse model will use high-resolution MS to characterise changes in urinary metabolites in response to dietary EPA, or a diet rich in salmon. In a another study, using a hypercholesterolaemic rabbit model, n-3 PUFA dose-dependently increased levels of specific peroxidised n-3 PUFA metabolites [3]. At the highest dose, this increase was associated with an accumulation of triacylglycerols and increased mRNA levels of lipoprotein receptors in liver [3].

Conclusion: These studies show that the effects of dietary n-3 PUFAs can vary depending on the amount used, target tissue and physiological status. These factors are important to consider when assessing biomarkers by which their biological effects can be non-invasively monitored in animal models and ultimately in humans.

[1] Knoch et al, J Nutrigenet Nutrigenomics 2009, 2(1):9-28.
[2] Cooney et al, J Proteome Res 2012, 11(2): 1065–1077.
[3] Gladine et al, Br J Nutr 2011, 14:1-20.

LUKE GEMMING

SELF-REPORTED DIETARY INTAKE USING PASSIVE IMAGE CAPTURE: A PILOT STUDY

L. GEMMING[1], J. UTTER[1], A. DOHERTY[2], P. KELLY2 AND C. NI MHURCHU[1]

[1]The University of Auckland
[2]University of Oxford
Email: l.gemming@nihi.auckland.ac.nz

Background: SenseCam is a research-specific, passive image capture device. The SenseCam is worn on a lanyard around the neck and automatically captures first-person perspective images in response to movement, heat, and light (every 20-30s). This device may enhance self-reported dietary assessment by prompting improved recall of actual food and beverage consumption.

Method: A pilot study was conducted in a convenience sample (n=13) of adults in Oxford, United Kingdom. Participants wore the SenseCam for two days while continuing their usual daily activities. On day 3, participants' diets were assessed using an interviewer-administered 24h recall. Participants then viewed the SenseCam images and the interviewer recorded any additional dietary information that participants provided whilst viewing the images.

Results: Ten participants were included in the analysis (8 males and 2 females), mean age = 33±11.3 yrs, mean BMI = 25.9±5.1 kg/m2. Three participants were excluded due to device malfunction (n=2) and non-protocol adherence (n=1). Viewing the SenseCam images increased self-reported energy intake by 12.5±14.9% (P=0.018). The increase was predominantly due to inclusion of 42 additional foods from a range of food groups. Beverages were most frequently under-reported followed by: fruit and vegetables; breads and cereals; meats and other proteins; sweets; and spreads, dressings and sauces. Only eight changes in portion size were made which had little impact on energy intake.

Conclusion: These pilot results justify further evaluation of passive image capture as a method to enhance self-reported dietary assessment methods. A gold-standard doubly-labelled water validation study will next be undertaken to validate the SenseCam-assisted 24h recall.

JESSICA KANE

SATIATING EFFECTS OF A RICE-MIX IN ASIAN PEOPLE WITH TYPE II DIABETES

J. KANE[1], B. VENN[1], A. LIU[2] AND Z. ZHANG[1]

[1]University of Otago
[2]Auckland District Health Board
Email: kanje198@student.otago.ac.nz

The consumption of low glycaemic index foods in individuals with type 2 diabetes can assist in lowering postprandial glycemia, a risk factor for diabetic complications. However, improvements in satiety for low glycaemic index foods served on an equal-volume basis has not been widely explored.

Using a repeat randomised crossover design, it was examined whether substituting 40% of the white rice with a mixture of low glycaemic index grains, nuts and seeds could increase satiety. Thirteen Asian diabetics ate equal portions of the rice-mix and the white rice, eating each meal on two occasions. Responses to four appetite (hunger, satiety, fullness, prospective consumption) and four preference questions (desire to eat sweet, savoury, salty and fatty foods) were recorded at half hour intervals for three hours after eating on validated visual analogue scales (VAS). Scores are reported as area-under-the curve (mm x min).

The mean (SD) desire to eat something fatty after the rice-mix was 375 (444), this was significantly lower than after white rice that had a score of 483 (456) mm x in ($P< 0.05$). There were no other significant differences between the rice meals although there was a tendency for the hunger score to be lower after the rice mix; 721 (356) compared with 610 (306) mm x in for white rice, (P=0.09).

Although consuming the rice-mix in place of white rice did not increase satiety in the short term, the desire to eat fatty food was diminished. The lack of significance for hunger may have been due to a small sample.

LOUISE BROUGH

IODINE STATUS OF PREGNANT WOMEN PRE- AND POST-INITIATIVES TO IMPROVE IODINE STATUS IN PALMERSTON NORTH, NEW ZEALAND

L. BROUGH[1] AND Y. JIN[1]

[1]Massey University
Email: L.Brough@massey.ac.nz

Background: Two initiatives were introduced to prevent iodine deficiency in New Zealand: (i) mandatory fortification of all bread (except organic) with iodised salt; and (ii) provision of a subsidised iodine supplement (150 µg) for all pregnant and breastfeeding women.

Aims: To assess iodine status among a self-selecting sample of pregnant women in Palmerston North, before and after the two initiatives.

Methods: Pregnant women were recruited before (n = 25; 2009) and after (n=34; 2011) the initiatives. Iodine concentration was determined in 24 hour urine samples using inductively-coupled plasma mass spectrometry and daily intake estimated by extrapolation. Iodine data were analysed using non-parametric Mann Whitney U test (2-tailed).

Results: Median urine iodine concentration (UIC) increased from 47 (27, 52) µg/L in 2009 to 85 (52, 150) µg/L in 2011 ($p < 0.001$), although remained below the cut-off for adequate iodine status (150 µg/L). Estimated median iodine intake (µg/day) was 105 (67,148) in 2009 and 205 (137, 282) in 2011. 75% women in 2011 achieved the Estimated Average Requirement (160 µg/day) compared to 20% in 2009. In 2011 70% of women used iodine supplements; UIC (µg/L) was significantly higher for supplement users than non-users (126 (94, 171) vs. 66 (48, 133) µg/L; p=0.007) and (258 (218, 305) vs. 158 (109, 177) µg/day; $p < 0.001$).

Conclusions: Iodine intake within this sample of pregnant women has improved after the initiatives, especially among supplement users. However, inadequate iodine status remains. Alternative strategies need to be evaluated to ensure pregnant women have adequate iodine intake.

ABBEY BILLING

IMPROVEMENT IN THE IODINE STATUS OF NEW ZEALAND PREGNANT WOMEN POST-FORTIFICATION

A. BILLING[1] AND S. SKEAFF[1]

[1]University of Otago
Email: abbeybill@hotmail.com

An adequate intake of iodine during pregnancy is necessary for normal growth and brain development of the fetus. The aim of this study was to determine if mandatory iodine fortification and/or iodine supplementation has improved the iodine status of pregnant New Zealand (NZ) women. An cross-sectional study of pregnant women living in Hamilton, NZ was conducted from June to September 2012. Participants were recruited through clinics and by advertisement. Particpcants were asked to provided a casual urine sample for the determiantion of urinary iodine concentration (UIC) and complete a questionnaire used to obtain socio-demographic information and the frequency of consumption of iodine containing foods including fortified bread and dietary supplements. A total of 118 pregnant women took part in the study. The ethnicity of the women was as follows: 65% NZ European, 19% Maori, 2% Pacific, 7% Asian, and 7% were other ethnicities. Most women had a secondary school(42%) or tertiary (55%) qualification. The median UIC of the women was above the 100 µg/L cut-off indicating adequate iodine status in adults, and significantly higher than the 38 µg/L reported in pregnant women prior to fortification. Fortified bread was consumed five or more times a week by 58% of women. The majority of women (64%) reported taking a dietary supplement containing iodine, ranging from 75-400 µg; 25% of women did not take supplements. The iodine status of pregnant women in Hamilton has improved as a result of the mandatory fortification of bread and the consumption of iodine-containing supplements.

YING JIN

IODINE STATUS OF BREASTFEEDING WOMEN PRE- AND POST- INITIATIVES TO IMPROVE IODINE STATUS IN PALMERSTON NORTH, NEW ZEALAND

Y. JIN[1] AND L. BROUGH[1]

[1]Massey University
Email: y.jin@massey.ac.nz

Background: Two initiatives were introduced to prevent iodine deficiency in New Zealand: (i) mandatory fortification of all bread (except organic) with iodised salt; and (ii) provision of a subsidised iodine supplement (150 µg) for all pregnant and breastfeeding women.

Aims: To assess iodine status among a self-selecting sample of lactating women in Palmerston North, before and after the two initiatives.

Methods: Lactating women were recruited before (n = 32; 2009) and after (n=36; 2011) the initiatives. Iodine concentration was determined in 24 hour urine and breastmilk (30 mL) samples using inductively-coupled plasma mass spectrometry. Iodine data were analysed using non-parametric Mann Whitney U test (2-tailed).

Results: Median urine iodine concentration (UIC) increased from 34 (25, 58) µg/L in 2009 to 74 (46, 117) µg/L in 2011 ($p < 0.001$), however, remained below the cut-off for adequate iodine status (100 µg/L). Median iodine concentration in breastmilk rose from 48 (37, 66) µg/L to 56 (38, 88) µg/L, with 13% achieving 75 µg/L increasing to 36% in 2009 and 2011, respectively. In 2011 only 36% women used iodine supplements, UIC was higher for users than non-users (169 (92, 210) vs. 86 (76, 138) µg/day; p=0.032), as was breastmilk iodine concentration (133 (76, 173) vs. 53 (34, 80) µg/L; p=0.003)

Conclusions: Iodine deficiency remains a problem within this sample of lactating women. Iodine supplementation increased status however many women did not use supplements. On-going surveillance of iodine status in lactating women throughout New Zealand is needed to assess the efficacy of these initiatives.

ORAL PRESENTATIONS

Micronutrients

BLOOD DONATION, ASIAN ETHNICITY AND PARITY ARE STRONGER PREDICTORS OF SUBOPTIMAL IRON STATUS THAN DIETARY PATTERNS IN PREMENOPAUSAL WOMEN LIVING IN AUCKLAND, NEW ZEALAND

K. BECK[1], C. CONLON[1], R. KRUGER[1], A. HEATH[2] AND J. COAD[1]

[1]Massey University
[2]University of Otago
Email: k.l.beck@massey.ac.nz

Previous research has not considered the effects of dietary patterns as well as non-dietary determinants (e.g. blood loss) on iron status in premenopausal women. This cross-sectional study aimed to investigate the relative importance of dietary patterns as determinants of suboptimal iron status in premenopausal women living in Auckland, New Zealand. Participants were 375 women aged 18-44 years (305 with sufficient iron status (serum ferritin 20-200 µg/L, haemoglobin ≥120 g/L); 70 with suboptimal iron status (serum ferritin <20 µg/L)). Information on demographics, health, menstruation, blood donation, nose bleeds, and dietary patterns (using a validated food frequency questionnaire) was obtained. Using multiple logistic regression analysis, significant determinants of suboptimal iron status were:blood donation in the past year [OR: 6.74 (95% CI: 3.10, 14.65) P<0.001], being Asian [OR: 5.22 (95% CI: 2.42, 11.24) P<0.001], having children [OR: 2.72 (95% CI: 1.41, 5.28) P=0.003], previous iron deficiency [OR: 2.07 (95% CI: 1.09, 3.94) P=0.027], a 'milk & yoghurt' dietary pattern [OR: 1.44 (95% CI: 1.08, 1.91) P=0.014], and longer duration of menstrual periods [OR: 1.31 (95% CI: 1.07, 1.61) P=0.01]. A 'meat & vegetable' dietary pattern was associated with lower risk [OR: 0.56 (95% CI: 0.39, 0.81)P=0.002]. The strongest determinants of suboptimal iron status were blood donation and Asian ethnicity. However, both dietary patterns were stronger determinants than duration of menstrual blood loss and together accounted for 5.7% of the variance in suboptimal iron status. These determinants could be important to identify and treat women at risk of suboptimal iron status.

Micronutrients

CALCIUM SUPPLEMENTS AND CANCER RISK: A META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS

S. BRISTOW[1], M. BOLLAND[1], G. MACLENNAN[2], A. AVENELL[2] AND G. GAMBLE[1]

[1]The University of Auckland
[2]The University of Aberdeen, Scotland
Email: s.bristow@auckland.ac.nz

Background: Some evidence suggests calcium and vitamin D supplements affect cancer risk, but it is uncertain whether effects are due to calcium, vitamin D or the combination. We investigated the effect of calcium supplements without coadministered vitamin D on cancer risk.

Design: Medline, Embase and the Cochrane Central Register of Controlled Trials, reference lists of meta-analyses of calcium supplements, and two clinical trial registries were searched. Trial-level data was analysed using random-effects meta-analyses, and patient-level data using Cox's proportional hazards models.

Results: Sixteen trials were eligible for inclusion, ten provided trial-level data (10,496 participants, mean duration 3.9 years), four patient-level data (7,221 participants, median follow up 3.5 years,), and six had no data available. In the meta-analysis of trial-level data, allocation to calcium did not alter the risk of total cancer (pooled relative risk 0.95, 95% confidence interval 0.76 to 1.18, P = 0.63), colorectal cancer (1.38, 0.89 to 2.15, P = 0.15), breast cancer (1.01, 0.64 to 1.59, P = 0.97) or cancer-related mortality (0.96, 0.74 to 1.24, P = 0.75), but reduced the risk of prostate cancer (0.54, 0.30 to 0.96, P = 0.03), although there were few events. The meta-analysis of patient level-data showed similar results, with no effect of calcium on the risk of total cancer (hazard ratio 1.07, 0.89 to 1.28, P = 0.50).

Conclusions: Calcium supplements without coadministered vitamin D did not alter total cancer risk over 4 years, although the meta-analysis lacked power to detect very small effects, or those with a longer latency.

Micronutrients

TIME IN THE SUN AND VITAMIN D IN DUNEDIN

M. POLAK[1], T. CONNER[1], T. REEDER[1] AND L. HOUGHTON[1]

[1]University of Otago
Email: mariapolak@psy.otago.ac.nz

Background: Suboptimal levels of circulating 25(OH)D, the main marker for vitamin D status, has been associated with poor bone health. However, achieving sufficient sun exposure for optimal vitamin D manufacture poses challenges to skin cancer prevention efforts.

Objective: The current study investigated the relationship between time spent outside during daylight hours and serum 25(OH)D3 level, taking into account sun protection behaviours.

Design: 303 individuals (37% men, mean age 20y, range 17-51y) recruited between March and May 2011 in Dunedin (latitude 45°S) participated in a 13-day daily diary where they answered questions on their daily sun exposure and habitual sun protection behaviour. Following this period, a non-fasting blood sample was collected and analyzed for 25(OH)D3. Multivariable linear regression was used to examine associations between time spent outside and serum 25(OH)D3 levels adjusted for other predictors.

Outcomes: Mean 25(OH)D3 level was 62.1 (SD=26.4) nmol/L. Women had higher 25(OH)D3 than men (65.5 vs. 56.3 nmol/L, P=0.001). 65.3% of participants reported spending 15 minutes or less outside every day. Frequency of having spent more than 15 minutes outdoors was significantly associated with 25(OH)D3 level. For example, each additional day that participants spent more than 15 minutes outside was associated with an increase of 2nmol/L in 25(OH)D3 level.

43.2% of participants reported using sunscreen often or always. Time spent outside was not associated with sunscreen use (P=0.992), and remained a strong predictor of 25(OH)D3 even after adjusting for daily reported sun exposure, habitual sunscreen use and skin colour (P<0.001).

Conclusion: In Dunedin, time spent outside has a significant association with vitamin D status even after adjusting for sunscreen use. These results suggest that in general, use of sunscreen does not interfere with overall vitamin D manufacture. Public health interventions to improve vitamin D status should target safe sun exposure with sunscreen use.

Micronutrients

AN INVESTIGATION OF VITAMIN D STATUS AND ITS DETERMINANTS IN MIDDLE EASTERN WOMEN LIVING IN AUCKLAND: A PILOT STUDY

H. MAZAHERY[1], W. STONEHOUSE[1] AND P. VON HURST[1]

[1]Massey University Albany
Email: majedtmm@yahoo.co.nz

Background: Vitamin D status in Middle Eastern populations has been the interest of research due to the high number of risk factors for vitamin D deficiency in this population.

Objectives: A pilot study to identify the likelihood of vitamin D deficiency and determinants of vitamin D status in Middle Eastern women living in Auckland in order to plan strategies for further vitamin D research in this population.

Design: Cross-sectional. *Setting:*

Auckland, winter 2012. *Subjects:* 43

Middle Eastern women aged ≥20 with no major illness, living in Auckland.

Results: Vitamin D-containing supplements and prescribed vitamin D were used by 37.2% (16/43) and 20.9% (9/43) of women, respectively. None of the participants were vitamin D sufficient (serum-25(OH)D≥50 nmol/L). Vitamin D deficiency was observed in 74.4% (32/43) of subjects, with 27.9% (12/43) having severe deficiency (serum-25(OH)D<25 & <12.5 nmol/L, respectively). Serum-25(OH)D did not vary significantly with age, BMI, and having a private outdoor area. Serum-25(OH)D was lower in veiled than unveiled women (11.0[9.0-14.0] vs. 27.0[12.0-22.0] nmol/L, P=0.04, excluding supplement users), and in women with hypothyroidism (n=6) (12.0[10.0-14.0] vs. 18.0[13.0-31.0] nmol/L,P=0.05), and was higher in Persian (n=37) than Arab women (n=6) (20.0[14.0-31.0] vs. 9.0[9.0-11.0] nmol/L, P=0.001), and in prescribed vitamin D users vs. non-users (31.0[24.0-41.0] vs. 16.0[10.0-21.0] nmol/L, P=0.001).

Conclusion: Hypothyroidism, ethnicity, dress and prescribed vitamin D were determinants of vitamin D status. Prevalence of vitamin D deficiency in this population was alarmingly high. Further studies are required to determine if these findings are typical of this population, and if there are measurable seasonal differences.Background: Vitamin D status in Middle Eastern populations has been the interest of research due to the high number of risk factors for vitamin D deficiency in this population.

Nutrition and Elite Performance/ Appetite and food behaviours

DIETARY NITRATE SUPPLEMENTATION IMPROVES ROWING PERFORMANCE IN HIGHLY TRAINED ROWERS

A. BRAAKHUIS[1], H. BOND[2] AND L. MORTON[2]

[1]The University of Auckland
[2]Waikato Institute of Technology

Increased plasma nitrate concentrations from dietary sources of nitrate have proven to benefit exercise performance. Beetroot contains relatively high levels of sodium nitrate which increases nitric oxide production.

Purpose: This study investigated whether dietary nitrate supplementation, in the form of a beetroot beverage, improved rowing performance during ergometer repetitions.

Methods: In a randomised crossover design, fourteen elite male rowers consumed either beetroot containing ~5.5mmol.day-1 NO3 (BR) or placebo (PL) isocaloric drinks daily, for six days. Following supplementation, rowers completed six maximal 500m ergometer repetitions and times were recorded. A seven day washout period separated the two trials. Blood pressure, oxygen saturation, maximum heart rate, urine (specific gravity, pH and nitrites) and lactates were collected for analysis at baseline (one-month testing prior to experiment), once 30-min pre and immediately, 1- and 2-min post-performance testing.

Results: Changes in the mean with 95% confidence limits were calculated. There was a likely benefit to average repetition time in the BR condition, compared to PL (0.4%, 95% confidence limits, ± 1.0%). In particular, repetitions 4 – 6 showed an almost certain benefit in rowing time on BR (1.7%, 95% CL, ± 1.0%). The underlying mechanisms for the observed results remain unknown as differences observed in rowers' physiological measures between the two conditions were generally unclear.

Conclusion: Nitrate supplementation in the form of beetroot juice resulted in improved maximal rowing ergometer repetitions, particularly in the later stages of exercise.

Nutrition and Elite Performance/ Appetite and food behaviours

THE EFFECT OF PROBIOTICS ON ILLNESS INCIDENCE IN ELITE RUGBY PLAYERS

B. HAYWOOD[1], K. BLACK[1], R. BROWN[1] AND D. BAKER[2]

[1]University of Otago
[2]High Performance Sport New Zealand
Email: haybr111@student.otago.ac.nz

Probiotic supplements contain living organisms that effect the micro-fauna of the intestines. They are becoming increasingly popular for the attenuation of upper respiratory tract infections (URTI) and gastrointestinal illness (GI). Athletes are at increased risk of URTI compared to the general population. Research with endurance athletes suggest probiotic may enhance immune function and reduce incidence of URTI. At present there is no research examining the effects of probiotics on athletes in high intensity team sports. The aim of this study was to investigate the effects of probiotics on illness incidence in elite rugby players.

The study was a randomised, single-blinded, placebo-controlled, crossover trial with two arms: probiotics and placebo. A total of 34 participants from the Waikato Chiefs squad were recruited and randomly assigned to a treatment group. Each treatment was 4weeks, separated by a 4week washout period. On a daily basis throughout each treatment each player completed an "incidence" diary to record any URTI and GI symptoms during the past 24 hours. They were then provided with their allocated pill which was consumed in front of the researcher.

Probiotic supplementation resulted in a significantly lower incidence of any symptoms compared to the placebo, 16 episodes vs. 24 episodes ($p=0.03$). There was a tendency for fewer days of illness on the probiotic trial compared to the placebo trial ($p=0.054$). The mean duration of all symptoms was found to be significantly reduced in the probiotic participants 1.51 days vs. 2.91 days, $p=0.031$). There was no significant difference in severity of the symptoms between the two groups.

Nutrition and Elite Performance/ Appetite and food behaviours

EFFECTS OF NUT CONSUMPTION IN COMPARISON TO OTHER ENERGY-DENSE SNACK FOODS ON ENERGY BALANCE AND DIET QUALITY

AUTHORS
R. BROWN[1], S.L. TEY[1], A. GRAY[1], A. CHISHOLM[1] AND C. DELAHUNTY[2]

[1]University of Otago
[2]CSIRO, Australia
Email: rachel.brown@otago.ac.nz

Background: Epidemiological studies have shown that frequent nut consumption is not associated with adverse weight gain. Randomised controlled trials report that nut consumption results in either no weight gain or less weight gain than predicted. However, no studies to date have been designed to determine whether regular nut consumption is different to the frequent ingestion of other energy-dense foods in terms of body weight regulation and diet quality.

Objective: To examine the effects of regular nut consumption on body composition, resting metabolic rate (RMR), blood lipid profiles, and diet quality in comparison to other energy-dense snack foods.

Design: This 12-week study was conducted using a randomised, controlled, parallel design including four treatment arms: each of 1100 kJ/d of hazelnuts (42 g/d), chocolate (50 g/d), potato crisps (50 g/d) or no snack food (control group). Body composition, RMR, blood lipid profiles, and diet quality were measured at baseline and 12 weeks.

Results: There was no evidence of any statistically significant differences in follow-up body composition, RMR, and blood lipid profiles between groups after adjusting for baseline values, age, sex, and BMI (all $P \geq 0.106$). However, diet quality was substantially enhanced in the nut group. Compared to all other groups, the percentage of total energy from saturated fatty acids (all $P \leq 0.045$) and carbohydrate (all $P \leq 0.006$) was significantly lower whereas vitamin E intake (all $P \leq 0.007$), the percentage of energy derived from monounsaturated fatty acids (all $P \leq 0.001$) and polyunsaturated fatty acids (all $P \leq 0.011$) was significantly higher in the nut group at week 12.

*Conclusion:*Consuming energy-dense snack food for 12 weeks appears to have no effect on body composition, RMR, and blood lipid profiles in this group of healthy, normocholesterolaemic non-obese individuals. Nut consumption significantly improved diet quality in a way that would be expected to lower cardiovascular disease risk.

Nutrition and Elite Performance/ Appetite and food behaviours

NORMALISED EATING IN THE TREATMENT OF EATING DISORDERS

J. WEBER[1] AND G. BINFORD[2]

[1]Massey University
[2]Regional Eating Disorders Service
Email: garalynneb@adhb.govt.nz

Background: Normalising eating behavior is one of the primary goals for recovery from eating disorders. There is a lack of consensus or working definition about what normalised eating is. Investigation of eating patterns in recovered eating disorder patients has been limited. The assumption appears to be normalised eating will automatically follow weight restoration.

Objectives: Primary aims of the study were to 1) describe normalised eating as a treatment goal for eating disorders using a sample of "expert opinions" and 2) compare the description with the eating patterns of the general New Zealand population and New Zealand food and nutrition guidelines.

Methods: Mixed methods used online survey and depth interviews. Participants were recruited through online and print advertising. The participants included 1) a healthy control group, 2) individuals who had recovered from a diagnosed eating disorder, 3) dietitians working in the field of eating disorders and 4) other clinicians working in the field of eating disorders.

Outcomes & Conclusion: Participant groups showed overall agreement. A range of eating patterns was described as normalised. For example, it can involve 2 to 7 eating episodes in a day. While normalised eating is likely to involve a specific set of actions most of the time (e.g. 3 meals and 2-3 snacks), the reasons for eating seem to underpin normalised eating more than the specific actions (e.g. "if hungry after dinner will have a piece of fruit"). The core characteristics of normalised eating identified were: eating mostly in response to physiological appetite, flexibility in food choices and eating behaviours, the total absence of fear or anxiety around eating, and a nutritionally adequate intake. Apart from higher fibre content, the nutritional content of a day of normalised eating is similar to the intake of the general New Zealand population. This description of normalised eating differs from New Zealand food and nutrition guidelines in the inclusion of baked products or sweets.

Healthy start to life

FREQUENCY OF CONSUMPTION OF FOODS AT 4 AND 6 YEARS OF AGE: RELATIONSHIPS TO BODY WEIGHT AT 9 YEARS IN CHILDREN IN THE PACIFIC ISLAND FAMILIES STUDY

E. RUSH[1], F. SAVILA[1] AND V. OBOLONKIN[1]

[1]Auckland University of Technology
Email: Elaine.rush@aut.ac.nz

Background: Food frequency questionnaires (FFQ) may be used to determine key foods, dietary balance and patterns from a whole food perspective. The longitudinal Pacific Island Family (PIF) Study recruited mothers (n=1376) of children born at Middlemore Hospital in South Auckland in 2000.

Objective: To identify the most frequently eaten foods by the children at ages 4 and 6 years and identify associations with body size at 9 years.

Design: Completed FFQ were available at 4 and/or 6 years for 1225 (582 girls, 643 boys; singleton, term children whose mothers did not have known diabetes) were available and food scores for 111 foods computed assessing frequency/day. Individual foods were grouped by common characteristics e.g. sugar added. Associations of the top 12 foods and by food group with weight at age 9 were explored.

Results: On average at ages 4 and 6, 24% of the 31 portions reported consumed in a day were foods that had sugar added and when fruit and fruit juice were added to this grouping 35% of all portions consumed was accounted for. On average each child had a portion of chicken every three days. An extra half portion of chicken consumed at 6 years was associated with a weight difference at 9 years of around 10 kg in boys and girls.

Conclusion: This longitudinal PIF study provides some evidence that body weight at 9 years is associated with foods consumed at 4 and 6 years.

Healthy start to life

INVESTIGATING THE FOOD HABITS AND BELIEFS OF PREGNANT WOMEN LIVING IN RURAL BANGLADESH

M. KINDRED[1], R. KRUGER[1] AND C. CONLON[1]

[1]Massey University Albany
Email: mon.kindy@gmail.com

Background and aim: In developing countries such as Bangladesh, the maternal diet is limited and malnutrition rates are high. A qualitative approach was used to gain an understanding of food consumption practices during pregnancy and the role of traditional eating habits/beliefs in the maternal diet in rural Bangladesh.

Methods: Individual interviews (demographic questionnaire; individual dietary diversity questionnaire) were conducted with pregnant women (n=43) in nine villages in Pirganj. Eight focus groups (one per village) were conducted, completing a harvest calendar ('ten seed method') and a semi-structured discussion about food habits and beliefs whilst pregnant.

Results: The women's age ranged between 15-42 years, 25 belonging to an ethnic minority and 18 being Muslim. The mean diet diversity score was 5.9 (14 food groups) and their mean food variety score was 7.2, indicating poor diversity. Crops cultivated included rice, jackfruit and mango. Rice is their main crop, harvested twice a year, and consumed daily by all women. Most women eat fish 1-2 times a week and meat once every 2-3 months. Taboos regarding pregnancy include: food preparation during an eclipse can cause babies to be born with ear/mouth deformities; a small pregnancy belly is desirable to prevent difficult childbirth; encouragement to eat eggs, milk and banana to improve their health; avoiding pineapple and green papaya because it can cause miscarriage.

Conclusion: Eating habits and taboos are engrained into the Bangladeshi culture, often resulting in poor nutritional outcomes. Understanding eating habits and taboos is vital in making sustainable improvements to health and wellbeing.

Healthy start to life

COMPLEMENTARY FOOD PROCESSED FROM SWEETPOTATO COULD POSITIVELY CONTRIBUTE TO VITAMIN A AND IRON STATUS OF INFANTS BASED ON COMPOSITIONAL ANALYSIS

F. AMAGLOH[1,2] AND J. COAD[1]

[1]Massey University Palmerston North
[2]University for Development Studies, Ghana
Email: J.coad@massey.ac.nz

Background: Although cereal-legume blends could positively contribute to growth during infancy, such blends have not been associated improved vitamin A and iron status unless fortified with these micronutrients. The low β-carotene (vitamin A precursor) and high phytate (an inhibitor of iron) of cereals and legumes contribute to the low vitamin A and iron status when infants are fed cereal-legume blends without micronutrients fortification. Fortification of porridge with micronutrients at the household-level is seldom particularly for infants in resource-poor low-income countries.

Objective: To compare the levels of inhibitors of iron absorption such as phytate and total polyphenols, and iron enhancers, ascorbic acid and possibly β-carotene, in sweetpotato- and cereal-based infant formulations.

Design: An easy-to-replicate household-level processing method was employed to produce the sweetpotato-based weaning food (denoted ComFa) from orange-fleshed (OFSP) and cream-fleshed (CFSP) sweetpotato varieties. A household-level maize-soyabean-groundnut blend, referenced as Weanimix, was processed, and a proprietary wheat-based infant cereal, NESTLÉ® CERELAC® Wheat and Ikan Bilis (anchovies), was sourced for comparison with the ComFa formulations. The OFSP and CFSP ComFa, as well as Weanimix contained the same amount of fish powder prepared from anchovies as an ingredient.

Outcomes: The OFSP ComFa exceeded the maximum limit of 43 µg/100 kJ for "added" vitamin A stipulated the Codex Standard for processed cereal-based infant food that will be prepared for consumption with either water or non-protein liquid. The vitamin A content CFSP ComFa, Weanimix and Cerelac was 5, 0.1 and 11 µg/100 kJ respectively, below the minimum limit of 14 µg/100 kJ. The sweetpotato-based formulations and Weanimix were slightly below the recommended iron level (12 mg/100 g) in the CS. The amount of phytate in the in OFSP ComFa, CFSP ComFa, Weanimix and Cerelac was 230, 79, 438 and 67 mg/100 g, respectively. The sweetpotato-based formulations contained about twice the amount of total polyphenols (expressed as mg Gallic acid equivalents/100 g) in Weanimix (264) and Cerelac (214). Measurable amounts of ascorbic acid (mg/100 g) were only in the OFSP ComFa (32), CFSP ComFa (37) and Cerelac (53). The β-carotene content (µg/100 g) was 13 353, 1 263, 34 and 66 in OFSP ComFa, CFSP ComFa, Weanimix and Cerelac respectively.

Conclusion: These results suggest that the orange-fleshed sweetpotato-based complementary foods would positively contribute to the vitamin A and iron status of infants in low-income countries

because of the relatively low phytate and high levels of ascorbic acid and carotene.

Lipids and proteins

BASELINE INFLAMMATORY STATUS MODULATES PLASMA LIPID AND INFLAMMATORY MARKER RESPONSES TO KIWIFRUIT CONSUMPTION IN HYPERCHOLESTEROLAEMIC MEN: A RANDOMISED CONTROLLED TRIAL

C. GAMMON[1], R. KRUGER[1], C. CONLON[1], P. VON HURST[1], B. JONES[1] AND W. STONEHOUSE[1]

[1]Massey University
Email: c.gammon@massey.ac.nz

Background and aims: Kiwifruit has the potential to beneficially affect markers of metabolic dysfunction, but the response may be modulated by inflammatory state.We aimed to investigate whether inflammatory state would modulate the effect of consuming two green kiwifruit daily on plasma lipids and markers of inflammation.

Methods: Eighty-five hypercholesterolaemic men (LDL-C >3mmol/L and triglycerides (TG) <3mmol/L) completed a 4-week healthy diet run-in, before being randomized to a controlled cross-over study of two 4-week intervention sequences of consuming two green kiwifruit/day plus healthy diet (intervention) or healthy diet alone (control). Anthropometric measures and fasting blood samples (plasma lipids, serum apolipoproteins A1 and B, hs-CRP and IL-6, TNF-α and IL-10) were taken at baseline, 4 and 8 weeks. Subjects were divided into low and medium inflammatory groups, using baseline hs-CRP concentrations (hs-CRP <1 and 1-3 mg/L, respectively).

Results: In the medium inflammatory group the kiwifruit intervention resulted in significant improvements in plasma HDL-C (mean difference 0.08 [95% CI: 0.03, 0.12)] mmol/L [P<0.001]), TC/HDL-C ratio (-0.29 [-0.45, -0.14]) mmol/L [P=0.001]), plasma hs-CRP (-22.1 [-33.6, -4.97] percent [P=0.01]) and IL-6 (-43.7 [-63.0, -14.1] percent[P=0.01]) compared to control treatment. No effects were seen in the low inflammatory group. There were significant between inflammation group differences for TC/ HDL-C (P=0.02) and TG/HDL-C (P=0.05) ratios, and plasma IL-6 (P=0.04).

Conclusions: Inflammatory state modulated the responses to the kiwifruit intervention. Improvements in inflammatory markers and lipid profiles were seen in subjects withmodest inflammation, suggesting this group may particularly benefit from the regular consumption of green kiwifruit.

Clinical trial registry:
ACTRN12610000213044
www.ANZCTR.org.au

Lipids and proteins

DOSE-RESPONSE EFFECT OF HAZELNUT CONSUMPTION ON CVD RISK FACTORS AND ACCEPTANCE IN OVERWEIGHT AND OBESE INDIVIDUALS

A. TEY[1], R. BROWN[1], A. GRAY[1], A. CHISHOLM[1] AND C. DELAHUNTY[2]

[1]University of Otago
[2]CSIRO, Australia
Email: siewling.tey@otago.ac.nz

Background: Regular nut consumption may have beneficial effects on cardiovascular disease risk factors that go beyond their cholesterol-lowering properties, e.g. improvement in markers of inflammation. These markers are more pronounced amongst overweight and obese populations. Studies are lacking regarding the quantity of nuts required to confer these health benefits without compromising body weight.

Objective: To compare the effects of incorporating hazelnuts at two different doses with a diet without nuts on blood lipids, inflammatory markers, body composition, and acceptance ('desire' and 'liking') in 107 overweight and obese individuals.

Design: This 12-week randomised, controlled, parallel design study included three treatment arms: 30 g/d of hazelnuts, 60 g/d of hazelnuts or no nuts (control group). Plasma lipids, hs-CRP, IL-6, ICAM-1, VCAM-1, and body composition were measured at baseline, 6 weeks and 12 weeks. In addition, 'desire' and 'liking' for nuts were assessed using 150 mm visual analogue scales at weekly intervals during the 12-week exposure period.

Results: There was no evidence of any statistically significant differences in follow-up clinical outcomes between groups after adjusting for baseline values, age, sex, and BMI (all $P \geq 0.065$). The 'desire' and 'liking' for nuts remained stable across the exposure period in the 30 g nut group whereas these ratings decreased significantly over time in the 60 g nut group (both $P < 0.001$).

Conclusion: Twelve-weeks of hazelnut consumption appears to have no effect on blood lipids, inflammatory markers, and body composition in this group of healthy, normocholesterolaemic overweight and obese individuals. The current guideline to consume one serve (i.e. 30 g) of nuts on a regular basis is achievable and sustainable in the long-term. However, encouraging higher intakes (i.e. 60 g) appears to compromise acceptance, which may in turn reduce nut consumption.

Lipids and proteins

DOES DRY ROASTING LIGHTLY SALTING NUTS INFLUENCE HEALTH OUTCOMES AND ACCEPTABILITY?

T. ROBINSON[1], R. BROWN[1] AND A. CHISHOLM[1]

[1]University of Otago
Email: terryn.robinson@otago.ac.nz

Background/objectives: Raw nuts have many nutritional attributes, which have been shown to exert a wide range of health benefits, thus reducing the development of risk factors for cardiovascular disease. Roasted and salted nuts have been reported to be more palatable than raw nuts. Dry roasting and lightly salting nuts may improve their acceptability and result in intakes congruent with recommendations. However, it is unknown whether the consumption of dry roasted lightly salted nuts negates the health benefits observed with raw nuts. Thus, the objective of this study was to investigate the effect of regularly consuming raw or dry roasted lightly salted hazelnuts on cardiovascular risk factors and acceptability.

Methods: This study was conducted using a randomized crossover design. Seventy-three participants were assigned in random order to consume 30g of raw or dry roasted lightly salted hazelnuts for 28 days. Cardiovascular risk factors (blood lipids and lipoproteins, glucose, α-tocopherol, blood pressure, body composition) were measured at the beginning and end of each treatment. In addition, acceptability ("desire to consume", "overall liking") for nuts was assessed daily during the 28-day exposure periods.

Results: HDL-cholesterol and TAG concentrations were significantly lower following the consumption of dry roasted lightly salted hazelnuts, compared to raw hazelnuts. When compared to baseline, consuming both forms of hazelnuts significantly improved LDL-cholesterol, HDL-cholesterol, apolipoprotein A1, α-tocopherol and blood pressure, without significantly changing body composition. There were no significant differences in "desire to consume" and "overall liking" ratings between both forms of hazelnuts. The ratings remained high and stable throughout the exposure periods.

Conclusions: There were no significant between-group differences in any of the outcome measurements, except for TAG and HDL-cholesterol concentrations. Consuming both forms of hazelnuts equally improved plasma lipid and apolipoprotein profiles, α-tocopherol and blood pressure in a way that would be expected to reduce cardiovascular disease risk. Acceptability results suggest that both forms of hazelnuts were equally acceptable and the ratings were not influenced by long-term consumption of these products at the recommended amount (i.e. 30 g).

Healthy aging

INCREASED VEGETABLES, HERBS AND FRUIT INTAKE: EFFECTS ON BONE TURNOVER MARKERS AND URINARY ELECTROLYTE EXCRETION IN POST MENOPAUSAL WOMEN.

C. GUNN[1], J. WEBER[1] AND M. KRUGER[1]

[1]Massey University Palmerston North
Email: c.a.gunn@massey.ac.nz

Background: Bone health and fruit and vegetable intake are positively linked. Possible mechansims for this include lowering potential renal acid load (PRAL) and provision of micronutrients. Select vegetables, fruit and herbs have been shown in an animal model to affect bone resorption suggesting a functional role of phytochemicals. Objective: To assess the effect of increasing fruit and vegetable intake to 9 serves/day in postmenopausal women on PRAL, markers of bone turnover and urinary excretion of electrolytes. Method: 150 healthy women (≥ 5 years postmenopausal) were recruited from the community. Using a randomized parallel controlled design, 100 women in the dietary intervention were assigned to one of two groups both increasing intake to 9 serves/day but emphasising different selections of vegetables, fruit and herbs. Another 50 women served as a negative control. Blood and 24hour urine samples were taken at baseline and end of study for calcium, potassium, magnesium and sodium and bone markers C-terminal telopeptide (Ctx) and procollagen type 1 amino- terminal propeptide (P1NP). Results: Both groups with increased intake of fruit/vegetable/herbs had significantly reduced PRAL and urinary excretion of calcium and sodium and increased potassium excretion. The bone resorption marker CTx signifcantly reduced in women over 60 years of age emphasizing a specific range of vegetables, fruit and herbs. Conclusion: Bone health may be improved by increasing fruit and vegetables and including specific fruit, vegetables and herbs regularly.

Healthy aging

MALNUTRITION IN NEW ZEALAND'S ELDERLY POPULATION: INTERIM RESULTS FROM A TEN YEAR INTERNATIONAL COMPARATIVE SURVEY

J. WESTSTRATE[1]

[1]Care-Metric
Email: j.weststrate@gmail.com

Aim: To present findings from the interim report of the International Prevalence Measurement of Care Problems that provides healthcare decision makers an accurate picture of how important issues, especially malnutrition, impact on patients and staff and on rising health care costs.

Method: Several institutions worldwide collaborate in this annual international survey. Originating in the Netherlands, it is now conducted in Germany, Austria, Switzerland and New Zealand. Each country reports results, providing a good overview of the policy, prevalence, prevention and treatment of measured care problems in the elder population, including malnutrition.

Results: This paper presents the combined results of the measurements in the 2011 international survey.

Results show that awareness genuinely leads to improvement in daily practice. For example, the more times one institution participated in a malnutrition measurement, the higher the reduction in malnutrition prevalence. Not just due to the measurement itself though, as intervention is required to initiate change.

Conclusion: Evidence shows that measurement leads to improvement, with feedback and audit being the strongest interventions for change in health care institutions.

Measuring care problems brings them into the awareness of caregivers, managers, policymakers and politicians. Based on the results of the IPMCP survey, health care institutions can start improving their care performance by examining the daily routine for prevention, interventions and quality indicators.

Importantly, these results give politicians insight into care quality whilst providing evidence-based data to support programmes designed to improve care quality nationally, as in the Netherlands - where malnutrition prevalence has reduced.

Healthy aging

LILACS NZ: PREDICTORS OF NUTRITION RISK IN OLDER MĀORI AND NON-MĀORI

C.A. WHAM[1], R.O.Y. TEH[2], S.A. MOYES[2] AND N.M. KERSE[2]

[1]Massey University Albany
[2]University of Auckland
Email: c.a.wham@massey.ac.nz

Aim: This study aims to examine predictors of nutrition risk.

Methods: Life and Living to Advanced Age, a Cohort Study (LILACS NZ) recruited 937 (421Māori; 526 Non-Māori) octogenarians living in the Bay of Plenty and Lakes District Health Board areas.Standardised questionnaires and physical assessments were undertaken. The 'Seniors in the Community: Risk Evaluation for Eating and Nutrition '(SCREEN II)'identified nutrition risk. The 24 hour MPR method assessed nutrient intake.

Findings: Among older Māori 59% were at high nutrition risk (SCREEN II score <49). The mean SCREEN II score was 46±6 (range 20-56; maximum score of 64). Controlling for health and socioeconomic factors predictors of high nutrition risk were living alone, depression and a lower physical activity score. Cultural factors included those whose mother lived as Māori and for men, those with a specific role in Māori organisations. BMI attenuated the relationship between physical activity and the mother living as Māori. Nutrition risk factor items and macronutrient intake differed among those who used Te Reo Māori and those who had a specific role in Māori organisations compared to those who don't. High nutrition risk was prevalent in 39% of older non-Māori. The mean SCREEN II score was 50±6 (range 20-63). Predictors of high nutrition risk were gender, living alone and depression. Those with better physical health related QOL were at lower nutrition risk. Controlling for living arrangement, marital status and SES there was a significant difference in macronutrient intake by gender.

Relevance: Nutritional wellbeing of older Māori appears to be related to culture in combination with other factors. Common nutritional risk factors were evident in older non-Māori. Taking the opportunity to eat meals with others is an important preventative measure.

Nutraceuticals and functional foods

BENEFICIAL GUT HEALTH EFFECTS OF VEGETABLE FIBRES

C. BUTTS[1], G. PATURI[1], T. NYANHANDA[1], J. MONRO[1] AND J. ANSELL[1]

[1]The New Zealand Institute for Plant and Food Research
Email: chrissie.butts@plantandfood.co.nz

Dietary fibre has been shown to have a profound effect on general health and well-being. The associated health benefits of consuming a diet rich in fruit, vegetables and whole grain cereals is likely due to the presence of dietary fibre.

We investigated the effects of dietary fibres from vegetable sources on gastrointestinal (GI) health using the rat as a model for the mammalian GI tract. When rats were fed broccoli fibre with a high fat (30% corn oil) diet, the number of Lactobacillus spp. ($P = 0.009$), butyric acid concentration ($P = 0.011$) in caecum, and the number of colonic goblet cells ($P < 0.001$) were enhanced compared with rats fed cellulose.

A high protein (25% lean cooked beef) diet supplemented with potato fibre increased the abundance of Bifidobacterium spp. ($P < 0.001$) in the colon of rats, while those fed the diet supplemented with potato resistant starch showed an increase in abundance in Bifidobacterium spp. ($P < 0.001$) and Lactobacillus spp. ($P = 0.016$). Potato fibre supplementation lowered the growth of undesirable bacteria such as Enterococcus spp. in the caecum. Beneficial changes in short-chain fatty acid concentrations and more goblet cells per crypt were observed in the colon of rats fed potato fibre.

The results of these studies show that increasing the amount of fermentable fibre can enhance GI tract health despite the diet containing high levels of fat and protein.

Nutraceuticals and functional foods

FUNCTIONAL ATTRIBUTES OF KIWIFRUIT IMPORTANT TO HEALTH

S. MISHRA[1] AND J. MONRO[1]

[1]The New Zealand Institute for Plant and Food Research
Email: suman.mishra@plantandfood.co.nz

Kiwifruit is well known for its laxative effects in the large bowel. However, because it contains a high proportion of pectin-rich cell walls we hypothesed that it would also exhibit physicochemical properties in foregut that could be beneficial to health. We therefore analysed the properties of dietary fibre under in vitro digestive conditions and measured its ability to influence mixing and diffusion in a simulated small segment. Digestion-resistant remnant of kiwifruit were able to strongly retard both mixing of intestinal contents and glucose diffusion. The retardation of mixing by kiwifruit cell wall particles was strongly dependent on background viscosity provided by soluble dietary fibre. In the presence of low viscosity guar gum solution (0.5%) digested kiwifruit cell wall that had been allowed to settle passively reduced mixing by 75%. The same digested kiwifruit preparation retarded glucose diffusion by 30% and the effect was similar for GREEN and GOLD kiwifruit. The results show that kiwifruit may have health benefits through its effects on rate of nutrient absorption in the foregut, by reducing postprandial blood glucose and probably postprandial lipidaemia.

Nutraceuticals and functional foods

MANUKA CYCLOPOWER - NEW ADVANCEMENTS IN THE DEVELOPMENT AND BIOACTIVE EFFICACY OF NEW ZEALAND'S MANUKA HONEY

L. CHEPULIS[1], E. FRANCIS[1] AND E. TRUTER[1]

[1]Waiariki Institute of Technology
Email: lynne.chepulis@gmail.com

The bioactive properties of Manuka honey are now well recognised (including antimicrobial, anti-inflammatory and immuno-stimulatory activities) and most of these actions are due to the compound methylglyoxal. However, the nature of honey (a sticky, viscous fluid) can create a challenge when using it as a treatment for health complications. A new technology using encapsulation of Manuka honey with alpha-cyclodextrin (a natural 5-glucose cyclical oligosacharride) has been developed by Manuka Health NZ creating a free-flowing powder that can easily be added to foods and beverages, or encapsulated for the ease of delivery of health products. Initial research has demonstrated that Manuka Cyclopower™ (containing 45% active Manuka honey and 55% alpha-cyclodextrin) increases the bioactivity of the Manuka honey (specifically antimicrobial potency (including antibiotic-resistant organisms) and anti-inflammatory activity) when compared with the uncomplexed honey. Further, clinical evaluation demonstrated that the product is well tolerated at up to 16 capsules a day (6400 mg of Manuka Cyclopower™) in most individuals, despite the fact that larger quantites of alpha-cyclodextrin have been associated with having gastro-irritant properties. Manuka Cyclopower™ has also been shown to have a significantly lower glycaemic index value (18) than a comparable amount of honey (~50). Both the complex and raw Manuka honey have potential as a dietary sugar replacement and as a therapeutic neutraceutical agent for gastrointestinal infection and inflammation.

POSTER PRESENTATIONS

ABSTRACTS ARE LISTED IN ALPHABETICAL ORDER BY TITLE

ANTIOXIDANTS AND OXALATES OF SOME FRUITS GROWN IN NEW ZEALAND

H. NGUYEN[1], G. SAVAGE[1] AND J. BUSCH[1]

[1]Lincoln University
Email: Janette.Busch@lincoln.ac.nz

Antioxidants and oxalates of some fruits grown in New Zealand Nguyen, H.V.H. Savage. G. P. and Busch, J. M. Department of Wine, Food and Molecular Biosciences, Lincoln University, Canterbury, New Zealand The regular consumption of fruit is promoted because fruits contain health promoting nutrients, including phenolic compounds, dietary fibre, folate, potassium and plant proteins. Phenolic compounds are the largest portion of antioxidants found in plant foods. Antioxidants in fruits have attracted attention because of their potential to reduce the level of oxidative stress; a major factor in the development of many human diseases. However, other components present in fruit that may cause adverse health effects, such as oxalates. Oxalates have been implicated in the formation of kidney stones in susceptible people. Unfortunately, some fruits high in phenolic compounds also have high oxalate contents. In this study, total, soluble and insoluble oxalates, antioxidant capacities and total phenolics concentrations were determined in golden and green kiwifruit, kiwi berry, black raspberry, persimmon, red gooseberry, feijoa, red currant and rhubarb. Total oxalate results ranged from 7.4 to 640.2 mg/100 g FW; soluble oxalates from non-detectable to 43.3 mg/100 g FW; insoluble oxalates from 5.1 to 208.9 g/100 g FW; antioxidant capacity determined by ABTS assay ranged from 42 to 679 µmol Trolox equivalents (TE)/100 g FW; by ORAC assay from 629.0 to 4728.0 µmol TE/100 g FW; total phenolic concentrations from 60 to 431.9 mg gallic acid equivalents (GAE)/100 g FW. Multiple regression analysis of the data for black raspberry, redcurrant, golden kiwifruit and kiwi berry (fruit containing both high oxalate contents and high phenolic compounds) revealed some interesting relationships.

ARTERIAL STIFFNESS AND BODY COMPOSITION IN PALMERSTON NORTH MEN AGED 30-70 YEARS: A PILOT STUDY

M. QUILTER[1], S. BUCHANAN[1], L. HODGES[1] AND J. COAD[1]

[1]Massey University
Email: m.l.quilter@massey.ac.nz

Augmentation index(AIx) reflects systemic arterial stiffness, commonly associated with increased cardiovascular risk. Obesity influences vascular stiffness; however, there is limited knowledge about the association between AIx and body composition. This pilot study investigated the association between AIx and body composition in a self-selected group of men (n=29) aged 30-70 years. Arterial stiffness was assessed via radial applanation tonometry (SphygmoCor®, pulse-wave analysis). This technique measures peripheral arterial pressure waveforms and generates corresponding central aortic waveforms, allowing determination of the augmentation of central pressure resulting from wave reflection and AIx. Height, mass, body mass index (BMI), waist (WC) and hip circumferences (HC), waist-hip ratio (WHR), and percentage body fat (%BF) using Air Displacement Plethysmography (BodPod®) were measured. The expected correlations were present between all body composition measurements ($P<0.001$). Age correlated with body mass ($r=-0.412$, $P = 0.026$), BMI ($r=-0.397$, $P = 0.033$), WC ($r=-0.382$, $P = 0.045$) and HC ($r=-0.539$, $P = 0.003$). Weight correlated with height ($r=0.391$, $P=0.036$). Heart rate correlated with WC ($r=0.377$, $P = 0.048$) and %BF ($r=0.619$, $P = 0.000$). Systolic, diastolic, and peripheral mean pressure all positively correlated with BMI, WC and WHR ($P <0.05$). Central systolic pressure showed a positive correlation with WHR ($r=0.504$, $P=0.006$), central diastolic pressure was correlated with weight ($r=0.369$, $P=0.049$), BMI ($r=0.418$, $P=0.024$), WC ($r=0.415$, $P=0.028$), and WHR ($r=0.485$, $P=0.009$). However, no correlations existed between any body composition measurements and AIx. The small sample size resulted in a lack of statistical power to detect other relationships. A number of trends suggest further investigation is required.

ASSESSING THE PREVALENCE OF MALNUTRITION AND THE RISK OF NUTRITIONAL DETERIORATION IN HOSPITALISED PAEDIATRIC PATIENTS IN NEW ZEALAND

V. MOEENI[1], T. WALLS[1] AND A. DAY[1]

[1]University of Otago
Email: moeve231@student.otago.ac.nz

Background: assessment is an important aspect of monitoring children. Several nutritional risk screening (NRS) tools have been developed for early detection of "at risk" paediatric patients. ThreeNRS tools (STAMP, STRONGkids and PYMS) have been validated in Europe but not in NZ.

Aims: 1. to define the nutritional status of hospitalised childrenin comparison with healthy children in the same community 2. To compare and contrast the three NRS tools for patients in terms of the ease of completion and the validity of scores with comparison to their current nutritional status.

Methods: 162 children admitted to Christchurch Hospital were assessed along with a matched group of healthy children. The nutritional state of patients was assessed by anthropometry and classified using standard criteria. The three NRS tools were applied and patients were classified into low, moderate and high risk groups. The results were compared in terms of tools' feasibility and validity.

Results: Under-nutrition was more frequent in the inpatient group (9.9% versus 3.7%; p=0.04), whereas both groups had similar rates of overweight/ obesity. NRS tools were able to identify the majority of the malnourished patients in their moderate to high risk groups. Under-nourished patients had longer hospital stay than well-nourished patients.

Conclusion: Hospitalised children in NZ have higher rates of under-nutrition than healthy children. The three NRS tools were able to identify children at nutritional risk with differing utility. STRONGkids was the most usefuland reliable tool: the use of this tool in the routine clinical setting requires further assessment.

ASSESSING THE RELIABILITY AND VALIDITY OF BIOELECTRICAL IMPEDANCE ANALYSIS AND DUAL-ENERGY X-RAY ABSORPTIOMETRY TO MEASURE BODY FAT PERCENTAGE AGAINST AIR DISPLACEMENT PLETHYSMOGRAPHY

M. INGRAM[1], C. WONG[1], D. WALSH[1], P. VON HURST[1], C. CONLON[1], R. KRUGER[1] AND W. STONEHOUSE[1]

[1]Massey University Albany
Email: m.ingram@massey.ac.nz

Background: Body fat percentage (BF%) is most accurately predicted using BodPod (gold standard). Dual X-ray Absorptiometry (DXA) and Bio-impedance Analyser (BIA) also predict BF %, but have not been validated against the BodPod in a large sample with a range of healthy adults.

Aim: To assess the validity of BIA and DXA for assessing BF% against BodPod, and to test the repeatability of each method.

Methods: BF% of 164 adults (18-70y) was assessed twice within 5 days using BodPod, DXA and BIA. Validity was determined by comparing methods (t-test), Pearson's correlations, linear regression and method of triads. Repeatability was assessed by Pearson's correlations and comparing first and second measurements.

Results: Overall, there was a good relationship between BIA and BodPod (r2=0.88). Mean BF% difference for BodPod – BIA was 2.04[95% CI 1.68-2.40]%. Half of BIA measurements ranged from 4.6 below to 0.4 above BodPod (median 2.00; 25th, 75th percentile: -0.4, 4.6). Mean BF% difference for BodPod – DXA was 0.39[95% CI 0.02-0.77]. DXA BF% from 20% - 40% had a good relationship with BodPod (r2=0.78, intercept=-0.02, slope=1.03), but BF% <20 and >40 were lower and higher than BodPod, respectively. Method of triads showed strong correlations between both BIA and DXA and the 'truth' (ρBI.T=0.967; ρDX.T=0.974). For repeatability, within-subject correlations were strong for all methods (BodPod 0.9898; DXA 0.9951; BIA 0.9953). Analysis of differences between visits show most less than 1%, but up to 5.6% (BodPod).

Conclusions: On average, BodPod BF% can be predicted from BIA readings by adding 2%. DXA compares well to BodPod from 20-40% body fat, but underestimates BF% <20 and overestimates >40.

BIOCATALYTIC SYNTHESIS OF PHYTOSTEROL ESTERS WITH CONTROLLABLE FATTY ACIDS COMPOSITION AND EVALUATION OF THEIR HYPOCHOLESTEROLEMIC EFFECT IN GOLDEN HAMSTER

M. ZHENG[1]

[1]Oil Crops Research Institute, Chinese Academy of Agricultural Sciences
Email: mingmingabc1983@163.com

Fatty acid esters of phytosterols are advantageous in applications to a wide range of food products because of their better lipid-solubility, lower melting point and more significant cholesterol-lowering activity compared to the free phytosterols. The fatty acids composition that linked with phytosterol esters could influence the activity of sterol ester significantly and has gained much attention. For example, phytosterol esters of PUFA possessed more significant hypocholesterolemic effect compared with sterol esters of saturated fatty acids (SFA) and MUFA. However, little attention has been paid to synthesis phytosterol esters with controllable fatty acids (FFAs) composition until now. A novel immobilized lipase was prepared employing mixed-mode composite material SiO2@P(MAA-co-VBC-co-DVB) as the carrier. The resulting immobilized CRL showed much better thermal stability and reusability in comparison to free CRL. Base on the excellent biocatalyst prepared, a method for high efficiency enzymatic esterification of phytosterols with different fatty acids to produce the corresponding phytosterol esters was developed. Under the optimized condition, six phytosterol esters with conversions of above 92.1% and controllable fatty acids composition were obtained. The prepared phytosterol esters possessed low acid value (AV) (≤0.86 mgKOH/g), peroxide value (PV) (≤2.2 meq/kg) and conjugated diene (CD) value (≤1.74 mmol/kg) and high purity (≥97.8%) and fatty solubility (≥28.9g/100mL). All the characteristics favored the wide application of phytosterol esters with controllable fatty acids composition in different fields of functional food. Compared with commercially available phytosterol esters, the phytosterol linolenate has more significant hypocholesterolemic activity using golden hamster as the hyperlipidemia model.

DELETION OF THE GSTT1 GENOTYPE LINKED TO TOLERANCE OF BRASSICACEAE IN PEOPLE WITH CROHN'S DISEASE IN A NEW ZEALAND COHORT

B. CAMPBELL[1], D.Y. HAN[1], W.J. LAM[1], A. MORGAN[2] AND C.M. TRIGGS[1]

[1]The University of Auckland
[2]University of East Anglia, United Kingdom
Email: b.campbell@auckland.ac.nz

Nutrition has a major role particularly in Crohn's disease, which is one of the major expressions of inflammatory bowel disease (IBD), through nutrigenomic and epigenetic regulation of the genes involved. Brassicaceae are the source of important nutrients that are involved in promoting immune function, suppressing inflammation and boosting anti-cancer factors in the body.

The Isothiocyanates,a component of glucosinolates, the phytochemicals almost exclusive to Brassicaceae, have been identified as the major bioactive constituent interacting with particular genotypes to enable this. Isothiocyanates are substrates for the glutathione transferases enzyme glutathione transferease GSTT1 (GSTTI).

The aim of this study was to investigate if there was a link to the null genotype or active or expressed genotype of the GSTT1 gene in association with Brassicaceae intake and the symptoms experienced by people with Crohn's disease in a Caucasian data set from the IBD Study in Auckland, New Zealand. The GSTT1 positive/null genotypes were determined using the Sequeonum platform and the TaqMan Copy Number Assay on 400 people with Crohn's disease and 615 controls.

When an adjustment for smoking was made the data indicated a trend with respect to the GSTT1 deletion(-/-) for a beneficial effect on the symptoms of Crohn's disease from consuming three varieties of Brassicaceae - broccoli, cauliflower and Chinese greens (p=0.015, 0.036, and 0.031 respectively).

The findings of this study indicate that GSST1 deletion in people with Crohn's disease in a New Zealand cohort may be associated with increased tolerability to specific Brassicaceae.

DEVELOPMENT OF A NOVEL NANOSTRUCTURED LIPID CARRIERS CONTAINING MICROALGAL OIL FOR FOOD APPLICATION

X. DONG[1], J. WANG[1], H. CHEN[1], F. HUANG[1] AND C. HU[1]

[1]Institute of Oil Crops Research, Chinese Academy of Agricultural Sciences
Email: dxuyan2006@163.com

In recent years, considerable attention has been focused on essential fatty acids and Lipophilic bioactive components, especially omega-3 fatty acids. In this paper, nanostructured lipid carriers (DHA-NLC), using stearic acid as solid lipid and microalgae oil as liquid lipid by high pressure homogenization, were prepared and characterized. The result of the study showed the DHA-NLC that we obtained had excellent mobility and dispersion. The encapsulation efficiency and loading capacity of DHA-NLC were 88.49% and 10.62% separately. The mean particle size of DHA-NLC was about 300 nm and the polydispersity index was below 0.2. As indicated in optical microscope and SEM images, the particle diameters were consistent of those shown in Zetasizer Nano and these particles mainly exhibited spheroid-like appearance. At different temperature 4℃, 20℃and 40℃, DHA-NLC was stable. However, when pH is up to 8, the system changed unstable and was easy to produce flocculation and precipitation. Meanwhile, encapsulated efficiency, loading capability and thermal behavior of nanostructured lipid carriers prepared by different solid lipids and liquid lipids were compared. In conclusion, the NLC system is a stable delivery for encapsulating and protecting DHA and provides a promising approach for large scale production and application of DHA in food industry. What's more the established method of NLC also provides theoretical basis to protect sensitive bioactive components from unfavorable environmental conditions, eradication of incompatibilities, or masking of unpleasant taste or odor and increase the application in food industry.

DEVELOPMENT OF RESOURCE MATERIAL FOR BEHAVIOURAL CHANGE

D. ANDERSON[1]

[1]Diabetes Projects Trust
Email: anddiana@gmail.com

Introduction: Diabetes Projects Trust has a long history of producing quality resources. The Cook'n Kiwi Train the Trainer programme aimsto increase the nutrition knowledge and awareness of staff from community organisations using a resource kit to designed to facilitate behavioural change.

Objective: The Budget Board game was formulated to demonstrate the importance of meal planning and modification of shopping practices in regulating food consumption and spending habits.

Method: Consultation was held with fellow nutritionists to formulate a board game that would provide tips for modification of shopping practices.

The game was tested and refined using groups of nutritionists, health workers and clients from the community who were asked for feedback before final testing, printing and packaging of the game.

Discussion: The concept of the Budget Board game was developed using a popular Power Point slide depicting a typical supermarket layout. This emphasizes shoppers should stick to the supermarket perimeter where most fresh food is positioned for sale. Participants progress through the sections of the supermarket and use three different types of cards: money saving choices; creation of own ideas; and penalty cards. Each participant begins with a budget of $30. The participant with the most amount of money wins.

The game allows for multiple learning opportunities yet is simple enough for a broad range of participants to play. This keeps production costs to a minimum.

Conclusion: The game allows for participants to practically engage with concepts while motivating each other. Collaboration is valuable in the formulation of resource material.

DIETARY FACTORS AND GUT INTEGRITY IN CROHN'S DISEASE

H. MORTON[1]

[1]Massey University Palmerston North
Email: h.morton1@massey.ac.nz

Background: Crohn's Disease (CD) is an idiopathic inflammatory disease of the digestive tract that can have serious consequences for those affected including nutrient deficiencies and chronic pain. Evidence suggests that the first step in the aetiology of CD may be a compromised intestinal epithelial barrier, probably due to disruption of the tight junctions, which could be caused by exposure to certain foods in predisposed individuals. Early studies have identified foods reported to have a detrimental effect on gastrointestinal symptoms experienced by CD sufferers, however little research has investigated the effect of these foods on gut integrity.

Objectives: To identify foods commonly reported to trigger or exacerbate gastrointestinal symptoms in CD sufferers, and to investigate the effect of these foods on gut integrity using human Caco-2 cells (a well validated in vitro model of the intestinal epithelial barrier) in combination with an in vitro digestion system to mimic digestion in the human gut.

Design: Potentially problematic foods (corn, milk, wheat, egg, apple, citrus, peanut, and mushrooms) were identified through an extensive literature search. These foods, alongside a saline control, were subjected to in vitro gastric and intestinal digestion processes. Caco-2 monolayers were exposed to a digest supernatant treatment for 60 minutes, and gut integrity, as indicated by Trans-Epithelial Electrical Resistance (TEER), was measured at baseline, and 4 hours following treatment removal. Visualisation of tight junctions using fluorescently-tagged antibodies and confocal microscopy was performed on monolayers that demonstrated significant TEER reductions.

Results: When compared to controls, a significant reduction in Caco-2 TEERs was observed one hour after treatment with milk or peanut digest (-39%, $P<0.0001$ and -12%, $P<0.0001$ respectively, $n=24$). After four hours the TEERs of Caco-2 monolayers exposed to milk digest had increased suggesting tight junction recovery. In contrast, the TEERs of Caco-2 monolayers exposed to peanut digest remained significantly decreased and monolayers had visually begun to lift and fragment.

Conclusions: Exposure to peanut that has undergone an in vitro gastric and intestinal digestion process significantly reduces Caco-2 TEERs and causes marked monolayer damage. Further research is required to investigate the mechanisms involved.

EFFECT OF PLATE SIZE ON APPETITE AND ENERGY INTAKE: A POSTPRANDIAL STUDY OF APPETITE REGULATION

W. YIP[1], K. WIESSING[2] AND S. POPPITT[3]

[1]Human Nutrition Unit
[2]The University of Auckland
[3]Fonterra Chair in Human Nutrition
Email: wilsonyiphknz@gmail.com

Background: The regulation of food intake is critical to control of body weight. Decreased portion size as well as eating from a smaller plate is frequently recommended as a strategy to decrease food intake. However, very few studies have investigated these effects.

Aims: The aim of this study was to determine whether altering plate size would affect ad libitum food intake from a buffet-style lunch meal.

Method: This was a two treatment cross-over study where 20 overweight (BMI 29.7±4.5 kg/m2) women attended the Human Nutrition Unit on two occasions. They were randomly assigned to either small (19.5cm) or large (26.5cm) plate size on to which they served themselves from a lunch meal. Participants were given a light (0.5MJ) breakfast at 9am and then asked to eat to appetite at an outcome lunch meal at 12 noon. Throughout the day, appetite sensations were measured using visual analogue scales (VAS). Food items were weighed before and after lunch to calculate energy intake (EI).

Results: There was no detectable difference in VAS-assessed appetite ratings following the breakfast meal on each of the two visits (P>0.05), hence participants were in a similar state of hunger/fullness prior to the lunch meal. Mean (SEM) EI at lunch using small and large plates was 3975±26.7 and 3901±27.8 kJ respectively. There was no detectable decrease in EI when the large plate was replaced by small (paired t-test, P>0.05).

Conclusion: Plate size did not affect ad lib food intake from a multiple item buffet-style lunch in overweight women.

EFFECTS OF EXTRUSION ON THE NUTRITIONAL QUALITY EVALUATION OF CRUSADER PEAS

C. BUTTS[1], L. CHEPULIS[2], D. HEDDERLEY[1] AND A. HARDACRE[3]

[1]The New Zealand Institute for Plant & Food Research
[2]Waiariki Institute of Technology
[3]Massey University Palmerston North
Email: chrissie.butts@plantandfood.co.nz

Peas contain moderate amounts of protein, energy, minerals and vitamins, but their nutritional value is limited by their low levels of sulphur-containing amino acids, low protein digestibility and the presence of anti-nutritional components. Extrusion cooking can be used to economically manufacture a wide range of foods into a ready-to-eat form, enhancing the appearance, taste and texture of the food as well as inactivating anti-nutritional factors.

The nutritional value of Crusader peas (developed by Plant & Food Research) was evaluated before and after extrusion using the laboratory rat as a mammalian model. The peas were ground and combined with ground maize and vitamins and minerals to provide a nutritionally balanced diet. The ground mixture was then passed through a short barrel single screw food extruder (2 hole 6 mm diameter) at approximately 160°C. Rats (n=8) were fed the extruded or non-extruded diet for 9 days. Food intakes were recorded daily. Total faeces and urine outputs were collected for the final 5 days of the study. Nitrogen and energy contents of the diets, urine and faeces were determined.

There was a significant increase in nitrogen digestibility (P=0.007) and faecal nitrogen output (P = 0.025) after extrusion however, there was no effect of extrusion on nitrogen balance (P=0.215). Apparent energy digestibility and energy balance were not influenced by extrusion.

Protein nutritional value was enhance and energy digestibility was unaffected by the extrusion conditions indicating that the Crusader peas are nutritious and the anti-nutritional factors were not of nutritional significance in this pea cultivar.

ESTABLISHING FOOD SERVING SIZES FOR NEW ZEALAND POPULATION BASED ON ENERGY CONTENT

J. PETRIE[1] AND T. WATSON[2]

[1]NZ Nutrition Foundation
[2]Baking Industry Research Trust
Email: jeremyandjanepetrie@hotmail.com

Objective: To outline the processes involved in the development of food groups and servings sizes to support the eMark, a practical food tool which assists the population with making healthy food choices.

Design: The Ministry of Health Food and Nutrition Guidelines (MOHFNG) sample meal plans were reviewed with regards to energy content and density of foods. International food guidelines and healthy eating programmes were referenced to understand how different countries grouped and organised servings of food. Using information from the New Zealand Food Composition Tables (NZFCT), similar types of foods were grouped together and for each food group, kilojoules per serve were set based on practical serving sizes, MOHFNG and nutritional requirements. Serving sizes for foods within a group were scaled to meet this criteria. Additional groups were included to highlight foods not included in the MOHFNG and sub groups were added for food groups where there were large discrepancies in energy density. The nutritional requirements of an 'eMark Reference Adult' were determined based on Nutrition Reference Values (NRV). A daily healthy eating plan was developed based on average energy requirements of 9500kJ and the MOHFNG Food Groups. To determine if the healthy eating plan would provide the required nutrients; targets were set for macronutrients, saturated fat, fibre and micronutrients based on NRV and these were checked using FoodWorks. Once these targets were met guidelines on the number of servings per food group per day for the 'eMark Reference Adult' were confirmed.

Results: To offer practical serving sizes and comparable energy density's of similar food types the traditional MOHFNG Food Groups were extended to eight food groups with five subgroups: Fruit and Vegetables (Fruit, Starchy vegetables and Non starchy vegetables), Bread and Cereals (Bread and flour based excluding pasta and Rice, pasta, cereal and grains), Milk-yoghurt-cheese, Meat and alternatives, Healthy fats and oils, Other foods, Condiments and Free Foods. Daily healthy eating plans were determined for different groups of the population based on age, gender, activity levels and nutrient requirements.

Conclusions: The eMark serving size and food group information offers a practical system which can assist the population in making healthy food choices.

FOOD LABELING COMPLIANCE OF COMMONLY SOLD PROCESSED FOODS IN METROPOLITAN MANILA

J. SIGGAOAT[1]

[1]Lyceum of the Philippines University, The Philippines
Email:jpsiggaoat@yahoo.com

Labelling is indispensable to consumers in the exercise of their right to information and choice. This study aimed to present an overview of the current situation of the food labelling practices on the strength and weaknesses of the Philippine food labelling policies and regulatory framework within labelling functions. The study assessed 491 national food products available for retail sale in Metropolitan Manila from January to June 2012. Each food label that was gathered was thoroughly read, classified, verified and tabulated using the instruments developed. The first instrument was a one page check list of the Philippine mandatory labelling requirements. The second instrument was an inventory of the nutrition facts stated on the food labels. Although there were some inconsistencies documented in the information given on some food labels, majority of the information contained on the food labels surveyed were compliant to the mandatory requirements set by the Philippine government agencies. In fact, 90% of the products inspected contain nutrition information on a voluntary basis even when no nutrition or health claims are being made. The study recommends further validation to cover wider scope in terms of sample size, and point of purchase of food products. Moreover, the veracity of the information should be validated by performing actual laboratory tests such as verifying the stated weight content or declared nutrients.

FREE RADICAL SCAVENGING AND ANTI-ANGIOGENIC PROPERTIES OF THREE RABBITEYE BLUEBERRY EXTRACTS

J. VUTHIJUMNONK[1], A. MOLAN[1] AND J. HEYES[1]

[1]Massey University
Email: J.Vuthijumnonk@masset.ac.nz

Blueberries are rich in phytochemicals which contribute to their high antioxidant activity. Oxidative stress is one of the major causes of cancer incidence therefore plant extracts with high free radical scavenging properties may result in reduced cancer incidence. This study has determined the ability of water extracts from three rabbiteye blueberry genotypes grown in New Zealand to scavenge the DPPH-radical (% inhibition) using DPPH assay. Among three genotypes, Centurion has shown the highest percentage of inhibition at 71.9% followed by Maru and Rahi at 65.9% and 39.3%, respectively.

Another key factor of tumor growth and metastasis is angiogenesis. Inhibition of angiogenesis may lead to prevention of tumor growth and metastasis. In this study, anti-angiogenic property of three rabbiteye blueberry extracts was investigated using chicken chorioallantoic membrane (CAM) assay. Water extracts from Rahi, Centurion and Maru were applied on CAMs of five day-old chicken embryos. Effects were monitored at 48 hours after addition of blueberry extracts. The number of blood vessels in a 0.25 cm2 field of view was counted using Image J software then the percentage inhibition was calculated in comparison to control membranes treated with water only. In comparison with the control CAM the aqueous extract from Rahi genotype showed the highest anti-angiogenic properties among the three genotypes, with 66.4% inhibition followed by Maru and Centurion at 59.3 and 53.1% inhibition, respectively. Not only was the number of micro-blood vessels on the CAMs treated with blueberry extracts lower than on the control CAM, but most of the blood vessels in the treated CAMs were deformed as evidenced by their shape and length. These results might indicate anti-angiogenic properties of the selected blueberry extracts

Although free radical scavenging activities and anti-angiogenic properties of each blueberry genotype were positively correlated (R2: Centurion = 0.71; Maru = 0.61; Rahi = 0.98, respectively), the relationship was much weaker across all the berry varieties. It can be concluded that some particular phytochemicals contributing to free radical scavenging activity are more important than other antioxidants for anti-angiogenic properties of blueberries.

HEALTHY HALOS?: NUTRITION RELATED CLAIMS AND NUTRIENT COMPOSITION OF GRAIN AND CEREAL PRODUCTS

J. WEBER[1]

[1]Massey University Palmerston North
Email: j.l.weber@massey.ac.nz

Background: Nutrition, health and related claims on food labels have the potential to result in a "healthy halo", whereby consumer focus is concentrated on a positive aspect of the food (for which a claim is made) and consequently other less positive aspects are overlooked.

Objective: The objective of this study was to assess the relationship between nutrition, health and related claims and nutrient composition and product price. Bread, cereal and snack bar products in 5 supermarkets in the lower North Island were surveyed. Products were ranked on sodium, saturated fat and sugar content. In addition a nutrient profile score was calculated using the Baseline Points from the "Health Claims Nutrient Profiling Calculator" developed by Food Standards Australia New Zealand.

Results: The majority of products surveyed carried a nutrition related claim or endorsement. Breakfast cereals were the most likely to carry claims (> 70%). Claims related to fibre content were the most common. Ingredient claims were also common, and serve as implicit reference to nutritional and functional benefits. There was not a clear relationship between number of claims and overall nutrient composition. There was also not a clear relationship between number of claims and price, but the less common nutritional claims (e.g. source of antioxidants) were more commonly found on higher priced products.

Conclusion: Nutrition related claims cannot be relied on to indicate better food choice in terms of nutrient composition, and there are examples of "healthy halos".

IMPACT OF COOKING METHOD ON APPEARANCE OF PLASMA AMINO ACIDS FROM RED MEAT IN YOUNG HEALTHY MALES

S. PUNDIR[1], V. CHIANG[1], A. MILAN[1], A. MCGILL[1], S. POPPITT[1], J. MARKWORTH[1] AND D. CAMERON-SMITH[1]

[1]The University of Auckland
Email: s.pundir@auckland.ac.nz

Red meat contributes between 30-50% of total daily protein intake. Cooking methods impact flavour development, although high-temperature cooking may both dehydrate and generate surface heterocyclic amines and polycyclic aromatic hydrocarbons. It was hypothesised that meat cooked at a high-temperature would impair the rate of protein digestion relative to low-temperature cooking. In a randomised cross-over study 12 healthy young males (22.25+0.48 years) ingested two breakfast meals of rump steak (250g) either pan fried (PF) (5 mins each side, ~240°C) or sous-vide (SV) (6 hours, vacuum sealed, 78oC water bath) separated by at least a 1 week washout period. The steak was served between two slices of white bread with 20g tomato sauce to enhance meal palatability. Venous blood samples were taken at baseline and then hourly for 4 hours. Plasma samples were analysed by GC-Mass spectrometry and general linear model methods were used to analyse the effect of cooking methods on circulating AA levels (Prism V6.0)

Plasma levels of all detected AA with the exception of cystine and aspartic acid increased ($p<0.05$) from baseline following the ingestion of both meals. Circulating concentrations of select amino acids including alanine ($p=0.042$), serine ($p=0.007$), glycine ($p=0.030$), and 4-hydroxyproline ($p=0.001$) were greater 2 hrs following SV feeding compared to PF. Furthermore, the cumulative postprandial response (incremental area under the curve, iAUC) of plasma alanine ($p=0.0089$), 4-hydroxyproline ($p=0.0056$), tryptophan ($p=0.0466$), glycine ($p=0.0421$) and lysine ($p=0.00420$) was greater following ingestion of the SV meal. The response of remaining amino acids did not differ between the two cooking methods ($P>0.05$).

Meat cooked for a long-duration at low-temperatures provides some evidence of superior absorption of Ala, Try, Ser, Lys and Gly, with an increased plasma appearance of 4-hydroxyproline when compared to meat cooked for short-duration high-temperature cooking. This data suggests that a long-duration at low-temperature cooking method may provide one strategy to increase AA availability in individuals with an impaired protein metabolism or have increased protein requirements. Additionally, lower levels of plasma 4-hydroxyproline following ingestion of a short-duration high-temperature cooked meal may be indicative of decreased bioavailability of ascorbic acid, the cofactor needed for oxidation of proline into 4-hydroxyproline, a key component of collagen.

IMPACT OF COOKING METHOD ON INFLAMMATORY RESPONSES TO RED MEAT IN YOUNG HEALTHY MALES

V. CHIANG[1], A. MILAN[1], A. MCGILL[1], J. MARKWORTH[1], G. SMITH[1], S. POPPITT[1] AND D. CAMERON-SMITH[1]

[1]The University of Auckland
Email: vchi029@aucklanduni.ac.nz

Red meat, although a major component in the New Zealand diet, has been attributed to an increased colorectal cancer risk. This is due in part to the formation of carcinogens , however there remains a quantitative discrepancy in impact of cooking method on their formation . Furthermore, high fat red meatgenerates an acute postprandial inflammatory response. It was hypothesised that high-temperature cooked meat would generate a greater postprandial plasma inflammatory cytokine response than low-temperature cooking. In a randomised cross-over study 12 healthy young males (22.25 +0.48 years) ingested two breakfast meals of rump steak (250 g) pan fried (PF) (5 mins total, ~240 ^{o}C) and sous-vide (SV) (6 hours, vacuum packaged, 80oC waterbath) separated by a 1--2 week washout period. Steaks were served between two slices of white bread with 20 g tomato sauce. Venous blood samples were taken at baseline (30 min prior to meal ingestion) and then hourly for 4 hours. Plasma samples were analysed using immunoassay for plasma cytokine and hormone concentrations, including; hsCRP, C-Peptide, GIP, GLP-1, ghrelin, IL-6, insulin, leptin, MCP-1,PYY,TNF-α and amylin.

Feeding had no significant effect on plasma CRP, IL-6 and leptin. Circulating C-peptide, insulin, GIP and amylin increased in response to both meals at 1 hr post-feeding (C-peptide, GIP, Insulin $p<0.0001$, amylin $p<0.01$) with no difference between cooking methods ($p>0.05$). Circulating MCP-1 and TNF-α decreased from basal concentrations following ingestion of the SV meal only at 3 hrs (MCP-1 $p<0.01$; TNFa $p.<0.05$) and 4 hrs (MCP-1 $p<0.0001$; TNF-α$p<0.01$). Plasma MCP-1 was elevated 4 hrs following ingestion of PF meal ($p<0.01$).

In young males the ingestion of a single red meat breakfast meal, prepared either at high or low cooking temperatures, had little impact on plasma inflammatory cytokine response ($p>0.05$). Thus in a single meal, steak prepared by high-temperature cooking (PF) does not elicit any marked impact in postprandial inflammation.

INFLUENCE OF DIETARY CALCIUM CONCENTRATIONS ON THE DIGESTION AND ABSORPTION OF CALCIUM AND PHOSPHORUS ALONG THE INTESTINAL TRACT OF BROILER CHICKENS

R.K. MUTUCUMARANA1, V. RAVINDRAN1, G. RAVINDRAN1 AND A.J. COWIESON2

1Massey University Palmerston North
2University of Sydney, Australia
Email: R.K.Mutucumarana@massey.ac.nz

The effects of dietary calcium (Ca) concentrations on the digestion and absorption of Ca and phosphorus (P) along the intestinal tract of broiler chickens were assessed. Three-week old broilers were fed maize-soy diets containing 6, 9 or 12 g/kg of Ca (Ca: total P ratios of 1:1, 1.4:1 and 2:1, respectively) for six days and digesta were collected from the duodenum, jejunum, upper ileum and lower ileum. Apparent digestibility coefficients in different segments were calculated using the titanium marker ratio in diets and digesta. Apparent digestibility coefficients of P and Ca were determined to be highly negative in the duodenum, indicating net secretion of these two minerals into this segment. Phosphorus was absorbed primarily in the jejunum in birds fed low Ca and normal Ca diets, but the site of primary absorption shifted to upper ileum in birds fed high Ca diets. The digestible coefficients of P in low Ca, normal Ca and high Ca diets at the lower ileum were 0.417, 0.379 and 0.325, respectively. Jejunum was the predominant site of absorption for Ca. At all intestinal segments, increasing concentrations of dietary calcium lowered ($P<0.05$) P absorption. Calcium digestibility was unaffected ($P>0.05$) by dietary Ca concentrations.

ISOLATION OF ULCEROPROTECTIVEC CUCURBITANE TYPE TRITERPENOIDS FROM CUCUMIS MELO SEEDS

G.S. BAL[1], B. KAUR[1] AND N.S. GILL[1]

[1]Punjab Technical University
Email: gurry_preet@yahoo.com

Medicinal plants are the richest bio-resources of drugs in traditional medicinal systems, modern medicines, folk medicines, intermediate and chemicals entitled for synthetic drugs. Plants provide a source of inspiration for novel drug development as they contain a vast array of substances that treat chronic diseases. *Cucumis melo* seeds have been traditionally used for treating various health ailments. The main aim of our current study is to isolate Cucurbitane-type triterpenoids from *Cucumis melo* seed extract and conduct antiulcerogenic activity of the isolated compound. Phytochemical investigations of methanolic seed extract of *Cucumis melo* was carried out which showed the presence of various important phytoconstituents. The main active constituents of *Cucumis melo* have shown a number of potent pharmacological activities. The isolation of Cucurbitane-type triterpenoids was carried out by column chromatography using methanolic seed extract of *Cucumis melo*. Mobile phase hexane and hexane-ethyl acetate (98:2) was used to run the column. TLC profiling was done simultaneously in an appropriate solvent system (hexane: ethyl acetate, 97:3). Various fractions were collected. The fractions with similar R_f value were pooled together. Fractions giving single spot in the TLC were regarded as pure. The isolated compound showed positive result for Liebermann-buchard test from which we can conclude that the isolated compound might be triterpenoid. The structure of the isolated compound was determined by IR, ^{1}HNMR, ^{13}CNMR techniques. The spectral analysis of the isolated compound showed following results:

IR: It showed the peaks at 3383, 2976, 2814, 1721, 1465, 1123 cm^{-1} indicated the presence of alcoholic group.

^{1}H NMR (400 MHz, CDCl3):δ 0.66-1.29 (m, 24H, -CH_3), δ 1.32-1.38 (m, 4H, H_7, H_8, H_9, H_{10}), δ 1.40-1.51 (m, 4H, H_{10},H_{19}, H_{20}, H_{21}), δ 1.52-1.59 (m, 3H, H_{11}, H_6, H_{22}), δ 1.61-2.38 (m, 2H, H_4, H_3), δ 3.16-3.20 (m, 6H, H_1, H_2, H_{12}, H_{13}, H_{15}, H_{17}).

^{13}C NMR (400 MHz, CDCl3):δ 15.99, 16.13, 18.01, 18.33, 19.32, 20.94, 25.16, 27.43, 27.46, 28.00, 29.71, 29.86, 34.30, 35.60, 37.18, 38.07, 38.73, 38.87, 40.02, 40.85, 42.84, 43.01, 47.99, 48.32, 50.45, 55.32, 79.00, 109.34, 109.67 (C=C), 150.96 (C=O).

From the above result, the isolated compound was elucidated to be tetracyclic triterpenoid. As triterpenoids are mostly responsible for anti-ulcerogenic activity so the isolated compound was further evaluated for antiulcer activity by pyloric ligation induced gastric ulcer, water immersion stress ulcer and indomethacin induced ulcer models in wistar albino rats. In the pyloric ligation induced gastric ulcer model, the isolated compound at the dose of 300 mg kg^{-1} showed significant reduction in gastric volume, free acidity and total acidity i.e., 1.79±0.12, 31.58±0.31 and 72.95±0.11 respectively. The percentage inhibition was found to be maximum at the dose of 300 mg kg^{-1} in all the three animal models. The percentage inhibition was 56.6, 66.3 and

61.2 in pyloric ligation induced gastric ulcer, water immersion stress ulcer and indomethacin induced ulcer models respectively. All the above gathered results the isolated compound i.e., Cucurbitane-type triterpenoids was found to be potent against gastric lesions and therefore can be used as future natural anti-ulcerogenic agent.

LOWERING POSTPRANDIAL GLYCAEMIA WITH A RICE-MIX IN ASIAN PEOPLE WITH TYPE II DIABETES

Z. ZHANG[1], J. KANE[1], B. VENN[1] AND A. LIU[2]

[1]University of Otago
[2]Auckland District Health Board
Email: zhazh902@student.otago.ac.nz

Introduction: White rice is a staple food for many Asians; however, its consumption may generate large glycaemic responses that are a risk factor for diabetic complications. Practically, reducing the amount of white rice eaten may be difficult.

Objective: Our objective was to develop an acceptable white rice alternative by replacing part of the white rice with whole grains, pulses, nuts and seeds, foods that elicit a smaller glycaemic response than white rice.

Design: This was a repeated randomised cross-over study of 12 Chinese non-insulin dependent type II diabetics. Postprandial glycaemic responses were monitored over 3-hours following consumption of equal-volumes of white rice and the rice-mix of average serving size.

Result: Postprandial glycaemia was 27% less after consuming the rice-mix than white rice ($P<0.001$). The mean length of time that postprandial glycaemia exceeded 10 mmol/L was 125 (95% CI: 110, 140) min for white rice and 95 (72, 118) min for the rice-mix ($P=0.001$). The mean glycaemic increment above 10 mmol/L was 3.1 (2.2, 3.9) mmol/L for white rice and 2.0 (1.2, 2.7) mmol/L for the rice-mix ($P=0.001$).Results of an exit questionnaire indicated that the eight participants would consume the rice-mix meal on a frequent basis with two people answering that they would be willing to completely replace white rice with the rice-mix.

Conclusion: Using rice-mix as an alternative to white rice is a feasible dietary approach to improve postprandial glycaemia in type II diabetic patients, particularly for people experiencing difficulties in reducing the amount of rice intake.

NUTRACEUTICAL AND FUNCTIONAL FOODS

R. SEHJI[1]

[1]*Diocesan School for Girls*
Email: rsehji@diocesan.school.nz

Reason for choosing this topic: This year I registered a team for The 2012 Upper North Island NZIFST/CREST Student Product Development Challenge organised by RSNZ. The team was mentored and sponsored by the Futureintech Ambassador, Stephanie Bishop (Regulatory Technologist) from Goodman Fielder. The brief required the students to develop a healthy energy spread for teenagers in a bid to replace/ reduce intake of the energy drinks that contain harmful chemicals. This led us to look at nutraceuticals to create our functional food, hence my interest in this topic.

Introduction: The project opened my eyes to a whole new area in food technology that I had previously overlooked when developing food products focusing just on nutritious foods.

Nutraceuticals - A food or part of food or nutrient which provides health benefits including the prevention and treatment of a disease. Those fortified foods that are enriched with nutrients not natural to the food.

Functional foods- are foods to which health-related nutraceuticals have been added

Rationale: Nutraceutical foods/Functional foods are one of the fastest-growing segments of the food industry. Consumer awareness into the health benefits of foods has escalated over past few years. Consumers awareness that certain foods, ingredients and certain ingredient components have potential health benefits that go beyond basic nutrition and may reduce risk of certain diseases fostering well-being.

The New Zealand nutraceutical industry is relatively young. Manuka honey, Green lipped mussels, deer velvet, dairy derivatives and dairy related bacteria are some examples of nutraceutical in NZ. New natural product derivatives are constantly being launced with health claims with the traditional nutraceutical industry bifurcating into fashion nutraceutical and science based ones

Objectives: To define the terms and provide information of nutraceutical/ functional foods in New Zealand including facts and figures and opportunities for further new product development. Identify strengths, opportunities weaknesses, issues/threats and risks associated with nutraceuticals and its future.

Method and Materials: Research using a range of information sources-qualitative and quantitative

Conclusion: It is imperative that consumers are aware of what really is in their food and where it has been derived from to enable them to make informed choices/decisions and empower manufacturers to make and label innovative new products that hold real benefit for consumers.

RESTRICTION OF ABNORMAL PROLIFERATION BY PHYSIOLOGICAL CONCENTRATIONS OF A FOOD-DERIVED METABOLITE, ENTEROLACTONE, IN MODELS OF PROSTATE TUMOURIGENESIS.

M. MCCANN[1], I. ROWLAND[2] AND N. ROY[1,3]

[1]AgResearch Ltd
[2]University of Reading
[3]The Riddet Institute
Email: mark.mccann@agresearch.co.nz

Scope: Enterolactone, a mammalian lignan produced in the human gastrointestinal tract from dietary precursors, has previously been shown to decrease the proliferation rate of prostate cancer cells when applied at high concentrations that are difficult to achieve through dietary modification [1-5]. We, therefore, investigated the anti-proliferative effects of low enterolactone concentrations that occur in men after dietary intervention, using an in vitro model of prostate tumourigenesis.

Methods and results: The effects of enterolactone (0.1 and 1 μM) on three markers of viability and proliferation (metabolic activity, growth kinetics and cell cycle progression) were assessed over 72 hours in seven human prostate cell lines of increasing tumourigenicity: RWPE-1, WPE1-NA22, WPE1-NB14, WPE1-NB11, WPE1-NB26, LNCaP and PC-3. Enterolactone-mediated effects on expression of twelve genes involved in the control of DNA replication initiation were quantified using TaqMan real-time PCR in the WPE1 cell lines. Our results showed that enterolactone was most effective at restricting proliferation in two early stage tumourigenic cell lines, WPE1-NB14 and WPE1-NB11, and suggest this may be a consequence of decreased expression of abnormally active DNA replication initiation genes.

Conclusion: In contrast to previous studies, low concentrations of enterolactone that are reported after dietary intervention restricted proliferation of early-stage tumourigenic prostate cell lines. This finding suggests that consumption of foods high in enterolactone precursors may restrict the progression of prostate cancer.

STANDARDISATION OF AN IN VITRO DIGESTION FOR INVESTIGATING IRON UPTAKE IN CACO-2 CELLS

R. STEWART[1], H. MORTON[1], J. COAD[1], G. REYNOLDS[1] AND K. PEDLEY[1]

[1]Massey University
Email: r.stewart@massey.ac.nz

Background: Human trials are regarded as the gold standard when investigating iron bioavailability; however they are often limited by cost and ethical considerations. The use of an *in vitro* digestion system coupled with Caco-2 cell monolayers has been used extensively to isolate factors which influence iron absorption. However critical measures within the digestion process such as pepsin and pancreatic protease activity or preservation of the integrity of Caco-2 cell monolayers requires further investigation.

Objectives: To investigate the activity of pepsin and pancreatic proteases under in vitro digestion conditions and to develop a protocol to remove or inactivate the digestive enzymes prior to incubation with Caco-2 cells.

Design: Pepsin and pancreatic protease hydrolytic activity was assayed by stop-rate spectroscopy during the simulated gastric and intestinal digestion phases respectively. Digestates were then treated by ultrafiltration (10kDa filter, 25psi) or pH adjustment (pH 2 for 5 minutes). Digestate protease activity was subsequently reassessed.

Results: Protease activity was significantly decreased under simulated gastric digestion conditions after 120 minutes (62.5% ± 2.4%) and intestinal digestion conditions after 180 minutes (32.5% ± 0.81%) compared to baseline ($P<0.0001$). Ultrafiltration (20.81% ± 0.23% activity) and pH adjustment (74.56% ± 1.47% activity) significantly reduced enzyme activity compared to control digests (100% activity) ($P<0.0001$). Ultrafiltration was most effective ($P<0.0001$).

Conclusion: Inactivation of pepsin and pancreatic proteases should be accounted for when preparing protease solutions in advance or when undertaking a prolonged gastric or intestinal digest. Digests should undergo ultrafiltration prior to incubation with Caco-2 cells to maintain cellular integrity.

THE COMPOSITION AND IMMUNOMODULATORY PROPERTIES OF MILK FROM RED DEER AND COWS

N.L. OPATHA VITHANA[1], S.L. MASON[1], A.E.D. BEKHIT[2], J.D. MORTON[1] AND L. CLUCAS[1]

[1]Lincoln University
[2]Otago University
Email: sue.mason@lincoln.ac.nz

Milk plays an important role in nutrition and milk proteins are recognised as the best source of bioactive peptides. Proximate analysis, protein and mineral composition of milk from Red deer and cow were compared. The immunomodulatory activities of the milks after in vitro digestion were also investigated. Protein and fat contents were higher in deer milk than cow milk. β-Casein content was significantly higher in Red deer milk while the immunoglobulin and serum albumin concentration was lower than for cow milk. Ash content of deer milk was higher than cow milk ($p<0\text{-}05$) with calcium, phosphorous, magnesium, sulphur, selenium and zinc all higher in the deer milk. The buffering capacity of deer milk was also higher than that of cow milk and presumably reflects the higher protein and mineral content. Following in vitro digestion deer milk had higher ($p<0.05$) lymphocyte proliferation activity when tested using human peripheral blood mononuclear cells than did cows' milk.

Overall the higher protein content, higher mineral contents, higher buffering capacity and higher lymphocyte proliferation activity means Red deer milk has potential for specific therapeutic uses and deserves further investigation.

THE COOL CANTEEN AWARD: RECOGNIZING HEALTHY SCHOOL CANTEENS

A. TSANG[1]

[1]Diabetes Projects Trust
Email: schools@dpt.org.nz

Introduction: A student food choices study found a positive association with canteen use and frequent consumption of some high- sugar/fat foods. This coupled with more relaxed government regulations for healthy food and beverages sold on school premises has caused a lack of incentive for school canteens to provide a wide range of healthy foods.

Consequently Diabetes Projects Trust (DPT) have designed a Cool Canteen Award as part of a wider health-awareness education program to encourage and give recognition to school canteens that promote and provide a good range of healthy foods.

Objective: The award encourages school canteens to provide a higher proportion of everyday foods compared to sometimes/occasional foods and to strongly promote everyday foods to the students.

Method: Application process requires school receiver input with a visit by a DPT representative. An application form must be completed and the canteen must score 18 points or more to get the award.

The award is based on the Food and Beverage Classification system where foods are placed into everyday and sometimes/ occasional food categories.

Discussion: The award has a strong focus on having a large amount and variety of everyday foods available. Food placement is important, as we understand that 'if a student wants to buy a pie, they will go to the local dairy/ bakery to buy the pie if it is not available at the school canteen'. Our hope is that school canteens have plenty of fresh and attractive everyday foods placed at eye level which appeal to the students.

THE MINERAL PROFILE OF NEW ZEALAND GROWN PINE NUTS

L. VANHANEN[1] AND G. SAVAGE[1]

[1]Lincoln University
Email: Leo.vanhanen@Lincoln.ac.nz

New Zealand grown pine nuts (Pinus pinea L.) are a relatively new product and are a growing sector of the tree nut industry in New Zealand. It is estimated that 36,080 tonnes of pine nut kernels where produced globally in 2011. New Zealand imported 22 tonnes of pine nut kernels for domestic consumption in 2010. Pine nuts have many nutritional qualities that make them very different compared to other tree-nut crops. Some of these qualities are positive and, some negative and one organoleptically novel feature of pine nuts is Pine Mouth. This phenomenon has yet to be researched fully. In this study a complete mineral analysis of five different species of pine nuts currently being grown in New Zealand, Chinese White Pine (*Pinus armandii*), Swiss Pine (*Pinus cembra*), Coulter Pine (*Pinus coulteri*), Stone Pine (*Pinus pinea*) and Torrey Pine (*Pinus torreyana*) was carried out. All of these nuts had a very positive mineral profile except for a very low Ca:P ratio compared to other foods. A low Ca:P profile also occurs in other tree nuts to a lesser extent. Previously published mineral data on these nuts will be compared to the new data and the nutritional significance of these values will be discussed.The mineral profile of New Zealand grown pine nuts.

USE OF A PRE-LABORATORY INTERACTIVE COMPUTER TUTORIAL TO ASSIST THE STUDENT LEARNING AND STUDY EXPERIENCE

J. THOMSON[1] AND J. WEBER[1]

[1]Massey University
Email: j.a.thomson@massey.ac.nz

Background: We were concerned that students who come to class practicals unprepared are growing in number, and as a consequence spend more time learning practical protocols and struggle to understand the underlying theory (Pogacnik and Cigic, 2006; Hesser, 2009).

Objective: To assess whether pre-laboratory interactive computer tutorials promote greater preparedness and understanding of the laboratory-practical theory than written materials.

Design: In a cross-over study, third year nutrition students were randomized into two conditions. Condition 1 was given access to the interactive computer tutorials before 2 class practicals while condition 2 gained access afterwards. Condition 2 then got access to interactive computer tutorials before the following two practicals and condition 1 access afterwards. Students' perceived benefit of interactive computer tutorials compared to written instructions was assessed by 6 Likert scale questions. Student understanding was assessed by quizzes at baseline, following each practical, and 4 weeks later.

Outcomes: Students spent 36 ±50 minutes preparing for laboratory-practicals. The most common preparation was lecture attendance. No significant difference in self-reported preparation time was found between the conditions. There was a trend (P=0.029) for less perceived enjoyment of computer tutorials versus written, but not significant (Bonferroni adjusted level of significance P<0.0125). There was a trend (P=0.039) for less perceived help from computer tutorials versus written materials, but not significant. Students were less likely to recommend computer tutorials to others versus written (P=0.008).

Conclusions: The students did not benefit scholastically nor did they perceive any benefit to having computerized preparation materials over written handouts.

Hesser, T. (2009). Web Based Classes for Enhancement of Pre Laboratory Lecture. Paper presented at the 2009 ASEE Annual Conference & Exposition
Pogacnik, L., and Cigic, B. (2006). How to motivate students to study before they enter the lab. Journal of Chemical Education; 83(7): 1094-1098.

VITAMIN D STATUS OF NEW ZEALAND PRE-SCHOOLERS - TE RA WHAKAORA: RECRUITMENT AND DATA COLLECTION PHASE

C. CAIRNCROSS[1], C. CONLON[1], W. STONEHOUSE[1], J. COAD[1], L. HOUGHTON[2], D. EYLES[3], C. COMARGO[4], C. GRANT[5,6], B. MCDONALD[1] AND P. VON HURST[1]

[1]Massey University
[2]University of Otago
[3]University of Queensland, Australia
[4]Harvard Medical School, USA
[5]The University of Auckland
[6]Starship Children's Hospital
Email: c.t.cairncross@massey.ac.nz

Background: There are limited data on the vitamin D status of preschool children in New Zealand. This is in part due to reluctance of parents to subject their child to blood sampling. New validated methods allow 25-hydroxyvitamin D (25[OH]D) to be measured from a dried blood spot, hence less invasive methods of blood sampling can be used. These advances increase the opportunity to determine in population samples if vitamin D status is associated with child health issues such as respiratory illness, eczema and food allergy.

Objectives:

1. To investigate the relationship between vitamin D status and the rates of respiratory illness, eczema and food allergy in a self-selected sample of New Zealand children aged 2 to 4 years.
2. To develop a 'vitamin D deficiency risk assessment tool'.

Methods: In this cross-sectional study over 1700 parents were recruited between August and September 2012 using a commercial database and local advertising. Parents completed a questionnaire on their child's medical history and risk factors for vitamin D deficiency. Forty-five pharmacies in 16 cities throughout New Zealand volunteered as testing centres for the study, where child height and weight were measured and a blood spot collected from a fingerprick test conducted by trained pharmacy staff.

Conclusion: This study will make an important contribution to the evidence regarding the association between vitamin D and child health, and use of the tool in community settings will assist in the identification of children at risk for vitamin D deficiency, enabling timely treatment.

VITAMIN D STATUS PREDICTS HAND-GRIP STRENGTH IN YOUNG ADULT WOMEN LIVING IN AUCKLAND, NEW ZEALAND

P. VON HURST[1], C. CONLON[1] AND A. FOSKETT[1]

[1]Massey University
Email: p.r.vonhurst@massey.ac.nz

The identification of the vitamin D receptor (VDR) in skeletal muscle tissue and research in muscle strength and development in VDR-null mice confirms a role for vitamin D in muscle function. The relationship between muscle strength and vitamin D status has been explored to some degree in older populations with regard to fall prevention, but there has been very little research in younger adults. This cross-sectional study considered the predictors of muscle strength in 137 young women (19 – 29 years) living in New Zealand. The following measurements were taken in the latter months of the New Zealand winter: serum 25OHD, dominant and non-dominant hand-grip strength (hand-grip dynamometer), and recreational physical activity (total, indoor and outdoor) assessed from a recent physical activity questionnaire (RPAQ). Dietary intake was measured with a four-day food diary. Total recreational physical activity ranged from zero to 3.93 hours per week, mean (SD) 0.86 (0.74) hours, ~ 50% comprised outdoor activities. Mean 25OHD was 54(28) nmol/l, dominant and non-dominant hand-grip strength were significantly different (t=6.049, p<0.001) at 27.3(5.8) and 25.6(5.7) kg respectively. Total recreational activity and 25OHD were entered into a linear regression model with handgrip strength as the dependent variable (Model R^2=0.11, p=0.001 non-dominant, R^2=0.13, p<0.001 dominant). Serum 25OHD was significantly associated with dominant (B(SE)= 0.05(0.02), p = 0.016) and non-dominant (B(SE)= 0.04(0.02), p = 0.019) handgrip, independent of recreational physical activity. Recreational activity had an association with both hand grip strength and serum 25OHD, and when each were adjusted to remove this association, 25OHD accounted for 4.3% of non-dominant and 4.5% of dominant handgrip strength. These results suggest that vitamin D status does have a small but significant association with hand-grip strength in this group of relatively inactive young women.