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# **Asia Pacific Journal of Clinical Nutrition**

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## ABSTRACTS:

# Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 1

### **Food memory: neuronal involvement in food recognition**

Hisao Nishijo and Taketoshi Ono

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 1: 3-12*

Previous studies indicate that ablation of the temporal cortex including the amygdala (AM) and hippocampal formation (HF) induce the Klüver-Bucy syndrome in which animals cannot discriminate food from nonfood. Of 710 AM neurons tested, 129 (18.2%) responded to single sensory stimulation (48 to vision, 32 to audition, 49 to ingestion), 142 (20.0%) to multimodal stimulation and 20 to only one item with affective significance. Eight food related AM neurons were tested in reversal by salting food or introducing saline, and all responses were modulated by reversal. In HF and parahippocampal cortices (PH), 864 neurons were recorded, and 160 (18.5%) responded to the sight of certain objects. Of these, 23 responded predominantly to food-related rewarding objects, 13 to several aversive objects such as a spider model, syringe,

objects associated with weak electric shock, ten to one object or one kind of object, seven to unfamiliar objects. Of 14 rewarding or aversive object-related neurons tested, responses of seven to the same test object did not change in extinction or reversal tests. Although responses of the other seven decreased in extinction or reversal tests, the magnitude of response remaining in five of those seven still exceeded that of responses to other categories. Results suggest complementary AM and HF-PH functions. The AM may be important in ongoing recognition of the affective significance of complex stimuli (food-nonfood discrimination) and the HF-PH in sustaining past affective significance

## **Protein energy malnutrition, thyroid hormones and goitre among Malaysian Aborigines and Malays**

Ali Osman, BAK Khalid, TT Tan, LL Wu, and ML Ng

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 1: 13-20*

The relationship between malnutrition, goitre and thyroid hormones was studied among Aborigines and Malays in Ulu Langat, Malaysia. Fifty Aborigines aged 27 years were selected randomly for anthropometric, clinical and hormonal assessment. Fifty Malays of similar age from the nearby Malay village were chosen as controls. The Aborigines had a higher prevalence of malnutrition and goitre compared to the Malays. The prevalence of goitre was 26.5% amongst Aborigines and 19.6% among the Malays. All the nutritional indexes measured were significantly different between the two communities, especially among females. The differences corresponded to significant differences in levels of thyroid-stimulating hormone (TSH) measured using a highly sensitive TSH assay. By univariate analysis the increase in TSH corresponded to the decrease in body mass index (BMI). On the other hand, no association was found between BMI and goitres. No thyroid autoantibodies were detected and all subjects were clinically euthyroid and had normal thyroxine and triiodothyronine levels. However, consumption of cassava conferred a four-fold risk of developing goitres. The high prevalence of goitres in malnourished subjects in this region which is not known to be iodine deficient could be due to cassava consumption.

## **Early life factors affecting body mass index and waist-hip ratio in adolescence**

Prasong Tienboon, Mark L Wahlqvist, and Ingrid HE Rutishauser

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 1: 21-27*

A study of the relative contribution of early, parental, contemporary influences on body mass index (BMI) and waist-hip ratio (WHR) in adolescence was carried out in 213 families with adolescents in Geelong, Victoria, Australia. Weight, height and body circumferences were measured in both parents and children and other relevant information was obtained by questionnaire. The parents of the families studied were broadly representative of the Geelong

workforce. The data obtained were divided into three categories: early life, parental and contemporary. The early life influences studied were sociodemographic environment, illness during the first year of life, infant feeding practices, weight, height and rate of growth. Parental factors included socioeconomic and anthropometric characteristics. Contemporary influences, studied in the adolescents, included sociodemographic, lifestyle and anthropometric data as for the parents. Multivariate analyses (multiple regression analysis) was used to determine the strongest influence on BMI from each of the following categories: early life, parental and contemporary. Subsequently the factors identified from each of these three categories were combined in a further multiple regression analysis to determine the strongest overall determinants for BMI and WHR in adolescence. Apart from gender, only BMI at 50 months contributed significantly to BMI in adolescence. Similarly, apart from gender, only BMI at 80 months was a significant determinant of WHR in adolescence.

## **Clinical nutrition in East Asia and the Pacific**

I Darnton-Hill, LT Cavalli-Sforza and PVE Volmanen

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 1: 27-36*

Identifying the nutrition problems of Asia and the Pacific is made difficult by the enormous geographic, socioeconomic and cultural diversity that exists in these areas. With increasing longevity and reduced infant mortality, the more chronic diseases are becoming increasingly important. For almost 90% of the countries that keep such data in the Western Pacific Region of WHO, at least three of the five leading causes of death are noncommunicable diseases. Nevertheless undernutrition is still the most important nutritional problem in the Region. Even though there have been some encouraging declines in the proportion of malnourished under 5 year-olds, increasing populations have meant the actual numbers have not declined. Vitamin A deficiency, iodine deficiency disorders and iron deficiency anaemia remain major public health problems in many countries. There is evidence that vitamin A deficiency is appearing in countries in which it has not previously been a problem. New challenges are occurring, such as childhood obesity, the susceptibility of undernourished populations to the human immunodeficiency virus and the increase in noncommunicable diseases. The three arms of clinical nutrition: therapeutic, research and public health will need to work closely to meet the considerable and continuing threat posed by the nutrition-related diseases.

## **Nutrition and gastrointestinal disorders**

Shao K Lin, John R Lambert and Mark L Wahlqvist

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 1: 37-42*

The gastrointestinal tract, including the liver and pancreas, is a complex system whose function is to process a wide range of nutrient and other products enabling their absorption as well as

detoxification and excretion. During the process, food is converted into energy and into other substances that are used by cells throughout the entire body. Many diseases can affect the various organs of the gastrointestinal (GI) system and diet plays a relatively minor role in the onset of such GI diseases.

Recently it has become clear that glutamine, a 'non-essential' amino acid, is important in the maintenance of intestinal mucosal metabolism, structure and function. Dietary fibre has complicated properties including trophic effects on intestinal mucosa, volatile fatty acid production, alteration of bacterial flora and faecal bacterial mass and change in faecal bile acids.

Gastrointestinal disease many result from deficiency or excess of specific nutrients in normal individuals. In allergic or susceptible subjects, diseases such as food allergy, disaccharidase intolerance and gluten sensitive enteropathy may occur with intake of normal daily requirements. In genetically susceptible individuals, specific nutrients have been linked, based on epidemiological studies and animal experimentation, to carcinoma of the stomach (high starch, high nitrate foods and smoked meats) and colon (low fibre, high fat, low vitamin A). A recent Australian multi-centre polyp prevention project has recruited subjects with adenomatous polyps cleared at colonoscopy. Subjects were randomised to receive high fibre, low fat, b-carotene or a combination of these and compared to an unchanged control group at 2-yearly follow up colonoscopy. Low fat and high fibre were not protective against polyp development; however, b-carotene ingestion was associated with an increased risk.

Duodenal ulcer disease is multifactorial with gastric acid and *H. pylori* induced gastroduodenitis playing important aetiological roles. Protection is afforded to individuals with a higher unsaturated fatty acid and lower refined sugar intakes.

Treatment of gastrointestinal disease may require dietary modifications or, if the gut is not functioning adequately, nutritional support via the parenteral route. In subjects with inflammatory bowel disease and short gut syndrome replacement of specific nutrients may be required particularly calcium, magnesium, zinc, iron, and vitamins B12, folate, D and A. Controversy still exists as to the role of parenteral and enteral nutrition as primary therapy for inflammatory bowel disease.

## **Diet and cancer - some results from Singapore**

Hin-Peng Lee

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 1: 43-46*

The notion that diet has an aetiological role in cancer is generally accepted, although the actual agents and mechanisms are still subjects of much research. A major problem in this work is the effective instruments in determining dietary exposures. The wide margin given as the likely population attributable risk (10-70%) is an indication of the relative imprecision of our state of knowledge at this moment.

In Singapore, digestive tract cancers account for about 30% of all cancers in males and 24% in females. In addition, other cancers that have a strong dietary link include lung (24% males, 10% females), liver (9% males, 4% females), nasopharynx (7% males, 4% females),

female breast (17%) and prostate (3%). Therefore, this is a very important subject for continued study in view of the preventive potential.

Based on recent studies conducted in Singapore, a review is provided of factors associated with colorectal and breast cancers. The main thrust of our findings point to the role of meat as a predisposing factor and vegetables/fruits as protective foods. Possible agents and mechanisms of action will be discussed.

## **The development of food and nutrition policy in Australia, with special attention to the State of Victoria**

John Powles, Mark Wahlqvist, Jane Robbins, Christopher King and Neville Hicks

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 1: 47-60*

Only 6% of Australia's workforce is engaged in agriculture but the country produces enough food for around 35 million people - more than half of them purchasers of exports. The federal political system includes 6 states and 2 territories, with states having responsibility for many aspects of health and agricultural policy. During the 1950s and 1960s Australia experienced a marked rise in ischaemic heart disease and death rates in middle aged men rose. With the onset of the economic slowdown in the 1970s, governments also looked to preventive measures to contain health service costs. In 1979 the Commonwealth Department of Health adopted 8 non-quantitative dietary guidelines and in 1986 a national Better Health Commission recommended a coordinated programme to change dietary habits. Developments in Victoria were stimulated by a conference on 'Agriculture and human nutrition' in 1983. Following this a report 'Making healthy choices easy choices: towards a food and nutrition policy for Victoria' was released in November 1984 and the state government began a Food and Nutrition Project to stimulate intersectoral activity to promote lower risk eating patterns. In March 1987 the Victorian government formally adopted a food and nutrition policy and established an Interdepartmental Committee on Food and Nutrition with representation for Health, Agriculture and Rural Affairs, Education and Industry, Technology and Resources and a Food and Nutrition Community Consultative Group. Increasing financial stringency in the late 1980s was fortuitously offset by the availability of funds from the Victorian Health Promotional Foundation, funded by a 10% surtax on tobacco.

## **Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 2**

**Serum bile acid fractions in neonates on total parenteral nutrition is**

## **lithocholic acid responsible for the occurrence of cholestasis?**

Akio Kubota, Kenji Imura, Akira Okada, Shinkichi Kamata, Riichiro Nezu and Hisayoshi Kawahara

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 2: 67-72*

In order to determine whether lithocholic acid (LCA) contributes to the occurrence of total parenteral nutrition (TPN)-associated intrahepatic cholestasis (IHC) in neonates, we investigated the serum bile acid fractions of neonates on TPN. Twenty-five surgical neonates, receiving TPN for more than 2 weeks were studied. TPN-associated IHC was defined as serum direct bilirubin greater than 2.0 mg/dl. Serum bile acid fractions were examined by HPLC using 3 $\alpha$ -hydroxy steroid dehydrogenase. Eight patients (32%; IHC group) developed TPN-associated IHC. Serum direct bilirubin concentrations in the non-IHC and IHC groups were 0.99 and 3.31 mg/dl respectively. Serum total bile acid levels in both groups were 14.4 and 71.6 nmol/ml respectively. Glycine- and taurine-conjugated cholic and chenodeoxycholic acids could be detected, and unconjugated and secondary (deoxycholic and lithocholic) bile acid were detected in trace levels in both the IHC and non-IHC groups. In conclusion, LCA is unlikely to be a causative factor in TPN-associated IHC in neonates.

## **The effects of branched-chain amino acid-enriched elemental diet in patients with biliary atresia**

Hisayoshi Kawahara, Yuichi Fukui, Kenji Imura, Akio Kubota, Shinkichi Kamata, Yoji Takagi and Akira Okada

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 2: 73-80*

Supplemental administrations of ED-H, branched-chain amino acid (BCAA)-enriched elemental diet for hepatic disorder, were performed in 10 postoperative biliary atresia (BA) patients. These patients were exhibiting, more or less, cirrhotic changes. The duration of ED-H administration ranged from 7 months to 3 years. Initially, these patients showed lowered molar ratios, Val+Leu+Ile/Phe+Tyr, in plasma aminograms with decreased levels of plasma rapid-turnover proteins. ED-H administration induced a significant increase in molar ratio as well as increases in plasma prealbumin and retinol-binding protein levels. With an improved general status, such as activity level and play performance, there were significant increases both in weight for age and weight for height. No particular deleterious effects were observed throughout the period of ED-H administration.

In conclusion, supplemental ED-H administration can be performed safely with an efficacy in postoperative BA patients who need metabolic/nutritional supports due to abnormal liver functions.

## **Evaluation of clinical and biochemical parameters after short-term**

## **consumption of microparticulated protein fat substitute (Simplesse®) in a frozen dessert**

William S. Harris, Aryeh Hurwitz, W Wayne Stargel, Thomas S Burns, and Christian Tschanz  
*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 2: 81-87*

The tolerance of microparticulated protein product (MPP, Simplesse®), a protein-based fat substitute, was evaluated in a randomised, double-blind, three-way crossover study using 24 healthy adult subjects (12 males and 12 females). A regular cafeteria diet was given alone or together with two 196-ml servings (approximately 13 fluid ounces) per day of either super-premium ice cream (16% butterfat content) or frozen dessert made with MPP for 7 days. The ice cream and MPP desserts were administered in a double-blind manner. Three-day dietary diaries were maintained for each 7-day period. Routine laboratory tests along with plasma lipid panels and amino acid profiles were done prior to study start and after each of the three regimens. Vital signs, body weight, and adverse experiences were monitored regularly. None of the three regimens had a clinically significant effect on routine laboratory tests, body weights, vital signs, or plasma amino acid profiles. Of interest, subjects on the ice cream regimen experienced statistically significant increases, although within the normal range, in plasma total cholesterol, LDL- and HDL-cholesterol, and in apolipoprotein A-I and B concentrations compared to either of the other two regimens. Two mild gastrointestinal adverse experiences were reported during the ice cream regimen. No adverse experiences occurred during the MPP or regular diet regimens. Thus, MPP fat substitute is well tolerated and can safely be used in a low-fat diet regimen.

## **Cereal grains, alpha tocotrienol and cholesterol metabolism in the rat**

GH McIntosh, FH Bulman and GR Russell

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 2: 89-94*

The influence of alpha (α)-tocotrienol, the main vitamer of vitamin E in barley and oats, on cholesterol synthesis has been studied in laboratory rats. Both oats and barley lowered plasma cholesterol relative to wheat, which had no such effect, and the change has been attributed to an inhibitory influence of α-tocotrienol on cholesterol synthesis rate.

Vitamin E was stripped from oats and barley by a petroleum ether extraction procedure and the grains compared with their unstripped equivalents. In the oats feeding experiment this resulted in a higher plasma cholesterol and lower liver cholesterol synthesis rate. The barley experiment produced no significant response.

Pure α-tocotrienol was gavaged into rats fed a semipurified diet without vitamin E, at the rate of 380 mg/rat/day for 28 days. There was no significant influence on plasma cholesterol level or on liver cholesterol synthesis rate. From these studies it is concluded that α-tocotrienol does not influence cholesterol synthesis rate significantly. Therefore, it is unlikely to be a factor in oats

and barley responsible for the plasma cholesterol lowering observed.

## **Effects of zinc depletion and repletion on natural killer cell activity in aged mice**

Pang Zhi, Wang Yu-Ming and Zheng Jia-Ju

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 2: 95-100*

The effects of zinc depletion and repletion on spleen natural killer (NK) cell activity in aged mice were studied. Sixty 24-month-old male Balb/c mice were divided equally into three groups according to their weight: group I were fed the zinc-deficient diet (1.3 mg/g Zn). Group II were fed the zinc-supplemented diet (58 mg/g Zn), but their intake was restricted to the average daily amount consumed by the zinc-deficient group and group III were fed the zinc-supplemented diet (58 mg/g Zn) ad libitum. After 4 weeks, 10 mice were taken out from each group. The determinations of NK cell activity and plasma zinc level were performed in aged mice. Then, the other 10 mice in each group were all fed the zinc-supplemented diet. After another 4 weeks, they were also killed and used for the measurements of NK cell activity and plasma zinc level. The results showed that the level of plasma zinc and spleen NK cell activity were both significantly lower in zinc-deficient mice than in the restricted mice and in the ad libitum controls ( $P < 0.05$ ). There was no statistical difference in plasma zinc level and NK cell activity between the restricted mice and the ad libitum controls ( $P > 0.05$ ). Supplementation of zinc for 4 weeks enabled a satisfactory recovery of all the indices in the zinc-deficient mice. The data suggest that zinc deficiency significantly impairs the spleen NK cell activity in aged mice, which can be satisfactorily recovered by an adequate zinc supplementation.

## **Critical nutrition events in human history**

Mark L Wahlqvist

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 2: 101-105*

Decisions we make and implement about how people should be fed or feed themselves can have far-reaching effects on population, health and ecosystems and not simply those of an individual's health or even that of a community. Nutritionists and food policy makers are usually preoccupied by the need to optimise health, well-being and life expectancy in the light of a contemporary analysis of food-health relationships.

Past pressures to feed human populations in Europe were temporarily resolved by the import from the Americas of maize and potatoes or sugar production with slave labour in various parts of the world. In China, the advent of rice production allowed population growth. In turn, the progressive increase in size of these populations has had long-term consequences for indigenous food cultures and people across the globe, often with their destruction and the reduction of food cultural diversity.

Innovations in agricultural practice and food technology have also had unintended

consequences. The development of dairying and dairy technology has contributed to the desertification of Africa and the increased fat consumption of Western peoples and their changing health patterns.

The present rapid changes in the production, transport, processing and storage of food may solve some immediate health and population problems, but a more sophisticated and long-range analysis is required if we are to minimise any adverse effects and encourage a favourable impact on the human species and its habitat.

## **The baby-friendly hospital initiative**

Petri VE Volmanen, Ian Darnton-Hill and Bituin Gonzales

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 1: 107-111*

A new global 'baby-friendly hospital initiative' has been launched by UNICEF and WHO. Its central elements are hospital practices that are known to protect, promote and support breast-feeding. The health benefits of breast-feeding have been shown to be more extensive than previously believed. The new initiative is needed because the 'code of marketing of breast-milk substitutes' alone has not had enough impact on infant-feeding practices. Also, contrary to expectations in most parts of the world, the health services have generally been unable to help mothers to breast-feed.

The 'baby-friendly hospital initiative' employs four basic interventions that have been shown to be effective in increasing breast-feeding: counselling of the mother, early initiation of breast-feeding, rooming-in and the establishment of support groups for mothers. The main strategy for overcoming institutional constraints to breast-feeding is to train the maternity health care providers. Also, administrative procedures and public information campaigns may be needed.

## **Changing lifestyles and health Background paper for Technical Discussions at 43rd Session of Regional Committee, September, 1991, World Health Organization, Regional Office for the Western Pacific, Manila, Philippines**

Prepared by John Powles

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 2: 113-126*

By early next century a majority of deaths in the countries classed as 'developing' will be due to chronic non-communicable diseases (NCDs). Such countries must now seek to counter the rise of NCDs while continuing the fight against traditional killers. 'Lifestyles'-socially sustained styles of living viewed in their material aspect--are major determinants of most diseases that vary markedly across cultures and through time, not just of those NCDs that typically increase with socio-economic modernisation. Earlier phases of socio-economic development also brought

with them adverse as well as beneficial effects on health. Living in cities greatly increased the transmissibility of infection but has since been made compatible with good health. The 'lifestyle diseases' associated with socio-economic modernisation pose difficult public health challenges: they often arise from the otherwise welcome 'first fruits of affluence' and there is typically a long delay between the behaviours involved and their health effects. Major efforts may be required, over several decades, to first contain adverse trends and then to encourage favourable trends. The first task may be to help build constituencies for action by documenting and publicising the likely health impact of the elements of lifestyle involved. In most industrialised countries, earlier adverse trends in the NCDs have been either reversed (heart attack, traffic injuries) or contained (lung cancer) in the last 2 decades, showing that such health costs are not a price that must inevitably be paid for by the other benefits of modernisation.

## **Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 3**

### **Supplementary feeding in Programmes in developing countries: lessons of the eighties**

#### **PART 1: FINDINGS OF THE REPORT**

Hossein Ghassemi

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 3: 131-152*

This extensive report reviews the important lessons learned during the 1980s on supplementary food distribution for the vulnerable groups in developing countries. These lessons may be useful in making such programs a more cost-effective option in narrowing the food/nutrient gap in intake among the program beneficiaries. This report follows a similar report published at the end of the 1970s by the author and George Beaton for UNICEF.

The primary focus in the study has been the food distribution among young children, particularly schoolchildren, and also in pregnant and lactating women. The data have been gathered through a comprehensive search of the literature, official reports and documents from several United Nations agencies, aid agencies, national and international institutions. As well as original research papers on theoretical and applied issues, reports on design and evaluation of specific programs in over 20 countries are studied.

Consideration of programme design examines objectives, nutrient/food gap, poverty reduction, malnutrition, mother and child feeding practices, foods, ration sizes, leakages, targeting, coverage, integration of feeding and health care. Potential and measured benefits are considered in the light of the report published at the end of the 1970s and consequent analysis of work up until the end of the 1980s. Programme costs are documented. In a discussion on context

and input, the functional significance of mild and moderate malnutrition is considered, together with diet and physical activity. The author offers some thoughts on future directions and high-lights the need for further research

## **Determination of tocotrienol and tocopherol isomers at physiological concentration by HPLC in Caucasian and Japanese women**

Che Sam Lo, Mark L Wahlqvist, Yoshimitsu Horie, Kazuyo Horie and Naiyana Wattanapenpaiboon

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 3: 153-158*

A sensitive, specific and simple method for simultaneous evaluation of tocopherol and tocotrienol isomers in human serum by normal phase HPLC with a fluorescence detector has been developed. Tocopherol and tocotrienol isomers are measurable in physiological concentration in human serum by this method. There is no significant difference in serum alpha- and beta-tocopherols and alpha-, gamma-, and delta-tocotrienols between Caucasian and Japanese subjects. However, serum gamma- and delta-tocopherol concentrations in Japanese women are significantly higher than in Caucasian women.

## **Trends and dietary implications of some chronic non-communicable diseases in peninsular Malaysia**

Geok Lin Khor and Chong-Ying Gan

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 3: 159-168*

Non-communicable diseases with dietary implications, ischaemic heart disease, diabetes mellitus and cancers of the breast and colon are discussed in relation to their prevalence and mortality rates in peninsular Malaysia during the past few decades. The mortality rate due to diseases of the circulatory system has more than doubled since 1970, deaths due to ischaemic heart disease being the major cause. The prevalence of diabetes mellitus has risen from 0.65% in 1960 to about 4% currently. The mortality risk for both ischaemic heart disease and diabetes is highest in the Indian compared to Malay and Chinese populations. The Chinese show the highest mortality rate for cancers of the breast and colon. This could reflect, partly, because more people especially in the urban areas are seeking treatment and improved diagnosis. Empirical dietary data indicate an increase in the prevalence of hypercholesterolaemia among urban adults and overweight among urban and rural adults. Aggregate data from food balance sheets indicate increased availability of energy intake from fats and oils, sugar, and animal products, with concomitant decline in available energy from plant products. Continued public health education on the important linkage between diet and disease is called for.

## **The effects of soluble dietary fibre from the Thai herb, sweet basil seed, on human body composition**

Preeya Leelahagul, Supanee Putadechakum and Vichai Tanphaichitr

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 3: 169-174*

Twenty obese patients, two males and 18 females, with a mean( $\pm$ SEM) age of  $41.7\pm 3.2$  years and body mass index (BMI) of  $31.8\pm 3.8$  kg/m<sup>2</sup>, were enrolled in a 16-week study to evaluate the usefulness and limitations of treatment with a sweet basil seed (*Ocimum canum*, Sims) extract. For 16-week (wk0-wk16), they were instructed to reduce their usual energy intake. After baseline observations for 4 weeks, for 12 wk (wk4-wk16), patients were asked to ingest 2 g of sweet basil seed extract, swollen with 240 ml of water, before lunch and supper (4 g/day). Sixteen patients commenced extract use at wk4. On the basis of their ability to ingest more or less than 50% of the extract, they were categorised into high dose (n= 10) and low dose (n=6) users.

In high dose users, there were a significant decrease in BMI by the 4th week of treatment which was maintained at the 8th and 12th weeks of treatment, but skinfold thickness measurements for fat did not decrease. There may, therefore, have been a reduction in total body water. Further support for this view was provided by an observed increase in serum total protein concentration at the 12th week of intervention. That the distribution of water may have changed was suggested by an increase in upper arm muscle circumference (UAMC). For low dose users, on the other hand, their body fat increased at wk8 as indicated by both BMI and skinfold thickness measurements, suggesting that supplement use gave a sense of false security. Apart from the change in serum total protein in the high dose group, no significant effect was observed on lipid, renal or electrolyte status, although fasting glucose rose within the normal range.

This investigation demonstrated the importance of direct measures of body fatness, as opposed to those implied from weight-height relationships in the evaluation of management strategies for obesity.

## **Promotion of healing by orally administered glutamine in elemental diet after small intestinal injury by X-ray radiation**

Takuzo Nambu, Tadao Bamba, and Shiro Hosoda

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 3: 175-182*

Glutamine was administered orally to rats with damaged small intestinal mucosa as the result of injury by X-ray radiation at 10 Gy to the abdomen. The healing effects of glutamine on the injured mucosa were studied serially from the day of radiation (Day 0) to Day 4. The rats received two types of isocaloric elemental diet, Gln(+) containing 2% glutamine and Gln(-) containing no glutamine, by paired feeding.

From Day 2 to Day 4, the wet weight, protein content, and DNA content of the jejunal mucosa were significantly greater in the Gln(+) than in the Gln(-) group. On Day 3, when the damage of the intestinal mucosa was the severest, the crypt cell production rate in the jejunum was significantly higher in the Gln(+) than in the Gln(-) group. The permeability of the intestinal mucosa to  $^{51}\text{Cr-EDTA}$ , administered to the rat stomach through an oro-gastric tube, remained significantly lower in the Gln(+) group. Light microscopic findings showed that oedema in the lamina propria mucosae of jejunum and fusion of jejunal villi were milder in the Gln(+) group on Day 4. when the mucosal mass began to recover. The arterial and portal blood glutamine concentration, and glutamine extraction by the gut from arterial blood and phosphate-dependent glutaminase activity in the jejunal mucosa, were higher in the Gln(+) than in the Gln(-) group. Ornithine decarboxylase activity was increased in both the jejunum and the ileum from Day 3, but no difference was observed between the two groups.

These findings suggest that, after X-ray radiation injury of the intestinal mucosa, the oral administration of the elemental diet containing 2% glutamine improved glutamine metabolism of the body, promoted the proliferation of jejunal epithelium, accelerated the recovery of the mucosal mass and the morphology of villi, and then contributed to maintaining the barrier function of the intestine from an early stage after the injury.

## **Options in obesity management**

Mark L Wahlqvist

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 3: 183-190*

The management of obesity requires acknowledgment of its heterogeneity. This derives from differences in pathogenesis, in genetic and psychological background, in physical activity, in food intake, and in aspects of lifestyle like cigarette smoking; as well as in degree, fat distribution, stability, and in consequences and associated disease. Pivotal to management is an appreciation that negative energy balance can be achieved at various levels of energy intake, depending on physical activity or on the degree of inefficiency of energy utilisation. Reduced food intake can help people start with reduction in body fatness and is sometimes necessary for extended periods, but in the long run, an emphasis on increased levels of physical activity is preferred. Management endpoints need careful consideration since a great deal can be done to help the obese without necessarily changing weight. It is important to document changes in body fat and its distribution particularly by way of abdominal girth. Setting other healthful endpoints, such as food intake itself, self-esteem, physical fitness, risk profile for non-communicable disease, and self-care, are equally important. Management options - social, behavioural, exercise, pharmacotherapeutics and surgical - can be considered singly, sequentially or in combination. There are risks of management and these will include social, psychological (sense of failure and alteration in body image), economic nutritional and physical (eg injury), and the more specific side-effects of pharmacotherapeutics and of surgery. Finally, the prevention of obesity requires the early detection of risk, eg the emergence of abdominal fatness with little

change in total body fatness, and attention to health education, regular physical activity and the use of food with little fat.

## **Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 4**

### **Supplementary feeding in programmes in developing countries: lessons of the eighties**

#### **PART II: DISCUSSION AND REFERENCES**

Hossein Ghassemi

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 4: 195-206*

This extensive report reviews the important lessons learned during the 1980s on supplementary food distribution for the vulnerable groups in developing countries. These lessons may be useful in making such programmes a more cost-effective option in narrowing the food/nutrient gap in intake among the programme beneficiaries. This report follows a similar report published at the end of the 1970s by the author and George Beaton for UNICEF.

The primary focus in the study has been the food distribution among young children, particularly schoolchildren, and also in pregnant and lactating women. The data have been gathered through a comprehensive search of the literature, official reports and documents from several United Nations agencies, aid agencies, national and international institutions. As well as original research papers on theoretical and applied issues, reports on design and evaluation of specific programmes in over 20 countries are studied.

Consideration of programme design examines objectives, nutrient/food gap, poverty reduction, malnutrition, mother and child feeding practices, foods, ration sizes, leakages, targeting, coverage, integration of feeding and health care. Potential and measured benefits are considered in the light of the reports published at the end of the 1970s and consequent analysis of work up until the end of the 1980s. Programme costs are documented. In a discussion on context and input, the functional significance of mild and moderate malnutrition is considered, together with diet and physical activity. The author offers some thoughts on future directions and high-lights the need for further research.

### **Insulin-like growth factor-I and fast growth-hormone levels in mild and moderately malnourished children**

Wan Mohamud Wan Nazaimoon, Ali Osman, Mee Lian Ng, Tean Tune Tan, Loo Ling WU,

Othman Sakinah and Abdul Kadir Khalid

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 4: 207-210*

Insulin-like growth factor-I(IGF-I) and fasting growth hormone levels were measured in a group of 255 children (163 males and 92 females, age ranged 6-17 years) of varying pubertal development and body mass index (BMI); well-nourished (BMI> 18), mildly-malnourished (BMI = 15-18) and moderately-malnourished (BMI<15). In well-nourished children MGF-I levels increased significantly ( $P = 0.02$ ) with pubertal development, where girls at Tanner 5 had significantly higher ( $P = 0.03$ ) IGF-I levels than the boys. Whilst there was no change in fasting GH levels with nutritional status, IGF-I levels of prepubertal boys and girls decreased significantly with BMI ( $P < 0.001$  and  $P = 0.01$  respectively). Hence, measurement of IGF-I levels is a sensitive biochemical index in the assessment of mild and moderate forms of malnutrition in prepubertal children.

## **A food frequency questionnaire for use in Chinese populations and its validation**

Bridget H-H. Hsu-Hage and Mark L Wahlqvist

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 4: 211-223*

There is no gold standard in the assessment of individual dietary intake methodology. The choice of dietary method to estimate individual intake depends upon the study objectives for the assessment of individual intake. We adopted a food frequency questionnaire and modified it for use in a study of food habits and cardiovascular health status in adult Chinese living in Melbourne, Australia. This is a semi-quantitative questionnaire (MCHS-FFQ) and is designed to estimate past food intake. It consists of 220 foods and beverages. A reference portion is given to obtain a quantitative estimate of the usual intake portion. Various internal validation tests were performed. The MCHS-FFQ, being a food frequency dietary method, does not provide a good estimate of nutrients in foods which are not served in standard portions, such as sodium. The MCHS-FFQ offered a good estimate for potassium and protein intake when compared to estimates derived from a single 24-h urine collection. Finally, the MCHS-FFQ was predictive of plasma cholesterol levels. We conclude that the MCHS-FFQ is adequate for the assessment of individual usual food and nutrient intakes in a representative sample of adult Melbourne Chinese. For foods that are not served in a standard portion or quantifiable addition, an alternative more reliable method would be required for quantitative purposes. The method is, however, likely to be useful for the appraisal of overall food patterns in Chinese populations.

REVIEW ARTICLE

## **Colostrum avoidance and early infant feeding in Asian societies**

G Dixon

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 4: 225-229*

A review of the literature on childbirth and early infant feeding in Asian societies indicates that the avoidance of colostrum and the introduction of other foods at a very early age are both widespread and persistent. These traditional attitudes should be recognized where there are attempts to reduce infant mortality and morbidity. Further research into these practices is suggested.

## **Trends in the development of Thailand's nutrition and health plans and programs**

Kraisid Tontisirin, Yongyout Kachondham, Pattanee Winichagoon

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 1: 231-238*

Thailand's achievements in health and social development, since its First National Economic Development Plan (1961) and those of its National Food and Nutrition Plans beginning in the Fourth National Economic and Social Development Plan (1977), have received worldwide acclaim. During the last decade the nation has experienced dramatic results in reducing protein-energy malnutrition (PEM), including the virtual eradication of severe PEM. Children and adults alike have better access to health care services, preventive and curative, during the past decade as Thailand's poverty alleviation, primary health care and quality of life approaches have reached out into even the remotest of rural villages. This paper explores the reasons behind this successful effort with special reference to how Thailand integrated nutrition plans into national health and rural development policies and programs.

## **Iron fortified salt distribution through integrated child development services in Orissa - an assessment**

KV Rameshwar Sarma, GNV Brahman, Ch Gal Reddy, M Ravindranath and N Pralhad Rao

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 4: 239-243*

The present study was undertaken in two backward districts namely Phulbani and Sundargarh, of Orissa State, India, to study operational aspects of the distribution programme of iron fortified salt (IFS), and the extent of any overlap with the ongoing National Nutritional Anaemia Control Programme (NNACP) and possible toxic effects thereof. All IFS samples tested showed iron levels in the range of 800-1000 mg of elemental iron per 1 kg of iron fortified salt. Distribution of IFS to households was irregular and only 40% of the households had stocks of IFS at the time of home visits. None of the households using IFS reported any kind of adverse effects. Prevalence of anaemia (blood haemoglobin level of less than 11 g/dl) was highest among pregnant women (90.9%) followed by lactating women (88.7%), school aged children (84.4%) and preschool children (77.9%) respectively. Folifer tablets are being distributed to pregnant, lactating women and preschool children. Adult tablets contain 60 mg of elemental iron in the form of ferrous sulphate (FeSO<sub>4</sub>) and 500 mg of folic acid. Tablets distributed to children contain 20 mg of elemental iron and 100 mg of folic acid. Enquiries regarding distribution of

folifer tablets showed that 71% of pregnant women, 22% of lactating women and 22% of children received the folifer tablets at sometime or other and no toxic effects were reported. These results indicate the necessity for some modifications in existing strategies for distribution of IFS in order that it be effective in the prevention of widespread anaemia.

## **The effectiveness of 50% lactose-reduced milk in alleviating milk intolerance**

J Brand Miller and V Munro

*Asia Pacific Journal of Clinical Nutrition (1992) Volume 1, Number 4: 245-248*

The level of lactose reduction in milk necessary to alleviate the signs and symptoms of lactose intolerance has received little study. The purpose of this study was to determine whether 50% lactose-reduction in milk is adequate to alleviate the signs and symptoms of lactose maldigestion, even when large amounts of milk are consumed. Seven healthy subjects with proven lactose maldigestion consumed graded doses of whole cow's milk and 50% lactose reduced (LR) whole milk to determine the amount which could be consumed before breath hydrogen rose  $\geq 20$  ppm. This threshold was exceeded on average with 500 ml of 50% LR milk and 200 ml of whole milk. Whole milk produced significantly more breath hydrogen ( $P < 0.05$ ) and maldigestion symptoms ( $P < 0.05$ ) at all levels than the 50% LR milk. These results suggest that milk with as little as 50% lactose reduction can play a major role in the diet of individuals with lactase deficiency.

# **Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 1**

REVIEW ARTICLE

## **Nutrition and HIV infection**

Julie R Lustig

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 1: 3-14*

Nutritional status may have an impact at all stages of HIV disease. Many of the clinical features of HIV infection cause nutritional problems and may also be exacerbated by the presence of malnutrition. Inadequate food intake, due to a wide variety of aetiologies, malabsorption and altered metabolism, may all contribute to malnutrition. Additionally, factors in food, including micronutrients, can modulate immune function. Reduced micronutrient levels are documented at all stages of HIV infection although the significance of these findings and how they may relate to HIV disease severity and prognosis are still unclear. Body composition changes in adults include

loss of weight with proportionately greater loss of lean mass. Paediatric HIV infection has received far less research attention, but growth failure is a significant nutritional complication seen clinically. Clinical experience suggests that early nutritional intervention may improve prognosis as well as quality of life. Nutritional management in HIV disease depends on the clinical state of the patient. Definition of the benefits of particular food factors and diets, as well as the most appropriate nutrition support modalities, would allow rational nutritional counselling. Better definition of the contribution food makes to health through its social role, and the opportunities this provides in patient care, would complement the biomedical research effort.

## **Uses of anthropometry in the elderly in the field setting with notes on screening in developing countries**

Noel W Solomons, Manolo Mazanegos and Ivan Mendoza

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 1: 15-23*

A field setting can be defined as any setting outside of a fixed, permanent, and sophisticated health facility or research laboratory. The most important applications of anthropometry at field level include biological anthropology, epidemiology, clinical application, and metabolic research. Data collecting in the field setting requires different levels of accuracy and precision; the standardization should also consider intra- and inter-observer variability due to the possibility of more than one observer participating in a given survey. A field setting, in contrast to the laboratory setting, involves special conditions that challenge the application of anthropometry. The required equipment is different and the conditions of data collection are less rigorous. Issues intrinsic to the target group - of education, culture and sophistication - might be limiting factors for carrying out anthropometric surveys in field settings.

Another issue is related to interpretation of the biological, nutritional and health significance of anthropometric findings in relationship to the elderly. Uncertainty regarding the accuracy of chronological age, and geography and differential survival of the elderly should be considered when designing a survey. In addition, because the majority of the elderly now live in developing countries, short stature should be a common finding in the age groups from these regions. It is in these short-stature elderly populations, that there is a problem interpreting and applying anthropometric norms or references for height or weight derived from elderly populations of developed countries.

In conclusion, although the application of anthropometry to the field setting is feasible, given its enormous importance to gerontological biology, nutrition and health, researchers should consider a series of factors and paradigms when designing and carrying out anthropometric surveys at the field level.

## **Urinary sodium and potassium in a sample of healthy adults in Sydney, Australia**

## L Notowidjojo and AS Truswell

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 1: 25-33*

Australia has had an official guideline for the last ten years, that people should aim to consume less than 100 mmol sodium per day (equivalent to 6.0 g NaCl). The only practical way of estimating sodium intake is from the 24-h urinary sodium excretion. Between 1970 and 1980 average sodium excretions in different Australian surveys ranged from 130 to 200 mmol/day (middle number 165 mmol/d). These surveys involved small numbers of subjects (n = 11 to 259). To see how Australians are responding to the guidelines and taking advantage of a range of reduced salt food products now in the supermarkets, we measured urinary sodium and potassium in 117 healthy adult subjects, mostly in the university community. In group N (nutrition personnel) sodium excretion averaged 128 mmol/d in females and 137 mmol/d in males. In group W (eating a western, traditional Australian diet, no special knowledge of nutrition) urinary sodiums averaged 133 mmol/d (female) and 159 mmol/d (male). In group A (eating an Asian diet) sodiums averaged 140 mmol/d (female) and 195 mmol/d (male). Potassium excretions were 73, 81, 72, 76, 53, and 65 mmol/day respectively in the six subgroups. We conclude that these results possibly reflect a small downward trend in Australian sodium intake and that sodium intake is lower in mainline Australian diets than Asian diets. But only a minority of subjects' urinary sodiums were within the recommended 40 to 100 mmol/d. Women excreted consistently smaller amounts of sodium than men; the guidelines for sodium should perhaps be expressed separately by gender. In six subjects who provided seven days' urine collections the coefficient of variation for sodium excretion was between 20 and 35%.

## **Diet does not predict incidence or prevalence of non-insulin-dependent diabetes in Nauruans**

Allison M Hodge, Gary K Dowse and Paul Z Zimmet

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 1: 35-41*

Cross-sectional and longitudinal relationships between diet and non-insulin-dependent diabetes (NIDDM) were assessed in Nauruan adults to determine if a particular component of the diet contributed to the high prevalence of NIDDM in this population. In 1982, 24-h dietary recall data were collected from 430 Nauruans over the age of 20, who were participating in a noncommunicable disease (NCD) survey. In 1987 a follow-up survey was performed which included 350 of the subjects from whom dietary data was obtained. Neither cross-sectional nor longitudinal analyses showed any statistically significant associations between any of the specific dietary components studied and NIDDM prevalence or incidence. However, when nutrient intakes were adjusted for energy intake it appeared that the age- and body-mass-index (BMI)-corrected mean intakes of total fat, total carbohydrates, alcohol, sugar and monounsaturated fat were slightly higher in the seven incident cases than in those who remained healthy, while intakes of protein, fibre and cholesterol were lower. Despite the inability to demonstrate an association between NIDDM risk and nutrient intake at the individual level,

Nauruans as a population have total energy intakes 115-135% greater than recommended for maintenance of healthy weight, protein intakes about 250% of that required, sugar intakes about twice the recommended, fibre intakes only about 30% of current recommended levels and in men a mean alcohol intake more than three times the recommended level. This adverse diet undoubtedly contributes to the high prevalence of obesity in the population and hence, even if there are no direct dietary effects, to the risk of NIDDM and other diet-related diseases.

REVIEW ARTICLE

## Nutrition and health of Victorian Aborigines (Kooris)

Jonathan M Hodgson and Mark L Wahlqvist

*Asia Pacific Journal of Clinical Nutrition* (1993) Volume 2, Number 1: 43-57

Prior to European settlement of Australia, the health of Aboriginal people was probably better than that of the Europeans. In the past 200 years there has been a considerable improvement in the health of non-Aboriginal Australians, and a deterioration in the health of Aborigines. Some improvement in Aboriginal health has occurred in recent times. The Aboriginal people who live in Victoria are known as Kooris. An understanding of traditional Koori diets is important because people were generally healthy eating these diets. The traditional Koori diet was high in dietary fibre, unrefined carbohydrates, and protein, with adequate vitamins and minerals, and low in total fat and saturated fat, sucrose, salt, and without alcohol. Their lifestyle also dictated a high level of physical activity resulting in a reduced likelihood of overweight. The other notable aspect of the traditional diet was the variety of foods consumed. The present health problems of the Koori people stem primarily from their loss of ancestral lands, and social and cultural disruption. Kooris went from a hunter gatherer society to one almost entirely dependent upon mission handouts. There are many factors which may now contribute to the continued poor health and nutrition of Kooris. The relative importance of any of these factors is unknown. Morbidity and mortality data provide valuable information about the overall health of populations and their nutrition status. The Australian population is one of the healthiest in the world. There is however a remarkable difference between the health of Aboriginal and non-Aboriginal Australians. The leading cause of death for both male and female Aborigines is disease of the circulatory system, including ischaemic heart disease and stroke. Deaths due to circulatory system disease is 2.2 and 2.6 times higher than the age adjusted Australian rates for men and women respectively, and between 10 and 20 times higher for young and middle aged adult Aborigines. Rates of hospital admission are 2.5-3 times higher than the rest of the population, with the highest rates being for infants. Although mortality statistics do not show nutrition related disorders such as obesity, non-insulin dependent diabetes mellitus (NIDDM), and hypertension to be significant contributors to mortality, these statistics are not representative of the problem. Across Australia the prevalence of obesity, NIDDM, and hypertension are higher for Aborigines than the general population. Available data on morbidity and mortality for Aborigines in Victoria are limited, but the indication is that the overall situation is similar to the rest of Australia. If the situation for Victoria is similar to the rest of Australia, then this would

suggest that the contemporary Koori diet is too high in fat and perhaps alcohol, and too low in fibre and variety. Further evidence is required to verify this suggestion.

There are several areas where information on Koori nutrition is limited or lacking. These include food intake, nutritional status, and dietary practices, such as cooking methods, salt and sugar use and meal patterns. It is generally agreed that information on Koori nutrition should be made available so that the problems can be identified, and strategies put in place to address the problem areas.

## **Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 2**

### **Nutritional management of Crohn's disease with a peptide-based enteral formula**

S Hosoda, T Shimoyama, T Takahashi, T Bamba, A Kitano, K Matsueda and N Hiwatashi  
*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 2:63-70*

We examined a nutritional approach to the therapy of Crohn's disease with an enteral formula ('Enterued', Terumo Corporation, Tokyo, Japan) which contains low molecular weight peptides as a protein source.

Total protein, albumin, transferrin, prealbumin and retinol-binding protein levels were significantly increased as indices of the nutritional status, when compared with those observed before treatment.

White blood cell count (WBC), erythrocyte sedimentation rate and C reactive protein (CRP) as the indices of inflammation levels were reduced significantly after the termination of the treatment, when compared with those observed before treatment.

The International Organization for the Study of Inflammatory Bowel Disease (IOIBD) assessment scores decreased in all cases, except for one case out of 51 cases evaluated.

Deterioration in nutritional status was not observed in any patient, but rather was maintained or improved; 42 out of the total 51 cases (82.4%) exhibited at least moderate improvement.

Treatment was discontinued on account of side effects such as abdominal distension, abdominal pain and diarrhoea in five cases (8.1%).

The enteral formula 'Enterued', utilizing low molecular weight peptides as a nitrogen source, appears to improve nutritional status and encourage remission of the inflammatory process with minimal side effects.

### **Evaluation of a nutrition education activity for medical students in**

## China

Georgia S Guldan, Yu Wen-San, Li Ying, Zhao Ming, Xiang Da-Peng, Yang Li, and Long Fei  
*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 2: 71-76*

In China, where cancers and cardiovascular disease are the major causes of morbidity and mortality, an important role for preventive medicine has emerged. Therefore, preparing China's medical students to tackle contemporary health problems requires attention to nutrition and health promotion in the medical curriculum. To evaluate the effectiveness of a nutrition education activity for medical students, a two-group pre-test/post-test nutrition education program was conducted in a medical university in south-western China (n=300 per group). Students in another south-western Chinese medical university served as controls (n= 150 per group). Special features of the intervention were: (1) nutrition education materials developed from (a) the results of a pre-test survey of medical students and (b) discussions with medical students, faculty, and physicians; and (2) a multi-channel delivery, which included a classroom lecture-discussion; a nutrition knowledge competition; a handout providing a day's dietary allotment; campus radio and movie theatre announcements, and posters. Analysis of variance, chi-square, and t-tests showed a significant increase ( $P<0.05$ ) in nutrition knowledge, but not in nutrition attitude score. The final nutrition knowledge and attitude scores were also found to be related to the students' increased exposure to the various channels ( $P<0.001$ ). Also observed was an increase in the consumption of soybean and dairy products ( $P<0.05$ ). It is concluded that the method is a useful and practical model for designing and developing student nutrition education activities in China, as well as demonstrating nutrition and health education methods among the medical university community.

### REVIEW ARTICLE

## Breakfast practices in the Asian region

JA Howden, YHChong, SF Leung, LB Rabuco, M Sakamoto, BS Tchai, K Tontisirin , ML Wahlqvist, FG Winarno and M Yap

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 2: 77-84*

Studies on changing dietary patterns throughout the Asian region have focused largely on overall alterations in nutrient intakes and changes in the consumption of various food groups. Changes in individual meal patterns have received little attention. Although country and regional differences occur, the first meal of the day, breakfast, tends to take the form of a traditional meal in most south-east Asian countries. Grain and cereal products, such as rice and wheat and rice noodles, appear to be dietary staples at breakfast. In some countries, the more traditional grain products are being replaced by alternative cereals, such as bread. Lifestyle changes and accompanying urbanization together with rising affluence, appear to be largely responsible for dietary alterations. The health implications of these changes require further investigation.

## **Motor effects of broad beans ( *Vicia faba*) in Parkinson's disease: single dose studies**

PA Kempster, Z Bogetic, JW Secombe, HD Martin, NDH Balazs and ML Wahlqvist  
*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 2: 85-89*

Broad beans (*Vicia faba*) are a natural source of L-dopa. To investigate a possible role for this substance in the treatment of Parkinsonian motor oscillations, we carried out single dose studies of *Vicia faba* pod mixture plus carbidopa in six patients. Motor responses of equivalent magnitude to those of conventional L-dopa medication occurred in five cases with mean onset of 39 min and mean duration of 104 min. *Vicia faba* meals produced comparable L-dopa blood levels to fasting standard tablet doses and recovery studies yielded 0.25% L-dopa per weight of bean pod mixture. *Vicia faba* contains sufficient L-dopa to be pharmacologically active in patients with Parkinson's disease and can potentially be incorporated into dietary strategies to manage Parkinsonian motor oscillations.

## **Principles of diet therapy in ancient Chinese medicine: 'Huang Di Nei Jing'**

Ho Zhi-chien

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 2:91-95*

*Huang Di Nei Jing*, the first systematic Chinese medical book, was compiled from the observations of imperial herbal doctors in the Qin and Han periods (221 BC - 220 AD). From this classic traditional source may be derived the concept of a balanced and complete diet and probably the world's first dietary guidelines. Basic to the tradition are *han*, *re*, *wen* and *bu* foods, respectively 'cold', 'hot', 'neutral', 'strengthening'. Basic to Chinese cuisine are *jan* and *tsai*- 'cereal' (the rice staple and main meal) and 'dishes' to accompany the rice. Chinese traditional medicine, as in *Huang Di Nei Jing*, considers the nourishment of body and mind. It also emphasises that herbal medicine and food have the same origin. Diet was essential to the prevention of disease which a glossary of Chinese terms is given at the end of the paper in the Chinese tradition, was superior to treatment.

## **Coronary risk in West Sumatran men**

Fadil Oenzil, MD, PhD

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 2: 97-100*

Lifestyle, food habits and blood lipid profiles were studied in two areas - one urban and one rural - of West Sumatra, Indonesia, where coconut oil is commonly consumed. Subjects were 102 randomly selected healthy adult men aged 25 to 39 years. Variables considered were socioeconomic level, smoking habits, alcohol and coffee consumption, food intake, indices for obesity, and blood lipid profiles. Urban incomes were higher than in rural areas. The prevalence

of cigarette-smoking was 75% in urban and 80% in rural areas. Alcohol consumption was higher in urban (31%) than rural areas (4%). Coffee was used by 52% of urban and 38% of rural men. However, quantities of alcohol and coffee consumed were small. Average energy intakes were 1915 kcal (456 kJ) in the urban and 1845 kcal (439kJ) in the rural areas. Protein intake was 55.8g (11.3% of total energy) in the urban and 46g (9.8%) in the rural areas. Fat intake was 45.0g (20.4%) in the urban and 33.5g (16%) in the rural areas. Dietary fat intake was significantly higher in the urban compared to the rural areas ( $P<0.005$ ). The average BMI ( $\text{mg}/\text{m}^2$ ) was 21.2 in the urban and 20.4 in the rural areas. Mean total body fat from 4 skinfolds was 13.4 kg in the urban and 9.1 kg in the rural areas (Durnin's equation). The waist-hip ratio was 0.90 in the urban and 0.88 in the rural areas. Concentrations of total serum cholesterol and of LDL, the LDL-HDL cholesterol ratio and the atherogenic index were significantly higher in the urban compared to the rural areas ( $P<0.001$ ). Serum HDL tended to increase in the urban areas. Overall, higher economic status married men generally had the higher prevalence of coronary heart disease risk factors.

## **Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 3**

### **Glycaemic index of some commonly consumed foods in western India**

UV Mani, BM Prabhu, SS Damle and I Mani

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 3:111-114*

- (1) Glycaemic index (GI) was determined in 36 non-insulin-dependent diabetes mellitus (NIDDM) patients.
- (2) The subjects were fed 50g carbohydrate portions of six foods consumed widely in India including Varagu (*Plaspalum scorbiculatum*) alone and in combination with whole and dehusked greengram (*Phaseolus aureus Roxb*), Bajra (*Penniseteum typhoideum*), Jowar (*Sorghum vulgare*) and Ragi (*Eieusine coracana*).
- (3) The GI of Varagu alone, Varagu in combination with whole greengram and Bajra was significantly lower than that of Ragi which produced a glycaemic response equivalent to that of the glucose load.

### **Iodine content in drinking water not an important determinant of endemic goitre**

Ali Osman, Muda Khalida, Abu Bakar Azmant, R Jamilt, TT Tan, LL Wu, SO Sakinah and BAK

Khalid

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 3: 115-118*

The prevalence of goitre was determined in several communities in rural parts of Pahang. Urine specimens were collected randomly among the participants. Drinking water from various sources such as river and spring, and water from gravity feed systems was also collected to determine the iodine content by using the ashing method. The results were compared to that of Kuala Lumpur City. It was found that the prevalence of goitre in rural areas was between 20 and 70% depending on village, ethnic group, age and gender. The interior parts of the jungle where Aborigines lived was moderately endemic with goitre prevalence of goitre more than 20% and urinary iodine content 2.0-5.0 mg I/dl). A nearby Malay traditional village which was studied had mild endemia (prevalence 10-30% and urinary iodine content 5.0-10.0 mg I/dl) while a Felda Malay resettlement scheme and Kuala Lumpur City did not have endemic goitre. Endemic goitre in rural areas was associated with low iodine content in drinking water. Even though Kuala Lumpur had low iodine content in its drinking water there was no endemic goitre, indicating that other factors were more important.

## **Iodine status in pregnancy**

Nina S Dodd and Jagmeet Madan

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 3:119-123*

The iodine status of 429 pregnant women in different trimesters from the lower socio-economic strata of the urban slums of Bombay was assessed using clinical and biochemical parameters. The total goitre rate (TGR) of 45% and a visible goitre rate (VGR) of 3.04% was observed. There was an evident increase in the TGR during the months of pregnancy. The urinary iodine excretion pattern revealed mild iodine deficiency. 55% of the women had urinary iodine excretion less than 5 mcg/dl with 13.2% having less than 2 mcg/dl. Elevated T<sub>3</sub> and T<sub>4</sub> levels were observed in 64 and 40% respectively of the women surveyed, while only 1.8% of them had TSH levels higher than the normal range. No significant difference in the levels of thyroid hormone (T<sub>3</sub> or T<sub>4</sub>) was noted between the euthyroid and goitrous subjects. The mean TSH levels in euthyroid women were however significantly higher than those with signs of goitre.

## **Effects of seasonality on blood ionized calcium in early neonatal periods**

Zheng Ming-Ci, Zhou Lu Sheng, Zhang Guo Feng

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 3: 125-127*

The levels of whole blood ionized calcium were observed in 200 healthy neonates in the first week of life in spring and in summer. Levels of blood ionized calcium were lower in neonates born in spring compared to those of neonates born in summer. The levels of blood ionized

calcium in adults did not change in different seasons. This study suggested that seasonality had a significant effect on blood ionized calcium in early neonatal life.

## **Long-term tocotrienol supplementation and glutathione-dependent enzymes during hepatocarcinogenesis in the rat**

Asmah Rahmat, Wan Zurinah Wan Ngah, Abdul Gapor and BAK Khalid

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 3: 129-134*

The effects of long-term administration of tocotrienol on hepatocarcinogenesis in rats induced by diethyl nitrosamine (DEN) and 2-acetylaminofluorene (AAF) were investigated by the determination of plasma and liver gamma-glutamyl transpeptidase (GGT), cytosolic glutathione reductase (GSSG-Rx), glutathione peroxidase (GSH-Px) and glutathione S-transferase (GST). Twenty-eight male *Rattus norvegicus* rats (120-160g) were divided according to treatments into four groups: control group, tocotrienol - supplemented diet group (30mg/kg food), DEN/AAF-treated group and DEN/AAF-treated plus tocotrienol-supplemented-diet group (30mg/kg food). The rats were sacrificed after nine months.

The results obtained indicated no difference in the morphology and histology of the livers of control and tocotrienol-treated rats. Greyish-white neoplastic nodules (two per liver) were found in all the DEN/ AAF treated rats (n-10) whereas only one nodule was found in one of the carcinogen treated rats receiving tocotrienol supplementation (n-6). Histological examination showed obvious cellular damage for both the DEN/AAF-treated rats and the tocotrienol-supplemented rats but were less severe in the latter.

Treatment with DEN/AAF caused increases in GGT, GSH-Px, GST and GSSG-Rx activities when compared to controls. These increases were also observed when tocotrienol was supplemented with DEN/AAF but the increases were less when compared to the rats receiving DEN/AAF only.

## **Vitamins, electrolytes and haematological status of urban construction site workers in Bangkok**

Praneet Pongpaew, Rungsunn Tungtrongchitr, Somsak Tawprasert, Samnieng Vutikes, Somchai Chanjanakitskul, Benjaluck Phonrat, Seevika Vorasarnta, Panata Migasena and Frank Peter Schelp

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 3: 135-140*

Vitamins, electrolytes and haematological status of 106 construction site workers were investigated. Most of the workers were from the northeastern part of the country. 3.4% of male workers were found to be anaemic, however, an even higher percentage was detected for females. Thiamin deficiency in males was 10.3%, compared to a 5.2% deficiency in females. It has been suggested thiamin deficiency might be one of the nutritional factors contributing to sudden unexplained nocturnal death syndrome (SUNDS) as found in workers. High percentage

of vitamin C, vitamin B2 and B6 deficiencies were observed, possibly related to insufficient dietary vitamin intake and the interference of drugs. Low serum potassium level or hypokalemia was found in about 10.3% of male and 5.6% of female workers.

## REVIEW ARTICLE

### **Nutritional factors in carcinogenesis**

Mark L Wahlqvist

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 3: 141-148*

There have been varying estimates of the role of nutritional as opposed to other contributors to carcinogenesis. Several considerations probably account for the different estimates: (1) genetic overestimates because of foetal and early life rearing practices and the nutritional modulation of genetic expression (2) errors in food intake methodology (3) the limitations of nutrient-carcinogenesis hypotheses, ie models which are too naive and do not allow for non-nutrients in food, food patterns and the overall package which is food culture (4) indirect pathways connecting nutrition and cancer such as that via immunosurveillance. Examples of cancers where rapid change in nutritional thinking is underway are breast, prostatic, colorectal and pancreatic. With breast cancer, weakly oestrogenic compounds from foods may be comparable to tamoxifen. Changing food culture away from that rich in phyto-oestrogens may increase the risk of prostatic cancer in men as well. Colorectal cancer incidence has continued at high rates in urbanized society despite an awareness of dietary contribution comparable to the knowledge of diet and coronary heart disease - is the analysis sufficiently stratified for large bowel site or nutritionally sophisticated enough to allow for aggregate food pattern effects? Pancreatic cancer on the rise presents questions about unidentified changes continuing in the diets of industrialized societies, possibly from an early age, and even during infant feeding. Nutritional surveillance with mathematical modelling of food intake at a more sophisticated level will be required to understand present food-cancer relationships, and those which may emerge with newer food technologies, especially those related to designer foods.

## **Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 4**

### **The trans fatty acid and positional (sn-2) fatty acid composition of some Australian margarines, dairy blends and animal fats**

MP Mansour and AJ Sinclair

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 4: 155-163*

We have analysed the fatty acid (FA) composition including the trans fatty acid by GLC and Fourier Transform Infra-Red (FTIR) Spectrophotometry of 13 margarines, five butter/dairy blends and two animal fats (lard and dripping). The samples were purchased from supermarkets in three separate locations across Victoria: Gladstone Park (near Melbourne), Waurn Ponds (near Geelong) and Geelong city. From the FA composition, the P/S, P/(S+trans monoenoic FA), P/M(S+trans monoenoic FA) and v6/v3 ratios were calculated. The FA composition and trans FA content were compared with the last published analysis of Australian margarines in Sydney in 1982. The FA composition of the sn-2 position was obtained by pancreatic lipase deacylation of the whole triglycerides (TG). From this data, we estimated the per cent interesterified fat which was present in the margarines. The trans FA content of the margarines which was determined by FTIR ranged from 9.2% to 16.3% (mean of 13.1% of total FAME) (7.6 g-13.0 g trans FA/100 g sample, mean of 10.4 g/100 g sample) and from 3.2% to 4.1% (mean of 3.8%) for butter and dairy blends. Lard contained 0.4% trans FA while dripping consisted of 3.6% trans FA. The trans FA content in the margarines was similar to the values published in 1982 with the exception of four brands. The v6/v3 ranged from 2.5 to 363 and the P/S ranged from 1.4 to 3.3 compared with the 1982 figures where the v6/v3 ranged from 3 to 49 and the P/S ranged from 0.1 to 3.7. The estimated per cent interesterified fat in the margarines ranged from 25% to 100%. We estimated the total trans FA intake in the Australian diet to be between 2.7 g/head/day and 4.8 g/head/day. We also estimated that table margarines account for between 36% and 64% of the total trans FA intake in the Australian diet.

## **Trans fatty acid content of margarines, oils and blended spreads available in New Zealand**

Madeleine J Ball, Dean Hackett, Ashley Duncan

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 4: 165-169*

Concern has been expressed about the possible adverse effects of high intakes of trans fatty acids on coronary heart disease risk. Data on New Zealand foods was very sparse. The fatty acid composition of New Zealand margarines, cooking oils, blended spreads and dairy products has thus been analysed using a methodology that determines the percentage of trans fatty acids. The C18:1 trans content of the margarines varied between 4.8% and 11.3% of the total fatty acids, and there was less than 0.7% C18:2 trans. The total trans fatty acid content of the oils analysed was less than 1%. The amount of trans fatty acids in readily available margarines, blended spreads and oils in New Zealand appears lower than for many other countries, and the intake of these products is relatively small. Most of the products also have a high linoleic acid content, which may modify any potential adverse effects of trans fatty acids on plasma lipoproteins. Replacement of products high in C12, C14 and C16 saturated fatty acids in the diet with these margarines need not be discouraged, although manufacturers should probably be encouraged to further reduce the content of trans fatty acids of some products and the increased use of partially hydrogenated fats in fast food restaurants should be examined.

## **Body composition of Indonesian adults assessed by skinfold thickness and bioelectrical impedance measurements and by a body mass index equation**

J Dierkes, JW Schultink, R Gross, SMB Praestowo, K Pietrzik  
*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 4: 171-176*

Body composition was assessed in Indonesian male (n=29) and female (n=17) students and rural women (n=35) using skinfold thickness measurements, bioelectrical impedance measurements (BIA) with two different equations, and a body mass index equation. Correlation between different methods was significant (P<0.01). In rural women and female students fat mass by skinfold measurements was respectively 2.5±2.9 kg (P<0.01) and 2.2±2.3 kg (P<0.01) lower than by BIA. In male students the difference between skinfold and BIA measurements was 0.8±2.6 kg. Disagreement between methods increased with larger fat mass. In some individuals differences between assessed values were substantial. It is concluded that, especially under field conditions, results obtained by different methods are not interchangeable.

## **Effect of iron supplementation on biochemical indices of iron status in selected pre-adolescent schoolgirls in North West Frontier Province, Pakistan**

Parvez I Paracha, SM Khan, I Ahmad and G Nawab  
*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 4: 177-181*

A study was carried out on eight to 11 year old schoolgirls to assess the prevalence of iron deficiency anaemia (IDA) and to study the impact of iron supplementation on the biochemical indices of iron status. The children were characterised iron deficient anaemic if their serum ferritin levels (SF) were ≤ 12 ng/ml and haemoglobin (Hb) < 12 g/dl or haematocrit (Hct) ≤ 35%. In a double blind trial, the anaemic and non-anaemic children were randomly selected for the treatment and control groups. All the groups received multivitamin tablets daily, the treatment group received an additional 76 mg elemental iron per day for 11 weeks. The prevalence of IDA in these children was found to be 35%. The supplementation caused a significantly (P<0.05) greater change in SF (20 ng/ml); Hb (1.5 g/dl) and Hct (3%) of the anaemic treatment group compared to the corresponding control group. The non-anaemic treatment group also showed a significantly greater change in SF (9 ng/ml); Hb (0.78 g/dl) and Hct (1.3%) than that of the control group. An increase in biochemical indices of the non-anaemic treatment indicates that this group's initial iron status was only marginally adequate.

## **Requirements of calcium: are there ethnic differences?\***

Warren Tak-keung Lee

Calcium is an essential dietary element to maintain the integrity of the skeleton. A higher peak adult bone mass has been shown to reduce the risk of osteoporotic fractures later in life. It is postulated that a lifelong higher calcium intake would reduce bone loss in advancing age. Available scientific evidence seems to indicate that within any ethnic group, calcium intake is positively associated with bone mass. Controlled calcium supplementation trials in both low and high dietary calcium intake children and adolescents showed that there is an association between calcium intake and gains in bone mass. Furthermore, studies in adolescents showed that genetic inheritance and skeletal responses to hormonal changes at puberty have great influences on bone mass increments in addition to calcium intake. Interestingly, across-cultural comparisons are not convincing enough to demonstrate that lower calcium intake would predispose to higher risk of osteoporosis. It implies that the genetic inheritance and complex environmental factors may be important modulators on bone mass achievement in addition to calcium intake within any ethnic group. There are pitfalls in the current Recommended Dietary Allowances (RDAs) for calcium which are usually based on clinical studies conducted in Caucasians with higher calcium intakes and the extent of nutritional adaptation to low calcium intake is ignored. Given the fact that there are ethnic differences in calcium absorption, dietary habits, bone metabolism, physical activity and skeletal size as well as body build, the requirements of calcium in Asians may be different from Caucasians. Ideally, each nation should establish its own RDA based on the ethnic make-up of its population. In Asian countries, the major sources of calcium are derived from vegetable types of foods, fish and shell fish with edible bones, fins and shells, etc. Recent absorption studies in humans with low-oxalate and low-phytate vegetables and pulses also showed that contrary to common presuppositions, these vegetables with low calcium chelators do have a comparable calcium absorbability to milk. Studies on bioavailability of calcium from Asian foods and diets are warranted in order to identify rich sources of calcium.

## **Preferred meal patterns in non-insulin-dependent diabetes**

Mark L Wahlqvist, Richard W Simpson, Che Sam Lo and Pauline Cooper

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Number 4: 191-194*

Current advice on the across-the-day distribution of energy and carbohydrate intakes in non-insulin-dependent diabetes (NIDD) is based on inadequate evidence. We have addressed this by a comparison of an even as opposed to a main evening meal pattern in 11 subjects with NIDD. Contributions of macronutrients to energy intake were fat 29%, protein 20% and carbohydrate 51% with each meal pattern. The peak glycaemic response in the morning was not as good as the response in the evening ( $P < 0.01$ ), where an even energy and carbohydrate spread was used; this contrasts with previous reports in healthy subjects where the morning response to glucose is better than that later in the day. This difference between peak morning and peak evening glycaemic response was not seen with a main evening meal. There was a lower overall glycaemic response with a main evening meal compared with an even meal pattern ( $P < 0.01$ , by

area comparison). The overall insulin response was not significantly different between the two meal patterns, although the sensitivity for insulin appeared better in the evening where there was an evening main meal.

## **Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Supplement 1**

### **Cellular functions of ascorbic acid: a means to determine vitamin C requirements**

Mark Levine, Kuldeep R Dhariwal, Philip W Washko, Richard W Welch, and Yaohui Wang  
*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Supplement 1*

Optimal ascorbic acid (vitamin C) requirements in humans are unknown. In situ kinetics is a biochemical approach to determine requirements for vitamin C and other vitamins. In situ kinetics requires that cellular functions of ascorbic acid are characterised. Vitamin-C-dependent cellular reactions are directly related to vitamin C concentrations inside and outside cells. By coupling intracellular and extracellular functions of ascorbic acid to vitamin concentration, in situ kinetics provides a novel approach to determining vitamin C requirements.

### **Natural antioxidants and atherosclerosis**

Roland Stocker

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Supplement 1: 15-20*

The precursors of fibrous atherosclerotic plaques are fatty streaks, characterized by accumulation of fat-laden macrophages beneath an intact endothelium. These macrophages are derived from monocytes in the circulating blood and the lipid is derived from plasma low density lipoprotein (LDL). But LDL is poorly taken up by monocytes/macrophages in vitro unless it has been oxidatively modified. Hence the hypothesis has developed that one determinant of atherosclerosis is whether LDL becomes oxidized by free radicals in the subendothelial space. An epidemiological study of 12 European sub-populations which all have about the same plasma cholesterol concentration but quite different incidences of coronary heart disease (CHD) showed a significant inverse correlation of plasma  $\alpha$ -tocopherol with CHD. In several animal models, vitamin E or some other antioxidants attenuate experimental atherosclerosis. Each particle of LDL contains about 8-12 molecules of tocopherol, 0.5 to 1 molecule of ubiquinol-10 and small amounts of carotenoids but other antioxidants in the extracellular fluid, notably (water-soluble) ascorbate protect against oxidative damage in *in vitro* experiments with human blood plasma. The ascorbate presumably acts by regeneration  $\alpha$ -tocopherol from its one-electron oxidation

product, the  $\alpha$ -tocopheroxyl radical. The author found that the small amounts of ubiquinol present in LDL offer important protection against oxidation. Unlike vitamins C and E, ubiquinol is biosynthesized by humans but it is also obtained from the diet (some fatty fish are the richest sources). The ubiquinol content of plasma LDL was increased 4-fold by giving volunteers ubiquinone. Their plasma LDL was subsequently found more resistant against oxidation.

## **Vitamins A, C, E and $\beta$ -carotene as protective factors for some cancers**

Ivor E. Dreosti

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Supplement 1: 21-25*

The importance of the antioxidant micronutrients vitamins A, C, E and  $\beta$ -carotene in cancer prevention is currently a widely debated human health issue. Generally supported by laboratory findings, and persuasively linked to the lower cancer risk associated with high intakes of fruit and vegetables, the hypothesis is now being tested in many prospective studies around the world. Increasingly, oxidative damage has been implicated in the etiology of several degenerative diseases including cancer, thus highlighting the need to ensure replete antioxidant nutrition as a central measure in preventive medicine.

## **The epidemiology of dietary antioxidants and atherosclerotic disease**

J Michael Gaziano and Charles H Hennekens

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Supplement 1: 27-31*

Recent evidence suggests that oxidative damage, particularly to low density lipoprotein, may be involved in the development and progression of atherosclerosis. Dietary antioxidants such as alpha tocopherol, ascorbic acid, and carotenoids represent one possible defence against oxidative stress, raising the possibility that these agents may prevent or delay the development of atherosclerotic disease. A growing body of observational data suggests an inverse association between dietary intake or plasma levels of dietary antioxidants and cardiovascular disease. In addition, limited randomized trial data further suggest these agents may reduce the risk of subsequent cardiovascular events. While epidemiologic evidence supports the possibility that dietary antioxidants may play a role in the prevention of atherosclerosis, these agents represent a promising but unproven means of reducing the risk of cardiovascular disease.

## **Regional differences in coronary heart disease in Britain: do antioxidant nutrients provide the key?**

AJ Brown

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Supplement 1: 33-36*

In Britain, there are large regional differences in mortality rates from coronary heart disease which can not be explained by established risk factors such as elevated levels of blood cholesterol or high blood pressure. These regional differences can to a large extent be explained by a cluster of inter-related factors: a poor diet lacking in fresh fruit and vegetables, cigarette smoking, and low socio-economic status. All of these factors are associated with a low dietary intake and hence a low blood concentration of antioxidant nutrients. Increased oxidative stress resulting from a low antioxidant status may therefore be the common mechanism by which these factors operate.

## **Vitamin E and athletic performance**

Richard D Telford

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Supplement 1: 37-42*

Vitamin E has been of interest to sports people for many years, with reports of its dietary supplementation in the 1950s. In the last decade there has been a resurgence in the interest in the relationship between vitamin E and athletic performance and animal studies have demonstrated that endurance is reduced in vitamin E deficiency. Much of the recent research has centred around the antioxidant properties of vitamin E and it seems that these properties are in part responsible for the improvement of aerobic power of humans at medium to high altitude venues following supplementation of the vitamin. However, there have been no similar reports relating to sea-level performance. On the other hand, one recent study has indicated that supplementation of vitamin E to athletes consuming the recommended daily intake (RDI) elicited a reduction in indicators of muscle damage following an exercise bout. Furthermore, vitamin E is implicated in maintenance of both optimal immune function and optimal blood viscosity, both factors being important in athletes' ability to train and compete, but it remains to be seen whether supplementation over the RDI has any beneficial effects. So, there seems little doubt that vitamin E deficiency will impair athletic performance and there is also some evidence that supplementation of vitamin E on top of the RDI may provide some advantage for the intensely training athlete, especially those training at altitude.

## **Folate and neural tube defects**

Barbara Field

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Supplement 1: 43-45*

The multifactorial aetiology of neural tube defects has stimulated many theories related to dietary factors in pregnancy. The results of the Medical Research Council Study confirm that folate has a protective effect if taken in the 3 months prior to conception and for the first trimester. The dosage recommended is 5mg daily for women at risk for recurrence of spina bifida or anencephaly and 0.5mg daily for those at low risk. Dietary modification to include foods with high folate such as leafy green vegetables and wholemeal grain is not considered sufficient.

Fortification of staple food items such as bread and cereals with folate is being considered in some countries. A comprehensive health education programme is essential, directed to women in the reproductive age group and to doctors involved in primary care, family planning and obstetric management. The incidence of neural tube defects could be reduced by 70% with the introduction of folate supplementation in all pregnancies.

## **Nutrients and degenerative eye diseases**

AS Truswell and Paul Mitchell

*Asia Pacific Journal of Clinical Nutrition (1993) Volume 2, Supplement 1: 47-50*

Cataract (opacity of the lens) and age-related degeneration of the macula of the retina are very common causes of disability in old age, and people are living longer. It seems likely that both of these conditions result from gradual photo-oxidative damage. The proteins in cataractous lenses are oxidized and 50 per cent of the fatty acids in membranes of retinal photo-receptors are highly polyunsaturated. The eye normally has unusually high concentrations of vitamin C and zinc which could have protective functions against free radical damage. For cataracts five reported case-control studies are reviewed and two prospective studies one of which included a very large number of subjects. Vitamin intakes were estimated from dietary histories or blood levels. In five of the six studies in which vitamin C was measured it appeared to be protective and vitamin E and carotenoids appeared protective in 5/7 studies. Other descriptive epidemiological studies are going on, including one in the Blue Mountains near Sydney. It is concluded that controlled trials of antioxidant nutrients for cataract prevention are now warranted. As to age-related muscular degeneration (ARMD), severe vitamin E deficiency is known to cause (a different type of) retinal degeneration spontaneously in humans (with cystic fibrosis or abetalipoproteinaemia) and experimentally in animals. Only three human case-control studies of ARMD and diet have been reported thus far and no clear relationship with any particular nutrient has emerged yet. Supplements containing antioxidant vitamins and zinc are being advertised and used in the USA and elsewhere but this is ahead of the evidence. More observational studies are needed and the US National Eye Institute is planning a 10 year intervention study, known as AREDS (Age-Related Eye Disease Study).

# **Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 1**

REVIEW ARTICLE

## **Intestinal failure - its nature, pathophysiology and treatment**

Akira Okada, Yoji Takagi, Masahiro Fukuzawa and Riichiro Nezu

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 1: 3-8*

The existence of 'intestinal failure' was proposed. This pathologic condition may occur in two distinct forms, ie short bowel syndrome marked by a gross reduction in functioning gut mass and impaired intestinal function (impairment of motility and extensive parenchymatous disorders). This has been newly recognized as a complex independent entity on account of an increasing number of patients that now survive thanks to the recent progress in nutritional management, especially total parenteral nutrition (TPN). In view of many unresolved clinical questions regarding long-term TPN and loss of gut mass, it is hoped that future research efforts will be directed towards settlement of these issues and how to surmount difficulties in bowel transplantation.

## **The relationship between high maternal aluminum ingestion and anemia-related hematologic changes in rats**

Guoo-Shyng Wang Hsu and Ching-Yueh Hsu

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 1: 9-13*

Microcytic, hypochromic anemia in dialysis patients has been associated with aluminum toxicity. Since pregnant women and infants are high-risk groups for iron-deficiency anemia, the purpose of this study was to investigate if high maternal aluminum intake could cause anemia in dams and pups of rats. Eighteen Sprague-Dawley (SD) female weanling rats were arranged in three groups under randomized completely block design (RCBD) experiment design. Control, Low-AI and High-AI groups had 0, 5(X), 2(X)0 mg Al/kg diet added in the basal diet, respectively, through growing, pregnancy and lactation. Rats were sacrificed after weanling. Results indicated that either body weight gain or feed efficiency was the lowest in High-AI groups dams ( $P < 0.05$ ). The body weights were the same in neonates from mothers with various aluminum intakes. However, the higher the maternal aluminum intakes, the lower the average body weight of weanling pups ( $P < 0.05$ ). There was a positive correlation between Al intake and serum Al concentration, Al intake and milk Al content of dams ( $r = 0.93$  and  $r = 0.89$ , respectively;  $P < 0.05$ ). Average milk and serum aluminum concentrations of dams with high aluminum intake were higher than those in the Control and Low-AI groups. Nevertheless, serum aluminum concentration in pups was not different among the three groups. There was no difference in hematocrit (Hct), hemoglobin (Hb), mean corpuscular hemoglobin concentration (MCHC), total iron binding capacity, or transferrin saturation among dams. On the other hand, the pups in the High-AI group had the highest Hct and Hb per unit body weight compared with the other groups, probably due to smaller litter size.

## **Monthly and seasonal variation in plasma lipids in healthy Australian men: a longitudinal study in Melbourne**

Mark L Wahlqvist and Nicholas DH Balazs

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 1: 15-18*

A prospective study of seasonal variability of lipids in 36 healthy men, aged 40-45 years, over 14 months in Melbourne showed significant monthly and seasonal variation by paired t-test. Measurement of cholesterol and triglycerides was carried out by standard, automated enzymic assays calibrated with CDC certified materials. High Density Lipoprotein Cholesterol (HDLC) was measured after Polyethylene Glycol 6000 precipitation of Apo B containing lipoproteins. Intra-individual variation ranged widely; Cholesterol: mean Coefficient of Variation (CV) 6.9%, range 4.1 to 14.0, HDLC: mean CV 9.1%, range 5.3 to 15.6 Low Density Lipoprotein Cholesterol (LDLC): mean CV 10.2%, range 5.2 to 18.4. The seasonal effect showed the most favourable lipid/ lipoprotein profile, ie lowest total and LDLC, highest HDLC to occur in the antipodean summer (Nov/Dec) and the least favourable profile in winter (Jul/Aug), with highest (total) Cholesterol and lowest HDLC. This is best observed as the LDLC/HDLC ratio which peaks in July (3.6), with the trough in December (2.7). This pattern is consistent with seasonal effects described previously in the northern hemisphere, except that the months are reversed. Weight did not alter significantly during the period of the study. Seasonal and individual variation in lipids and lipoproteins should be taken into account in the clinical management of lipid disorders.

## **Development of the Melbourne FFQ: a food frequency questionnaire for use in an Australian prospective study involving an ethnically diverse cohort**

Paul Ireland, Damien Jolley, Graham Giles, Kerin O'Dea, John Powles, Ingrid Rutishauser, Mark L Wahlqvist and Joanne Williams

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 1: 19-31*

**Objective.** To develop an optically scannable food frequency questionnaire (FFQ), 'The Melbourne FFQ', suitable for classifying Australian-, Greek- and Italian-born individuals into quantiles of intake for a range of foods and nutrients. The FFQ would provide the primary measure of dietary exposure in a prospective cohort study.

**Design.** The FFQ was modelled on that used for the (US) Nurses' Health Study. Food items were chosen on the basis of their relative contribution to the intake of a range of nutrients computed from weighed food records.

**Setting.** Metropolitan Melbourne, Australia; a city of 3 million people, of whom 75.5% were born in Australia, 2.7% were born in Italy and 1.7% were born in Greece.

**Participants.** *Weighed Food Survey (1987-1989):* A volunteer sample of 810 healthy middle-aged (40-69 years) men and women of whom 35% were born in Greece, 33% were born in Italy, and 32% were born in Australia. *Melbourne Collaborative Cohort Study (1990-1993):* A volunteer sample of 17 949 healthy men and women aged between 40 and 69 years of whom 61% were born in Australia, 21% were born in Italy and 17% were born in Greece.

**Results.** A 121 item FFQ was developed, together with a customized nutrient database. The optical scanning format was generally well received with the majority of subjects requiring no assistance. The FFQ appeared to overestimate the consumption of fruit and vegetables.

**Conclusions.** The Melbourne FFQ provides a convenient method of measuring habitual dietary intake in a large population setting. A separate study is required to assess how well the instrument characterizes diet at the level of the individual.

## **Body composition in the pathogenesis and management of diabetes: a Malaysian perspective**

Ali Osman and BAK Khalid

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 1: 33-39*

There is an increasing prevalence of diabetes mellitus around the world associated with rapid sociocultural development and changing lifestyles. Increased prevalence of obesity, with a higher consumption of animal products and lower consumption of fruits and vegetables, increases the risk of diabetes mellitus and other chronic degenerative diseases. Insulin-dependent diabetes (IDD) is caused by insulin deficiency, whereas the main feature of non-insulin-dependent diabetes (NIDD) which accounts for more than 90% of diabetics, is hyperinsulinemia and insulin resistance, which may eventually lead to actual insulin deficiency. Hyperinsulinemia is undesirable because it increases the risk of developing vascular disease. In Malaysia, the prevalence of NIDD in some communities now exceeds 5%, and of impaired glucose tolerance 10%. Along with these increases in prevalence of hyperglycemia are increases in prevalence of overweight (BMI>25) and almost certainly abdominal fatness. In terms of management, nutrition is given priority. Insulin and hypoglycemic drugs (sulphonylureas or biguanides), where required, may adversely affect body composition if overused. Newer therapeutic strategies require greater attention to the underlying problem in NIDD of abdominal fatness by attention to the relevant nutritional factors, physical activity and other lifestyle factors like cigarette smoking and alcohol. The greater impact of obesity and diabetes on Malaysian women as opposed to men also needs to be addressed.

## **Intake and food sources of ascorbic acid in China**

Donald D Hensrud, Douglas C Heimbürger, Junshi Chen, Ming Li and Gonghao Wang

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 1: 41-44*

Investigating differences in the intake of nutrients is of potential importance in characterizing diet-disease relationships and determining the level of intake necessary for optimal health. The intake and food sources of ascorbic acids were examined in an ecologic study of 64 rural counties in the People's Republic of China and compared with data reported for the United States. The mean ( $\pm$ SEM) and median individual intakes of ascorbic acid for all counties combined were 140 ( $\pm$ 88) and 128 mg/day, respectively (range 6-429 mg/day). This compares to a mean intake of 99 mg/day for adult men and 84 mg/day for adult women in the United States. The foods that contributed the most to ascorbic acid intake were sweet potatoes (37.2%), cabbages (23.9%), leafy green vegetables (10.6%), radishes (8.8%), and hot peppers (6.5%). In

contrast to the US, where fruits supply 43% of ascorbic acid to the diet, fruits contributed a relatively small amount to overall ascorbic acid intake in rural China (1%). The wide range of ascorbic acid intake among counties resulted, in part, from differences in the availability of fresh produce which is grown and consumed locally. Despite this, the mean intake was still greater than the US because of the large contribution of plant products (approximately 90%), especially tubers and other vegetables, to the diet.

## **Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 2**

### **The nutritional status of pre-school children in poor rural areas of China**

Chang Ying, Zhai Fengying, Li Wenjun, Ge Keyou, Jin Daxun and Mercedes de Onis  
*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 2: 55-60*

Described are the main findings of the first large-scale nutrition monitoring project carried out over a 4-year period in China. The nutritional status of nearly 10 000 preschool children in 18 comparatively poor rural areas in seven provinces was followed each year over the period 1985-89 in order to identify their major nutritional problems and improve their growth and development. Physical measurements were made and dietary surveys and biochemical tests were performed on a subsample of the children. The proportion of stunted and underweight children was far higher than the national average. Based on the possibilities offered by local circumstances, the prevalences of stunting and underweight were lowered and anemia greatly reduced. Along with the progress in nutrition monitoring, major efforts were made to train health workers, as well as to encourage increased production of green vegetables, poultry, and small livestock. The wealth of information collected and the experience gained may serve as a baseline record, the project currently being expanded to cover 100 counties throughout China.

### **Secular trend of growth in pre-school children in Singapore**

Mabel A Yap, Kwok Chan Lun, Kenneth R Lyen and Sian Lian Lam  
*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 2: 61-64*

An anthropometric study was conducted on more than 13 500 children aged 0-6 years in 1988. Percentile charts were plotted for height for age, weight for age, weight for height and head circumference for age. When compared to an earlier study done in 1972, it was found that Singapore pre-school children had increased in height by 4.4%; weight by 10.9 %; and head circumference by 4.1%. When the median height for age, weight for age and head circumference

for age were plotted against those of the NCHS charts (1978), Singapore's pre-school children were generally shorter, lighter and had smaller head circumferences than their American counterparts of the same age. But, the median weight-for-height for each age group was comparable to the Americans. The results indicate the secular trend of growth in Singapore children and a trend towards reaching their full genetic potential for growth.

## **Factors associated with obesity in primary-school children in Singapore**

Mabel A Yap and Wei Ling Tan

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 2: 65-68*

An upward trend in obesity has been observed in Singapore school children over the 15 years prior to the study. A case-control study of 400 children (mean age 10 years) and their parents was conducted to determine some of the factors likely to be associated with obesity in primary-school children. It included dietary practices and intake, activity patterns, family history and social factors. It was found that obese children were more likely to consume foods that were deep-fried or sweet and were more likely to have at least one obese parent and sibling. A variety of intervention measures were taken to reduce the prevalence and severity of obesity in school children following the study.

## **Adiposity, dietary and physical activity patterns in ethnic Chinese youths: a cross-country comparison of Singaporean Chinese and Chinese Americans**

MC Wang, TF Ho, G Block, M Lee, J Anderson and ZI Sabry

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 2: 69-82*

During the last decade, childhood obesity has been on the increase in Singapore and many newly industrialized Asian countries. We compared the mean body mass index (BMI) and triceps skinfold (TSF) values, as well as the dietary and physical activity patterns of Singaporean Chinese and Chinese American youths. Chinese Americans had a higher mean BMI but a lower mean TSF than Singaporean Chinese. Dietary comparisons suggest that Singaporean Chinese ate fish and grain products more often than Chinese American youths, while Chinese American youths consumed processed meats, dairy products and snack foods more frequently. Mean frequency of consumption of low fat, traditional Chinese foods such as rich porridge was higher among the Singaporean Chinese, while typical 'American' foods including cheese were consumed more often among the Chinese Americans. Certain food items that were more 'neutral' in terms of their cultural identity, such as carbonated drinks, cookies and bread were consumed with the same mean frequencies in both cohorts. In terms of physical activity, Singaporean Chinese youths, on average, spent more time in sedentary activities, less time

sitting, and more time in light or moderate activities. The mean time spent on vigorous activities per day was only one hour in both cohorts. Our study suggests differences in body fat distribution and composition, as well as in dietary and activity patterns, between Chinese American and Singaporean Chinese youths. There is a need to develop obesity indicators that are appropriate for the specific populations involved, and to carefully investigate environmental influences on childhood obesity.

## **The current dietary practice of Hong Kong adolescents**

Warren TK Lee, Sophie SF Leung, and Dora MY Leung

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 2: 83-87*

In Hong Kong, blood lipid profiles of adults and children are comparable to the western industrialized nations. The age on-set of ischemic heart disease in Hong Kong is gradually declining to occur in younger adults. Dietary practices of adolescents influence food habits later in life. However, published data on current dietary intakes of Hong Kong adolescents are scanty. This paper reports a dietary survey of current food habits in 179 12-year-old adolescents using a food frequency questionnaire. The mean  $\pm$  SD intake of energy, protein, fat, carbohydrate, cholesterol, calcium, iron, vitamin C and fibre were  $2164 \pm 766$  kcal,  $107 \pm 44$ g,  $71 \pm 33$ g,  $274 \pm 91$ g,  $481 \pm 246$ mg,  $643 \pm 252$ mg,  $16 \pm 6$ mg,  $78 \pm 41$ mg and  $3.5 \pm 2$ g, respectively. The percentages of energy derived from protein, fat, carbohydrate, polyunsaturated fats, monounsaturated fats and saturated fats were 19.7%, 28.8%, 51.5%, 4.4%, 11.5% & 10.4%, respectively, whereas the P/S ratio was 0.43. Protein intake was 2.5 times higher than the FAO/WHO/UNU RDAs, animal protein was the predominant source of protein; meat was the principal source of fat intake (45%), over 61 % of the individuals had saturated fat intake greater than 10% (% energy); mean cholesterol intake was 481 mg/d and 79% of the individuals had cholesterol intake above 300 mg/d. Low fibre intake was related to low intake of unrefined grains, vegetables and fruits. A high intake of animal products, cholesterol, a low P/S ratio and low consumption of unrefined grains, vegetables and fruits might be detrimental to a healthy heart. The increasing frequency of eating out at restaurants and fast-food outlets and relatively fewer meals being prepared and eaten at home is a growing concern for maintaining a healthy diet. Immediate action has to be taken to evaluate the current dietary practices of the population to establish appropriate healthy eating policy and guidelines in order to prevent the future risks of developing diet-related chronic diseases.

## **The difference in food and nutrient intake between smokers and non-smokers in an elderly Chinese population in Beijing, China**

Yanfang Wang and the late Daphne A Roe

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 2: 89-92*

This study examined variations in dietary intake, which were associated with differences in

education, lifestyle and health behaviours of elderly men and women (n=305) in Beijing. Twenty-four-hour dietary recalls were obtained through in-home interview. Nutrient analyses of the reported diets were carried out using the Chinese nutrient data base. It was found that more men than women smoked and that alcohol consumption was associated with smoking. Smokers had a lower intake of vitamin C ( $P<0.01$ ), carotenoids ( $P<0.05$ ) and calcium ( $P<0.05$ ) than non-smokers in both genders. Female smokers also showed a lower intake of fruits, vegetables and milk compared with female non-smokers.

## **Ethnic characteristics of coronary heart disease risk factors and mortality in peninsular Malaysia**

Geok Lin Khor

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 2: 93-98*

The types and prevalence of coronary heart disease (CHD) risk factors vary somewhat among the three main ethnic groups in peninsular Malaysia. Indians consistently show the highest prevalence for hypercholesterolemia and diabetes mellitus. Among the Malays, a relatively high prevalence of hypertension and hypertriglyceridemia have been reported. Overweight is also a risk factor among the Indians and Malays. In general, Chinese tend to have a lower prevalence for these CHD risk factors than the Indians and Malays. Parallel to the rapid socio-economic development and urbanization in recent decades is a rise in the percentage of deaths due to cardiovascular disease in peninsular Malaysia, that is from 1.8% of total deaths from all causes in 1950 to about 30% in 1991. Coronary heart disease accounts for 40% of all cardiovascular diseases. The mortality rate for CHD has more than doubled between 1965 and 1991, from 24.6 per 100 000 to 57.2. While Indians have been showing the highest CHD mortality rate so far, that of the Malays has been increasing most rapidly since 1970, concomitant with the latter's increase in their proportion of the urban population in peninsular Malaysia.

## **Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 3**

### **Diet and cancer among Chinese in Singapore**

HP Lee

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 3: 99-102*

Cancer statistics provided by the Singapore Cancer Registry and a series of diet-related studies carried out in Singapore since 1985 are reviewed. Incidence rates for cancers in various Chinese populations are compared. In terms of Singaporean diet a possible protective effect of soyabean

products against female breast cancer is highlighted.

## **Assessing food and health relationships: a case study of blood pressure determination in adult Melbourne Chinese**

Bridget H-H Hsu-Hage and Mark L Wahlqvist

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 3: 103-110*

An effective public health approach to cardiovascular disease prevention should be one which gives the general public alternatives in choice when fat, salt and sugar are reduced in the diet. Fat, salt and sugar are nutrients which can be found in various foods. Public health educators convert these nutrients into food so that the general public can engage in daily food choice. The usual nutrient-to-food conversion is indirect and can be misleading. For example, we are still unclear as to the potential benefit of polyunsaturated margarine over butter or olive oil. In a base-line data analysis of Chinese adults in Melbourne, we related food intake in addition to nutrients to major cardiovascular risk factors. In all models, food intake accounted for a higher variation of major cardiovascular risk factors than did nutrient intake. Melbourne Chinese, who consumed a wide variety of food and ate more fish, vegetables, and fruits, had a better cardiovascular risk profile. The findings are of importance in public health significance. Longitudinal documentation of changing food intake, in addition to nutrients, and associated change in cardiovascular risk factor in this population are needed at this stage followed by further work to confirm its generalizability to Australians at large. This report focuses on findings of blood pressure determination in 547 adult Melbourne Chinese and reviews the way in which food and health relationship may be studied.

## **Dietary transition in China and its health consequences**

Junshi Chen

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 3: 111-114*

The pattern of food consumption in China has been subject to significant changes during the last 30-40 years, although the average dietary pattern is still based on plant foods. These changes have been characterized by increased consumption of animal products and decreased consumption of cereal products. These trends are supported by both national food disappearance records and by household survey data on the intake of specific foods. Changes in urban areas have been much more substantial than in rural areas. Preliminary findings show that the dietary transition is associated with a simultaneous decrease in the prevalence of acute communicable diseases and an increase in the prevalence of the major chronic degenerative diseases, such as cancers and cardiovascular diseases.

## **The relationship between dietary factors and serum lipids in**

## **southern Chinese population samples**

Xiaoqing Liu, Zhendong Huang, Yihe Li, Xuxu Rao, Runchao Cen, Qiling Zhuo, Gemin Ni, Peifang Chen, Barbara H Dennis and Jeremiah Stamler

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 3: 115-118*

As part of the PRC-USA collaborative research project on the epidemiology of cardiovascular disease, baseline surveys were conducted in four random urban and rural samples in Guangzhou, Guangdong Province in southern China on 334 men and women aged 35-54 in the fall of 1983-84 with the aim of studying the correlation between dietary intakes and serum lipids. Methods standardized by the US Centers for Disease Control were used for measuring different parameters, and quality control was emphasized to assure comparability between workers and farmers. Three 24-hour recalls were collected from each participant in each survey. Mean values of daily intakes of nutrients per capita for the four groups were as follows: 59-69% kcal carbohydrate; 10-12% kcal protein; 22-26% kcal fat. Dietary total fat, saturated fatty acid (SFA), polyunsaturated fatty acid (PUFA) and cholesterol were higher in the urban than the rural areas. Mean levels of serum total cholesterol (TC), triglycerides (TG), high density lipoprotein cholesterol (HDL-C) and low density lipoprotein cholesterol (LDL-C) were 4.6 mmol/l, 1.1 mmol/l, 1.3 mmol/l and 2.8 mmol/l respectively. The TC, TG and LDL-C and HDL-C were significantly higher in the urban than the rural areas. Analyses of correlation showed that the Keys 'dietary lipid score' was positively associated with TC, LDL-C and HDL-C; specifically, dietary cholesterol was positively associated with serum TC. Saturated fatty acids (SFA) and monounsaturated fatty acids (MUFA) were positively correlated with HDL-C. It seems that the traditional dietary pattern of Guangzhou favours serum lipids being at an optimal level

## **Cross-cultural comparisons between Taipei Chinese and Framingham Americans: dietary intakes, blood lipids and apolipoproteins**

Li-Ching Lyu, Barbara M Posner, Ming-Jer Shieh, Alice H Lichtenstein, L Adrienne Cupples, Johanna T Dwyer, Peter WF Wilson and Ernst J Schaefer

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 3: 119-125*

Dietary intake (24-hour recall), total cholesterol (TC), triglyceride (TG), low density lipoprotein cholesterol (LDL C), high density lipoprotein cholesterol (HDL-C), apolipoprotein (apo) A-1 and apo B were assessed in healthy middle-aged subjects in Taipei, and in sex-age-menopause matched subjects in the Framingham Heart Study. Taipei subjects consumed a diet consisting of 16%, 48%, 35% and 1% of calories from protein, carbohydrate, fat, and alcohol, vs 17%, 40%, 39%, and 4% in Framingham subjects, respectively. The saturated, monounsaturated, and polyunsaturated fatty acid content of the diet was estimated to be 9%, 13%, and 13% of total calories in Taipei subjects and 16% 15% and 8% in Framingham subjects, respectively. The differences between Taipei and Framingham subjects were quite substantial for lipid parameters but less so for apolipoprotein levels. Gender differences for TG, HDL-C, apo A-1, and apo B

were more profound than differences due to nationality. Taipei male and female subjects had significantly lower TC, LDL-C, and significantly higher HDL-C concentrations than Framingham male and female subjects. After adjusting for body mass index (BMI), TC and LDL-C levels remained significantly different for both sexes between populations, probably attributable to differences in saturated fat intake. This study documents that urban workers in Taipei consumed a diet with a relatively high polyunsaturated and low saturated content and had more favorable lipid profiles than Framingham Americans.

## **Serum cholesterol and dietary fat of two populations of southern Chinese**

Sophie SF Leung, MY Ng, BY Tan, Christopher WK Lam, SF Wang, YC Xu and WP Tsang  
*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 3: 127-130*

Children in Hong Kong (HK) are the second generation of Chinese migrants from Guangdong Province and are leading a more affluent lifestyle than those in Jiangmen (JM). The association between affluence and coronary risk was investigated by comparing the serum cholesterol and dietary fat intake of children in HK and JM. Fasting serum cholesterol was examined in 94 HK children and 99 JM children, all aged seven, using the same enzymatic method by the same observer. Duplicate meals were collected in two subsamples of 20 children, one each from HK and JM and analysed for their total fat intake and fatty acid profile, again by the same observer using gravimetric methodology and gas chromatography. The mean (SD) cholesterol of HK children was 4.59 (0.83) mmol/l significantly higher than that of JM, 4.16 (0.61) mmol/l. The daily fat intake by the HK children was 48 g 37% higher than that of JM at 35 g. P/S ratio was 0.6 in HK and 0.8 in JM. C18-2/C14-0, the cholesterol-lowering ratio was mostly below 10 in HK whereas that of JM was between 10 and 40. Therefore, in order to lower the total serum cholesterol of Hong Kong children dietary intervention to lessen total fat in particular milk and animal fat while moderately increasing fat consumption from vegetable sources would seem to be appropriate.

## **Dietary protein, amino acids and their relation to health**

Zhao Xi-he

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 3: 131-134*

Against a background of economic and dietary change in China since the 1980s some Chinese scientists have advocated an increase in the production of animal food products and therefore (from a low baseline) of animal protein intake. The 1990 Chinese total diet study allowed the role of individual amino acids in the diet to be considered. Taurine, present in seafood, is singled out for its possibly antihypertensive effect.

## **Body mass index of Chinese adults in the 1980s**

Keyou Ge, Robert Weisell, Xuguang Guo, Lie Cheng, Haijiang Ma, Fengying Zhai and Barry M Popkin

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 3: 135-139*

Patterns and trends in the body composition of Chinese adults were studied using data from the 1982 China Nationwide Nutrition Survey (CNS-82) and the 1989 China Health and Nutrition Survey (CHNS-89)). The CNS-82 showed rural inhabitants were about 3 kg lighter than urban residents and about 2.2 cm shorter. Males were heavier ( $55.2 \pm 7.4$  vs  $50.7 \pm 8.0$ ) and taller ( $165.3 \pm 7.3$  and  $153.5 \pm 6.3$ ). Using a cut-off for underweight of a body mass index  $<18.5$  and for obesity of  $>25$ , 11.6% and 12.9% of the urban and rural sample were underweight and 9.8% and 6.9% respectively, were overweight. The CHNS-89 surveyed 5138 adults aged 20-45 in eight selected provinces. The proportion of underweight in both urban and rural samples declined slightly (about 1.3%) but the proportion of obesity increased considerably (4.8% for the urban sample and 2% for the rural one). Increased income was significantly associated with reduced low BMI in the urban sample, while in the rural and overall samples the opposite was found. Provincial patterns in energy intake were not associated with the distribution of BMI while occupation was. In particular, government officials and housewives were more likely to be obese as also were subpopulation groups consuming greater proportions of energy from animal sources. Over 80% of the population fell in the normal BMI range ( $18.5 < \text{BMI} < 25$ ). This may relate to the relatively even distribution of food in China during the past several decades.

## **Body composition of Chinese compared with data from North America**

Zhu-ming Jiang, Nai-fa Yang, Marc R Scheltinga and Douglas W Wilmore

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 3: 141-143*

A multiple tracer dilution method measuring total body water (TBW) and extra cellular water (ECW) was used to study body composition. Healthy Chinese were compared to a group of healthy Americans evaluated by similar dilutional methods. Compared to the American subjects, Chinese subjects were less heavy (body weight was  $62.1 \pm 2.0$  kg vs  $72.5 \pm 4.1$ ,  $P < 0.05$ ), leaner (body fat was  $19.6 \pm 1.8\%$  of body weight vs  $25.8 \pm 1.9$ ,  $P < 0.005$ ), wetter (total body water was  $58.9 \pm 1.3\%$  vs  $54.3 \pm 1.4$ ,  $P < 0.005$ ) and had a greater percentage of body cell mass ( $50.9 \pm 1.7\%$  vs  $44.2 \pm 1.4$ ,  $P < 0.001$ ). The multidilution method using deuterium oxide and sodium bromide to assess body composition is accurate but expensive and laborious. Therefore, equally precise but more economical bedside methods are needed for routine compositional analysis.

## **Dietary habits, physical activity and body size among Chinese in North America and China**

Marion M Lee

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 3: 145-148*

We examined the self-reported dietary nutrient intakes physical activity patterns and body mass index (BMI) of 2488 healthy Chinese men and women residing in North America (and Canada) and in the People's Republic of China. On average Chinese in China consumed more total energy (males 3024 kcal in China vs 2122 kcal in North America; females 2351 kcal in China vs 1745 kcal in North America) and carbohydrate but less fat (males 74.5 g in China vs 82.0 g in North America, females 56.0 g in China vs 68.8 g in North America) protein vitamin A, b-carotene and vitamin C than did Chinese in North America. Dietary fat provided 35% of total dietary energy for Chinese in North America and 22% for Chinese in China. Consumption of alcohol particularly wine and hard liquor was higher among Chinese in China than Chinese in North America. Chinese in China reported more kilocalories of energy expenditure per day especially in vigorous activity and walking than Chinese in North America. Chinese in China weighed less and were leaner than North American Chinese. These differences in nutrient intakes physical activity and body size of Chinese living in two different continents suggest possible explanations for observed differences in chronic disease rates in the two populations.

## **Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 4**

### **The glycaemic index of fermented and non-fermented legume-based snack food**

M Batra, S Sharma and V Seth

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 4: 151-154*

A study was conducted to estimate the glycaemic index (GI) of four isocaloric and equicarbohydrate variations of the snack food 'cheela' (a savoury pancake) made from powdered whole legumes *Phaseolus aureus* (green gram) and *Cicer arietinum* (Bengal gram) and their respective fermented batters. Fifteen healthy, normal weight females aged 18-23 years comprised the sample. Glucose was used as a reference food. The test meals were given within 4 weeks of reference food administration, with at least 2 days interval between the test meals. The meals and reference food were served at a fixed time in the morning, after a 12-h overnight fast. Blood glucose was estimated at 0, 30, 60 and 120 min after eating using an Ames glucometer II. The GI for the test meals ranged from 36% to 45%. The green gram cheela (unfermented) had the lowest GI ( $36 \pm 0.6\%$ ), peak blood sugar value ( $111.6 \pm 1.5 \text{ mg}\%$ ) and AUC ( $2319 \pm 72$ ) as compared to the other three products. There was no significant difference between the fermented and the corresponding unfermented preparations.

## **The prevalence of obesity and other coronary risk factors in a suburban Sri Lankan community**

DJS Fernando, SH Siribaddana, DR De Silva and SD Perera

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 4: 155-159*

Increasing numbers of developing nations experience a rising incidence of non-communicable diseases in parallel with economic development. Thus, developing countries such as Sri Lanka face the double burden of both communicable and non-communicable diseases. We therefore conducted a study to assess the prevalence of obesity, diabetes mellitus, impaired glucose tolerance (IGT), dyslipidaemias, hypertension, central (android) obesity, hypertension and smoking habits in a random sample of 633 (312 male) subjects selected from an electoral list with a target population of 2974 persons. The prevalence (age standardized to the world population of Segi 95% CI) was IGT 5.27 (3.74-7.78), diabetes 5.02 (3.59-6.53), hypertension 15.25 (11.67-18.8), hypercholesterolaemia 14.86 (11.09-18.61), hypertriglyceridaemia 8.46 (6.27-10.64), low HDL cholesterol 11.18 (8.35-13.99), obesity 9.89 (7.24-12.52) and android obesity 16.35 (12.47-20.24). We conclude that the high prevalence of coronary risk factors is an indication for initiating programmes for primary prevention of obesity, diabetes and coronary heart disease in Sri Lanka.

## **Immunomodulation of malnourished mice bearing Dalton's Lymphoma**

Debasis Ghoshal and Subha Manna

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 4: 161-167*

The immunomodulatory effect of a mouse-bone-marrow-derived cytokine (BIM), (mol wt < 10 kd), was studied in mice bearing Dalton's lymphoma. It was observed that this factor increased the life-span of mice malnourished with respect to vitamin B-complex and ascorbic acid and infected with Dalton's lymphoma, by  $40 \pm 4$  days when compared to malnourished lymphoma controls while in animals maintained on balanced diet (BDF) the increase in life-span was just over  $11 \pm 2$  days. In cultured bone marrow cells at different time intervals after introduction of lymphoma cells it was shown that introduction of lymphoma cells increased the secretion of BIM. While the lymphoma developed the secretion of BIM diminished much earlier in malnourished than in BDF mice. This observation further strengthens our previous findings that the BIM acted as an immunomodulator much more effectively in malnourished animals than in animals fed a balanced diet, where a feed-back inhibitory effect might be present.

## **Determinants of serum levels of retinol, b-carotene and a-tocopherol**

## **in men and women born in Australia, Greece and Italy**

Paul Ireland, Damien Jolley, Graham Giles, John Powles, Kerin O'Dea, John Hopper, Joanne Williams and Ingrid Rutishauser.

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 4: 169-177*

Serum retinol, b-carotene and a-tocopherol levels were measured in a volunteer sample of 764 Australian-, Greek- and Italian-born adult residents of Melbourne, Australia. There was no difference among the ethnic groups in mean levels of serum retinol or a-tocopherol. Mean b-carotene levels were between 11 and 22% higher for Australian-born subjects. Serum b-carotene was higher in females, retinol was higher in males. The serum levels of retinol, b-carotene and a-tocopherol were significantly positively associated with serum cholesterol. Serum triglyceride was positively associated with serum retinol and a-tocopherol but negatively associated with serum b-carotene. A positive association with retinol and an inverse association with b-carotene was found for alcohol consumption. Serum a-tocopherol was positively associated with dietary vitamin E. Serum b-carotene was correlated with carotene intake among subjects who had never smoked. Serum retinol increased with age in women only. These data provide a degree of cross-cultural robustness to previous findings in regard to the determinants of serum retinol, b-carotene and a-tocopherol in healthy men and women.

## **Anthropometric and clinical nutrition status of workers in some Indian factories**

Annamma R Kumar and Sabiha Vali

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 4: 179-184*

Anthropometric and clinical nutritional status of 195 male factory workers was assessed in Nainital, North India. Relationships between anthropometry and clinical scores and between nutritional status and either education or income were evaluated. Mean  $\pm$  standard deviation values were: height  $161.3 \pm 6.0$  cm, weight  $52.7 \pm 7.6$  kg, BMI  $20.2 \pm 2.4$  and MUAC  $24.0 \pm 2.3$  cm. For BMI, 57% of the subjects were below 20, a value below which FAO predicts that there will be increased risk of work performance. Values corresponding to chronic energy undernutrition (below 18.5 BMI) were found in about 20% of workers. Clinical signs of nutritional deficiencies were found to be 10.76% for vitamin B complex, 2.05% for ascorbic acid and 2.05% for iron. Clinical scores and anthropometric values were negatively correlated with each other, indicating that clinical signs of nutritional deficiencies increased with decreasing anthropometric values. Education and per capita income appeared to have a positive influence on nutritional status.

REVIEW ARTICLE

## **Possible anti-tumour promoting properties of traditional Thai food**

## **items and some of their active constituents**

A Murakami, H Ohigashi and K Koshimizu

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 4: 185-191*

From a view point of cancer chemoprevention, possible anti-tumour promoting properties of daily food items and some of their active constituents have been investigated by a convenient in-vitro assay, the Epstein-Barr virus (EBV) activation test. In a screening test for the inhibitory activity toward EBV activation by 40 methanol extracts from Thai edible plants used for flavours, condiments or folk medicines, more than three-quarters of the total were found to possess inhibitory activities. Significantly, the ratio of activity-exhibiting plants was about three times higher than that of Japanese common vegetables and fruits previously studied. The two plant families of Zingiberaceae and Rutaceae, in particular, were suggested to be promising sources for highly effective anti-tumour promoters. Hitherto, geranial (*Cymbopogon citratus*, Gramineae), cardamomin (*Boesenbergia pandurata*, Zingiberaceae), curcumin (*Zingiber cassumunar*, Zingiberaceae) and 1-acetoxychavicol acetate (*Languas galanga*, Zingiberaceae) have been identified as the active constituents of strongly active plants in the tumour promoter-induced EBV activation test. They showed more potent inhibitory activities than the representative anti-tumour promoters such as b-carotene or quercetin. The high potential of the traditional food items of Thailand in the search for potent anti-tumour promoters is described in this article.

## **Evaluation of a diabetes knowledge and behaviour (DKB) questionnaire**

D Simmons, . Mandell, . Fleming, . Gatland and . Leakehe

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 4: 193-200*

The primary prevention of type 2 (non-insulin-dependent) diabetes is now considered possible through adopting lifestyle changes. Population strategies for preventing diabetes are now being developed. The South Auckland Diabetes Project has developed a questionnaire to assess the impact of a diabetes awareness, exercise/healthy eating programme in the local communities. The questionnaire was evaluated among local adult Europeans (n=127), Maori (n=103) and Pacific Islands people (n =167). The questionnaire is interviewer-directed and takes approximately 30 min to administer. Diabetes knowledge was assessed using four open questions and 31 closed true/false questions which had good reliability (Cronbach's  $\alpha$  range: 0.59-0.90), reproducibility (Pearson's  $r$  range: 0.39-0.74) and external validity ( $r$  range: 0.28-0.56) among all ethnic groups. Median scores increased by 7-13% on re-testing. The open and closed question scores were 7-13% and 10-26% higher respectively among those with diabetes or a family history of diabetes (n = 78).

Important dietary habits were assessed using four tools: (1) a seven-item food preparation/fat content 'fat index'; (2) a four-item high-fat/high-refined-carbohydrate score had good reliability (Cronbach's  $\alpha$  0.51-0.74), reproducibility ( $r = 0.37-0.70$ ) and external validity

when compared with a dietetic assessment (total fat  $r = 0.44-0.90$ ); (3) a 12-item food frequency questionnaire based on standard portion sizes also shared good reproducibility (Pearson's  $r = 0.45-0.52$ ) and correlated well with the dietetic assessment of total calories ( $r = 0.48-0.64$ ) and of calories due to fat ( $r = 0.41-0.65$ ), and (4) a simple question related to the frequency of fruit consumption correlated negatively with the fat index in Europeans ( $r = 0.25$ ,  $P < 0.05$ ) and Maori ( $r = 0.33$ ,  $P < 0.01$ ). While the questionnaire does not give a quantitative assessment of nutritional habits, it does offer a speedy tool for evaluating population-based lifestyle and diabetes awareness interventions directed at the prevention and control of type 2 (non-insulin-dependent) diabetes.

## **Nutritional aspects of palm oil: an introductory review**

Augustine SH Ong

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 4: 201-206*

Malaysian palm oil, with its competitive cost of production and versatility, constituted 33% of world trade in oils and fats in 1991. Since >90% of palm oil is used in food applications in more than 90 countries its nutritional characteristics are important. Nutritional research on palm oil in Australia, Europe, the USA, Canada and elsewhere has been published in scientific journals. Key findings are highlighted in this review, showing that palm oil: (a) does not raise blood cholesterol, but often improves LDL/HDL ratio; (b) is not thrombogenic as indicated in both the human and animal studies; (c) is a good alternative to hydrogenated fats avoiding the unfavourable LDL/HDL ratio and increase in Lp(a) they cause and (d) contains carotenoids and tocotrienols which have been shown to have anti-cancer properties for certain types of cancers.

## **Responses of blood glucose and C-peptide to five Chinese starchy foods**

Wu Xiaomei, Ho Zhi-chien, Yu Binjie and Weng Jianping

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 4: 207-210*

Forty-nine patients with non-insulin-dependent diabetes mellitus (NIDDM) were randomly divided into four groups (10-18 patients per group) to compare the responses of blood glucose and C-peptide to some Chinese starchy foods. Ten healthy subjects were used as controls. After an overnight fast, the blood samples were drawn at fasting and 30, 60, 120, 180 minutes postprandially to measure plasma glucose and serum C-peptide levels. Bun, which was made from refined wheat flour and similar to white bread, was used in the assessment as the reference food. Other test foods included rice, lotus seed, seed of gordon euryale, and rhizome of common yam. There was only one kind of food in each test meal, and each serving contained 50 g of carbohydrate. With both glycaemic index (GI) and C-peptide index (CI) of bun set as 100 in this study, the GI and CI respectively were: rice 89 and 91; lotus seed 62 and 72; seed of gordon euryale 102 and 102; rhizome of common yam 103 and 95. The GI and CI of lotus seed were

significantly lower than those of other test foods. It appears that lotus seed may have a beneficial effect in NIDDM patients, and may be one of the more appropriate foods for diabetic patients.

## **Efficiency of the iron supplementation programme for pregnant women in Jeneponto, Sulawesi, Indonesia**

Barbara Thorand, Werner Schultink, Rainer Gross, Soemilah Sastroamidjojo and Sondra Wentzel

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 4: 211-215*

An official iron supplementation programme for pregnant women in Jeneponto, South Sulawesi, Indonesia was assessed for efficiency. Data were collected in a cross-sectional study of 107 women in the second or third trimester of pregnancy from 18 villages. 47.7% of the women were anaemic, although 63.6% stated they had received prenatal care. Of the 68 women who had received prenatal care, 49 had obtained iron tablets. However, 32.7% of the 49 women who received iron admitted that they had not taken all of the tablets. Mean Hb levels of women in the second trimester who had received tablets was 9 g/l higher ( $P=0.049$ ) than that of women who had not received tablets. To improve the efficiency of the iron supplementation programme there must be an improvement in the coverage of pre-natal care, in the completeness of iron tablet distribution, and in efforts to assure that the pregnant women actually take the tablets given to them.

## **Thiamine deficiency is associated with ethnicity in a subtropical area of China**

Su Liu, Kai-ning Zhang and Malcolm Riley

*Asia Pacific Journal of Clinical Nutrition (1994) Volume 3, Number 4: 217-222*

Clinical signs which probably indicate thiamine (vitamin B I) deficiency have been evident in the Meng Ding District of Yunnan province, China for decades. In 1990, 5979 people were surveyed using cluster sampling to investigate the association of signs of thiamine deficiency with potential causative factors.

Data on past and present symptoms of thiamine deficiency were collected from individual subjects, hospital records and health care personnel. Information on staple food intake over the previous three months was collected from both individual subjects and from commune administrations.

Signs of thiamine deficiency occurred most often in the Dai ethnic group. 5.1% of Dai males and 6.6% of Dai females had met criteria for thiamine deficiency at some time over the previous 7 years. In other ethnic groups, signs of thiamine deficiency occurred in only 0.1% of males and 0.2% of females over the same time period. The incidence of signs of thiamine deficiency did not vary with time during the 7 years prior to the survey, however the condition appeared to be more severe (resulting in more cases of hospitalization) in 1983-1985. Signs of

thiamine deficiency showed a seasonal distribution with the highest rates occurring in the hot, dry season. Signs of thiamine deficiency were common among Dai women after childbirth.

## **Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1**

### **Appropriate technology in body composition: a brief review**

JVGA Durnin

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 1-5*

This paper attempts to link the particular method to be used for body composition measurements to the objectives of the study. There is often inadequate attention paid to the real requirement for different degrees of precision, and excessive amounts of time and labour are spent on quite unnecessary minutiae of technology. Special attention is paid to bio-electrical impedance, skinfold thicknesses, stable isotope techniques, and methods for assessing fat distribution.

### **Body composition - what is measurable?**

Alun H Beddoe

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 7-10*

In 1878 Behnke noted that 'nothing is measured with greater error than the human body'. Over the intervening period measurement techniques have been developed which range from the relatively simple anthropometric methods to those based on sophisticated radiation and nuclear physics technologies. Nevertheless, despite the undoubted progress, it is important that we ask ourselves whether Behnke's observation might still have some validity.

Many reviews have concentrated on the problems and limitations of given techniques with particular emphasis on achievable precision (because precision is easy to measure). However a straight-forward analysis of published data, especially of that relating to indirect techniques, shows that measurement precision is frequently small in magnitude compared to biological precision, the latter being simply a reflection of Nature's refusal to conform to imposed regression relationships. In this paper the body composition technologies are reviewed in the context of achievable accuracy and precision.

### **Bone densitometry: relevance to health care**

Ego Seeman

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 11-13*

Since low bone density is a risk for fracture, the relevance of bone densitometry as a basis for health care assessment needs to be elucidated. Most patients with fractures are in the lower two quartiles of bone density. Bone densitometry can be used to provide a quantitative estimate of fracture risk and a measurable response to aging, disease or medical treatment in the individual. Some difficulties concerning the efficacy of screening the whole population are discussed, for instance in terms of the success of treatment. Screening to prevent fractures should be advocated in women considering HRT. Research into defining bone quality is needed, as are further studies on the pathogenesis of low bone density and on the contributions of low peak bone density and rates of loss to bone density in adults.

## **Using low-cost body composition technology for health surveillance**

D Prijatmoko and BJG Strauss

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 15-17*

Standards for skinfold thickness and abdominal/hip ratio have been published which facilitate the evaluation of body composition as an index of health risk and can be used to determine the degree to which lifestyle modification may be required. This study provides information on body composition including fat distribution in a Javanese population living in Jember, Indonesia. The sample consisted of 122 adults (71m, 51f), aged between 20 and 60 years, selected randomly from the Indonesian Government identification list. Data collected were compared with that obtained from the Melbourne Body Composition Study a representative sample of Australians living in Melbourne. Body fatness was assessed from the skinfold measurement at four sites: triceps, biceps, subscapular and supra iliac and converted using the Durnin and Womersley equation. Body fat distribution was assessed from the ratio of the smallest waist and the maximal gluteal circumference. The body composition profile of these two populations were also measured by the BIA method. The cross-sectional data showed that there are significant differences between the two populations in the degree of fatness and fat distribution. However, Melbourne Australians and Jember Indonesians were similar in biceps skinfold thickness of males and females, and in the subscapular skinfold thickness in females. The use of skinfold thickness of measuring body composition differences between populations is a valuable instrument, provided more than a single site is used. A low-cost technique like BIA provides additional information. A single skinfold thickness may still be valuable provided standards appropriate to the ethnic group are used. The difference in body composition profiles between the two populations suggests the evaluation of the association between fat mass and fat distribution and health risk should be based on standards appropriate to the ethnic group studied. This requires longitudinal studies of body composition, and health outcome specific to each population.

## **Low-cost appropriate technologies for body composition assessment:**

## **a field researcher's view**

Noel W Solomons and Manolo Mazariegos

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 19-22*

The field setting, as distinct from the clinical and laboratory settings, relates to the study of populations and subpopulations. It can involve either free-living or institutionalized individuals. The concept of 'body composition' goes beyond the traditional assumptions of screening anthropometrics, although it includes many of the same measures. The principal practical considerations for the selection of measurement techniques are ethics and cost. The quantitative considerations are the precision and accuracy of the measures. The biological considerations relate to the interpretation of the measure in terms of underlying body constituents; do the values mean what we hope them to mean?

## **Clinical needs and opportunities in assessing body composition**

Vichai Tanphaichitr and Preeya Leelahagul

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 23-24*

Protein-energy malnutrition (PEM) and obesity are hazardous to health with high morbidity and mortality rates. The assessment of body composition is essential to prevent, diagnose and determine the severity of these disorders as well as their response to therapy.

Body weight is the sum of fat and fat-free mass (FFM) whereas its chemical model consists of triglyceride, protein, water, and minerals. Thus one must recognize the appropriate method to assess each compartment of body composition. In clinical practice, the method must be simple, accurate, noninvasive and inexpensive. Body mass index (BMI) is a practical anthropometric parameter to assess protein-energy status in adults because it can easily be calculated from weight in kg divided by (height in meter)<sup>2</sup>, and correlates with fatness and mortality. Total body fat can be estimated by measuring the amount of subcutaneous fat by measuring the thickness of the subcutaneous fat layer at different sites of the body by a skinfold caliper or near-infrared interactance. A high waist-over-hip circumference ratio (WHR) can be used to diagnose abdominal obesity. Upper arm muscle circumference can be employed to measure muscle mass. However, whenever these methods are used to assess body composition their limitations should be recognized.

## **The elite athlete - assessing body shape, size, proportion and composition**

DA Kerr, TR Ackland, AB Schreiner

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 25-29*

In the quest to optimize performance of the elite athlete the sport scientist has sought to determine the ideal physique for a given sport or event. For some sports, specific structural

characteristics offer definite performance advantages; for example in rowing, in addition to height, a large arm span has been identified as important. In other sports, such as long distance running, low levels of adiposity or 'fatness' appear to be linked with faster running times. There are four areas where appraisal of the athlete's physique can provide useful information: (1) identification of talented athletes; (2) to assess and monitor the growing athlete; (3) to monitor training and performance; and (4) to determine 'race weight' in weight-category sports. As a research tool a particular method must be reliable and valid. Other considerations include how expensive the method is, if it is suitable for a field situation and if large amounts of data on a number of subjects can be collected quickly. The method should be safe for both the athlete and the tester and provide useful feedback for the athlete or coach. Anthropometry, with training is able to fulfil most of these criteria and is the most widely used method of physique assessment in sports science. Large anthropometric data bases have been collected on elite athletes at Olympic games and world championships according to a standard protocol. Kinanthropometry, which has developed from anthropometry, is concerned with measurement and evaluation of different aspects of human movement and individual variation in body shape, size, proportion and composition. For the assessment of adiposity a sum of skinfolds, usually over six sites, is most commonly used rather than percentage body fat formulae. Muscle mass can be assessed indirectly through girth and corrected girth measurements. Limb lengths and breadths are used to assess skeletal structure and proportional differences in limb size. The anthropometric methods most commonly used to describe the physique of the athlete, which appraise shape, size, proportion and composition, will be discussed.

## **Role of body protein as a prognostic indicator in wasting disease**

BJ Allen, CA Pollock, J Russell, C Oliver and R Smith

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 31-33*

Malnutrition is associated with many chronic diseases, though its extent and effect is not well known. Measurement of body protein provides a quantitative and reproducible means of monitoring malnutrition. Results for anorexia nervosa, end stage renal failure value and asymptomatic and symptomatic HIV positive subjects are presented to show that, with the exception of asymptomatic HIV subjects, substantial protein depletion does occur.

A more difficult problem is to determine the relation between body protein, the effects of treatment and prognosis. In the case of CAPD patients, 20% protein depletion was found to be associated with a poor prognosis. For anorexia nervosa subjects, readmission probability was found to be correlated with body protein however monitored refeeding and exercise achieved a more normal body composition and quality of life. The critical effect of protein depletion in AIDS remains to be determined, but once ascertained, the role of enteral and parenteral supplementation can then be quantitatively examined.

## **Body composition measurement in normal children: ethical and**

## **methodological limitations**

Louise A Baur

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 35-38*

There are significant ethical, practical and theoretical issues that need to be considered when measuring body composition in normal children. For example, when evaluating the use of techniques that involve ionizing radiation, then the benefit to the volunteer subject, or society at large, needs to be balanced against the likely harm to the subject. For children, the detriment per unit dose may be two to three times larger than that for young adults. At present the decision as to the acceptable radiation dose limit for healthy children undergoing research studies remains debatable. Most techniques for measuring body composition require specific validation of their precision and accuracy when used with small subjects; adaptation of existing methods may thus be necessary in order to measure children. In addition, techniques such as densitometry and dual-energy X-ray absorptiometry may be impractical for use in young children. A major theoretical issue to be considered is that most body composition techniques assume a constant density or chemical composition of the fat-free mass (FFM). However, the FFM in children does not consist of fixed proportions of water, protein and mineral; rather, the proportions of these change during growth, with water content decreasing and protein and mineral content increasing. Caution must therefore be used in the application of adult-derived body composition constants and equations to children.

## **Body composition measurement: the challenge in the unwell child**

Julie E Bines

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 39-42*

The assessment of body composition in the unwell child presents a significant clinical and technological challenge. The effect of disease adds to the complex series of changes in body composition that occur during normal growth and development. To assess the progress of disease or the effect of therapy, repeat measurements of body composition in a single patient may be desirable. However, repeat studies using some methods may not be appropriate due to the potential risks associated with repeated radiation exposure in this young age group. The ability to accurately detect changes in body composition between studies depends on the precision of measurement. Unfortunately, there may be a reduction in precision of measurement with smaller patients when the ability for detecting small changes is of particular relevance. Adequate and correctly timed fluid samples required for dilution studies may be difficult to obtain in the unwell infant and child. New equations or modification of 'adult' equations need to be devised to interpret raw data and these need to be validated in patients of different ages and sizes and in children with different disease states. Specific challenges related to some common and uncommon paediatric diseases are discussed.

## **Physical activity and movement in children: its consequences for growth and development**

AP Hills

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 43-45*

The value of physical activity to health and fitness and normal growth and development is undisputed. In contrast, lack of exercise or excesses in physical activity can be harmful to the growth and development process. Normal physical maturation represents a succession of events which appear in the same sequence in all individuals but vary in both starting point and speed of occurrence. It is often difficult to distinguish the effects of regular physical activity upon fitness from the changes associated with growth and maturation. An integral component of the relationship between health and fitness is body composition. Maintenance of a desirable body composition is an integral component in health status and in the evaluation of health, fitness and physical performance of individuals. Traditionally, discussions that have considered the benefits of regular physical activity have referenced cardiorespiratory and other components of physical fitness such as muscular strength and endurance. More recently, body composition has received considerable attention with numerous individuals of all ages preoccupied with body characteristics such as body fat and muscularity. Less recognition has been given to the role that exercise plays in the maintenance of skeletal health and the potential benefits to be gained by this component of body composition. This is gradually changing with the knowledge that osteoporosis is mediated by nutritional, physical activity and hormonal influences and that inappropriate physical activity can be potentially hazardous to the immature and mature skeleton. Regular physical activity that provides an appropriate weight bearing stimulus is critical for the maintenance of desirable body composition including normal skeletal health, irrespective of age or sex. Benefits derived for body composition are equally important to personal health as the development of other components of fitness.

## **Can total body nitrogen be measured in newborn infants?**

DJ Borovnicar and DB Stroud

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 47-50*

The feasibility of using prompt in vivo neutron activation analysis (IVNAA) of nitrogen to measure the total body nitrogen (TBN) of newborn infants has been investigated by redesigning and recalibrating an existing IVNAA facility used for the measurement of TBN in adults. Repeated 1000 sec measurements of an infant phantom (4kg wt: 80g N) yielded an average measured value that is within  $0.2 \pm 1.8\%$  (1xSD) of the actual value and a precision of 7.9% (CV) for a single measurement. Preliminary investigations indicate that the whole body radiation dose is no greater than 1 mSv (Q=20) for a 1000 s irradiation. It is proposed, and in part demonstrated, that measurement precision can be reduced to  $\approx 5\%$  by (i) using a graphite neutron reflector positioned over the infant to increase the in vivo thermal neutron flux, and (ii) doubling the number of NaI(Tl) detectors.

## **Evaluation of bio-electrical impedance as a clinical tool in prospective nutritional assessment in paediatrics**

Paul Quirk, Brian Thomas, Leigh Ward, Terry Holt and Ross Shepherd

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 51-52*

We have compared the use of bio-electrical impedance analysis (BIA) to anthropometry in the prediction of changes in total body potassium (TBK) counting in a group (n=26) of children with cystic fibrosis. Linear regression analysis showed that the change in TBK in each subject had a significant correlation with the change in BIA, the change in weight and the change in height, but not with the change in fat-free mass (FFM) (determined by skinfold thicknesses). The children were divided into two groups; those who had normal accretion of TBK (Group A) and those who had suboptimal accretion of TBK (Group B). Group t-tests showed that there was a significant difference between the changes in BIA that occurred in Groups A and B but not in the changes in weight, height, FFM, weight Z score and height Z score. The results of this study suggest that serial BIA measures may be useful as a predictor of progressive under nutrition and poor growth in children.

## **Evaluation of multiple frequency bio-electrical impedance analysis in paediatric subjects**

JM McCarthy, LC Ward, TL Holt and RW Shepherd

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 53-54*

The efficacy of multiple frequency bio-electrical impedance analysis (MF BIA) at discrete frequencies in predicting body cell mass, total body water, and fat-free mass compartments was investigated in healthy (n=30) and diseased (n=40) paediatric populations. Correlation coefficients achieved by comparing MF BIA with reference techniques using Deming's regression analysis were in excess of 0.9, but were not superior to those achieved comparing reference techniques with the traditional BIA application at 50 kHz. Applying the 95% limits of agreement procedure to the results showed that the agreement between the techniques was not sufficient for the technique to be of value in individual body composition assessments. The use of MF BIA at discrete frequencies does not improve the accuracy of estimations of body compartment sizes in paediatric subjects compared with those obtained with BIA at 50 kHz.

## **Body composition and the aged: what needs to be measured?**

B Steen, I Gause-Nilsson, I Bosaeus and M Alpsten

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 55-56*

Within the gerontological and geriatric population studies in Gothenburg Sweden body

composition studies have been performed with a four-compartment model (using whole-body potassium 40 counting and dilution of isotope labelled water) for two decades the impedance method for some years and total body nitrogen determination by in vivo neutron activation technique for the last few years. Examples are given from a longitudinal study in 70-year-olds followed at the ages of 75, 79 and 81 years and from a recent study of 75-year-olds.

## **Body composition and aging: a practising clinician's point of view**

Derek M Prinsley

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 57-58*

Human size and shape vary widely. Relative obesity or apparent under nutrition may not limit survival into old age. Normal body appearance can mask gross malnutrition, particularly mineral and vitamin deficiency, problems of measurement in the elderly. Obesity is associated with joint degeneration and systemic disease but with reduced incidence of fractures. Undernutrition is associated with skin breakdown, poor wound healing and fractures. Body composition changes due to disease include dysphagia, myxoedema, anaemia, chronic cardiac and renal disease. Skeletal changes include osteoporosis and Paget's disease. Body composition can change due to treatment, control of dietary energy intake and tube-feeding.

## **Body composition in MesoAmerica**

Noel W Solomons and Manolo Mazariegos

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 59-62*

The fundamental paradigm for the region is short stature. Adult height is on the order of 160 cm for men and 140 cm for women. The timing of this delayed growth has been fixed to the first two years of life, when as much as 2 Z-scores of stature may be lost to the median of the NCHS reference. In the elderly of the region, we have the issue of being initially short and then suffering further loss of stature with age. The height/armspan ratio has proven instructive for exploring that change in height with age. It appears to be less than in Europeans.

Demands of a rigorous agricultural lifestyle, the energy content and density of the diet, and the ravages of recurrent infection and parasitism comprise the environmental determinants of body composition in poor MesoAmerican population. They are conducive to a low storage of fat, with lean body mass being subject to response to infections. Because of the basic short stature but muscular maturity of children and adults, one questions whether the assumptions of proportionality of weight for height from the NCHS reference data apply, or whether MesoAmericans should be normally greater in weight for height than a comparably short North American. For some at the lower end of the stature scale, no international reference standards actually exist for adults.

All that can be measured with microtome, calliper, flexible tape and balance has long been recorded in MesoAmerican populations. Certain high-cost and facility-dependent

technologies, such as nuclear magnetic resonance imaging and whole-body neutron activation analysis, are beyond the scientific economies of any part of the region. Dual energy x-ray absorptiometry instruments are available for clinical diagnosis in Mexico, Guatemala and Costa Rica, and could be turned to research ends. Underwater weighing has been practiced variously in MesoAmerica. Researchers in Guatemala have pioneered in the investigative use of bioelectrical impedance analysis to all ages from low-weight newborns to the very elderly; currently, introduction of the multifrequency BIA to Guatemalan laboratories, and application to the very young in dehydrated (diarrhoea) and overhydrated (kwashiorkor) states are being conducted.

## **Body composition of ethnic groups in the US**

Alex F Roche

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 63-67*

Total body composition has not been reported from national samples of ethnic groups in the US but the data being recorded in the Third National Health and Nutrition Examination Survey include anthropometric variables and bioelectric impedance that jointly would allow the prediction of fat-free mass and other body composition variables for individuals. If these values were used in combination with the sample weighing coefficients, they could provide national estimates for composition values in whites, Afro-Americans and Hispanic-Americans. Despite the limitations of the reports currently available, data from relatively large groups will be summarised and ethnic comparisons will be made taking into account the procedures by which the data were obtained. Data for regional body composition, mainly skinfold thicknesses and circumferences, are much more plentiful. They allow the evaluation of possible secular trends and of fat patterning within ethnic groups and the possible interplay of genetic and environmental influences.

## **Body composition and lymphocyte subsets in an Anglo-Celtic elderly population**

Widjaja Lukito, Paul E Hutchinson, Mark L Wahlqvist, Neil W Boyce, Bridget H-H. Hsu-Hage, Boyd JG Strauss, Antigone Kouris-Blazos, Robyne Bainbridge

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 69-72*

Aging is accompanied by changes in body composition. Furthermore, with aging, immunocompetence is decreased. Insufficient studies are available on the relationships between body composition (fat, bone and non-bone lean mass) and immune function. Aside from the possible adverse effects on immune function of undernutrition, it has been reported that there is an increased incidence of respiratory tract infections and postoperative sepsis in the obese. Further investigation is required as to whether this observation could be attributed to impairment of immune function.

The aim of the present study is to investigate the association between body composition and lymphocyte subsets in apparently healthy elderly people.

One hundred and forty-three free-living elderly and representatively sampled (67 men and 76 women), aged 67 - 86 years, were studied. Body composition was measured using anthropometry and bioelectrical impedance analysis. A subset of 30 elderly subjects (14 men and 16 women) had their lymphocyte subsets measured. Lymphocyte subsets (CD3, CD4, CD8 and CD19) were assayed using an EPICS 752 flowcytometer.

Using partial Spearman correlation analysis, it was found that in elderly men, there were negative correlations between any of body mass index (BMI), total body fat (using BIA), fat-free mass (using anthropometry) with CD8 count ( $r=-0.56$ ,  $P=0.04$ ;  $r=-0.71$ ,  $P=0.006$ ; and  $r=-0.63$ ,  $P=0.02$ , respectively). On the other hand, in elderly women, there were positive correlations between total body fat (using BIA) with any of CD3, CD4 and CD19 counts ( $r=0.53$ ,  $P=0.04$ ;  $r=0.63$ ,  $P=0.01$ ; and  $r=0.53$ ,  $P=0.04$ , respectively).

These findings suggest that although lean mass and immunocompetence decline with age, in apparently healthy elderly population, there are likely to be protective mechanisms which could prevent deterioration of immunocompetence caused by changes of body composition, and that these might be gender dependent. Further studies are required to clarify the interplay between body composition, gender and immunocompetence in the elderly.

## **Body composition in Aboriginal Australians**

Ingrid HE Rutishauser

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 73-76*

The anthropomorphic features of Australian Aborigines have been described, measured and reported in considerable detail by explorers, anthropologists, anatomists and medical practitioners. These reports have provided evidence that some aspects of Aboriginal physique differ considerably from those of Europeans. For example, it has been reported that Australian Aborigines of both sexes have relatively shorter trunks and longer legs than almost every other ethnic group, that body proportions differ less between males and females, and that traditionally Australian Aborigines had a lower weight for stature than Europeans of the same age and sex.

Less information exists on their body composition. Available data, however, indicate that there may also be differences in body fat distribution, but not in the amount of fat-free mass (FFM) per unit of stature, between Australian Aborigines and Australians of European origin.

An analysis of the available data on body composition suggests that the very low body mass index (BMI) values observed in apparently healthy Aborigines, and the different relationship in this ethnic group between BMI and the amount of subcutaneous fat, are more likely to be due to a more central body fat distribution than to differences in skeletal body proportions between Australian Aborigines and Australians of European origin.

## **Technology in body composition: considerations for a traditional,**

## **elderly Indonesian population**

Fadil Oenzil

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 77-78*

Body composition has been measured in a group of elderly people living in nursing home care in West Sumatra, Indonesia. Anthropometric techniques were used to measure height, weight, waist and hip circumference, and skinfolds at four sites (triceps, biceps, suprailiac and subscapula). Body fat was determined with the equations of Durnin and Womersley, although difficulties were encountered because of the age and leanness of some of the subjects. The average age of the subjects was  $73.0 \pm 7.5$  years ( $n=20$ ) and  $73.4 \pm 5.4$  ( $n=15$ ) for males and females respectively. The average body mass index (BMI) was  $18.2 \text{ kg/m}^2$  for both groups. The mean total body fat and waist/hip ratio for the males was 8.8 kg and 0.86; corresponding results for the females were 12.3 kg and 0.77. The results demonstrate the limitations of these techniques. when they are applied to an elderly population for which appropriate standards are not available.

## **Influence of body composition on risk factors for coronary heart disease in Thai women**

Preeya Leelahagul, Suthira Soipet, Panitda Achariyont, Ratana Pakpeankitvatana and Vichai Tanphaichitr

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 79-80*

Height, body weight, body mass index (BMI), waist-to-hip circumference ratio (WHR), and body fat (BF) were determined in 453 female Ramathibodi Hospital Staff, aged 19-61 years. These mean ( $\pm$ SEM) anthropometric parameters were  $1.55 \pm 0.002$  m,  $55.1 \pm 0.4$  kg,  $23.0 \pm 0.2 \text{ kg/m}^2$ ,  $0.82 \pm 0.003$ , and  $21.2 \pm 0.2$  kg, respectively. The prevalences of overall obesity ( $\text{BMI} \geq 25 \text{ kg/m}^2$ ) and abdominal obesity ( $\text{WHR} > 0.8$ ) were 27.0 and 54.1%, respectively. Their serum TC, LDL-C, TG, TC/HDL-C, LDL-C/HDL-C, apo B and FBG increased with overall obesity based on BMI or BF whereas opposite results were observed for serum HDLC and apo A-I levels. Except serum TC, LDL-C, and apo A-I levels, other biochemical parameters were also influenced by abdominal obesity based on WHR.

## **Anthropometric indices among adult Melbourne Chinese Australians**

Bridget H-H Hsu-Hage, Mark L and Karin T Idema

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 81-87*

Anthropometric indices of adult Chinese living in Melbourne, Australia, were studied. 540 (271 men and 269 women) adult Melbourne Chinese were recruited for a study of food habits and cardiovascular risk factor prevalence; all had stature, body weight and waist and hip

circumferences measured. Body mass index and waist-to-hip ratio were estimated, along with fat-free mass, total body fat and the percentage body fat, using established or published formulae. Stature was negatively associated with age and positively related to education level. The Australian-born Chinese had the greatest anthropometric indices; those born in China and Hong Kong had a similar anthropometric profile; the anthropometric profile of Vietnamese Chinese was similar to that of their Australian born counterparts and was significantly greater than that of their counterparts born in China and Hong Kong. Our study suggests that a favourable environment can promote full genetic potential in growth, as evident in the Australian-born Chinese. Those born in Vietnam appeared to have taken full advantage of the Australian environment and showed an elevation of body composition.

## **Seasonal changes in body weight, body mass index (BMI) and body composition of rural Beninese women**

W Schultink, and JMA van Raaij

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 89-94*

Seasonal changes in body weight and body mass index (BMI) of two groups of rural Beninese women were investigated throughout a one-year cycle. Average body weight showed seasonal fluctuations of 1.4 kg in South Beninese women and of 3.8 kg in North Beninese women. Weight changes were reflected in changes of BMI distribution. In a sub-group of South Beninese women (n=24) body composition was estimated in a pre- and post-harvest season using D<sub>2</sub>O dilution, bio-electrical impedance (BIA), skinfold measurements, and BMI equations. Seasonal weight change in the sub-group was 0.8±1.6 kg (P<0.05). Each method indicated that there was a significant change in fat-free mass (FFM) but not in fat mass from the pre-harvest to the post-harvest season. Fat mass assessed by D<sub>2</sub>O was 12.3±3.3 kg which was significantly lower (P<0.01) than the assessment by the other three methods. The difference between D<sub>2</sub>O and skinfold method was 1.5±2.1 kg. between D<sub>2</sub>O and BIA 1.8±2.1 kg, and between D<sub>2</sub>O and BMI 2.0±2.0 kg. It is concluded that various methods to estimate body composition are not interchangeable in field conditions.

## **The interplay between nutrition and body composition**

P Furst and H Leweling

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 95-101*

Stress and malnutrition are associated with altered body composition. Extracellular fluid increases, with wt gain, but in response to stress BCM may gradually shrink with wt loss. In catabolic illness there is extracellular fluid expansion and erosion of AT and BCM. In stress, net loss of body fat was associated with interstitial accumulation of lipids preferentially in muscle, although BIA did not indicate increased fat and decreased water. Severe trauma and sepsis

exerted prolonged effects on tissue electrolyte and water metabolism. Treatment of the critically-ill is of the primary illness. Nutritional therapy is an effective adjunct except in chronic sepsis or critical patients with MOF with great wt and protein loss. Glutamine dipeptides may help with cellular hydration and address catabolic changes.

## **Measuring fat and fat-free mass: clinical significance and limitations**

BJG Strauss

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 103-104*

Measuring body composition is part of clinical nutritional assessment. Simultaneous measurements of fat mass, and fat-free mass, or, preferably, the components of fat-free mass, will yield the most clinical information, but may be limited by laboratory availability. In obese subjects, measurements of fat mass and fat distribution is complemented by a simultaneous assessment of cell mass or total body protein, since management will involve following changes in all of these parameters. Similarly, in osteoporosis, assessment of fat mass and distribution at the same time as bone mass and density, where hormonal replacement therapy has been instituted is a necessary part of the total management of the patient. Since fat distribution has been recognised as an important indicator of health risk, it has become increasingly important to know how to quantify risk and risk change in individuals with abdominal fat distribution. Little information is available about this, or the risks peculiar to peripheral fat distribution. As compartmental models of body composition become more complex, changes in these compartments in various illnesses are becoming clearer. The use of IVNAA for measuring total body protein changes in haemodialysis, and alcoholic cirrhosis, and the recent development of multifrequency BIA to assess extracellular water provide good examples. Although many hospitals clinics now have DEXA and BIA available, body composition laboratories per se are still a rarity, limiting clinical measurements to anthropometry. The errors involved in measurement using the various techniques mentioned still do not allow assessment of short-term changes in fat mass, or the components of fat-free mass.

## **Body composition of HIV-infected male adults with wasting syndrome**

KJ Ellis, RJ Shypailo, JM Pivarnik, BH Jenks, P Walzel and PDK Lee

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 105-108*

Chronic weight loss is a common characteristic of HIV infection; its full etiology remains unknown. We report body composition measurements for 39 adult males with wt loss  $\geq 10\%$  or a body mass index (BMI) below  $19.8 \text{ kg/m}^2$  while receiving stable antiretroviral therapy, and no recent history of opportunistic infection, malignancy, Kaposi sarcoma, or therapy with anabolic agents. CD4+ counts ranged from 2 to 531; 30 subjects having counts  $\leq 200$ . Body composition

was measured by  $^{40}\text{K}$  counting, dual-energy X-ray absorptiometry (DXA), and anthropometry. The reference body composition measures were total body potassium (TBK), lean tissue mass (LEAN), fat mass (FAT), and percentage body fat (%FAT). In addition, nutritional assessment was based on a 2-d food diary. The mean TBK was  $90.2\% \pm 10.8\%$  of normal controls, while the %FAT averaged only  $14.4\% \pm 5.3\%$ , also below the normal range. Reasonable estimates of these body composition compartments were obtained using a combination of BMI, mid-arm circumference (MAC), and triceps skinfold measurements (TSF).

## **Aspects of body composition in human immunodeficiency virus (HIV) infection**

CJ Oliver, BJ Allen and J Gold

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 109-111*

In the mid-1980s, body composition studies of symptomatic AIDS patients, utilising total body potassium counting and isotope dilution, indicated that the pattern of weight loss observed in advanced HIV infection was similar to a stressed or injured state, rather than one of starvation. A disproportionate depletion of body cell mass (of which skeletal muscle is a major component), relative to loss of body weight, was seen along with a relative expansion of the extracellular fluid volume. The same researches observed that this decline in body cell mass was predictive of mortality. Cross-sectional studies in HIV infection have also indicated that a reduction in body cell mass can occur early in the disease process; these studies utilising bioelectrical impedance analysis as a means of body composition assessment.

## **Body composition in anorexia nervosa - changes with treatment, determinants and techniques**

JD Russell, BJ Allen, J Vizzard, B Arthur, M Mira, PJ Stewart and PJV Beumont

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Body fat, total body water and totally body nitrogen were estimated twice before and after refeeding in 32 patients with anorexia nervosa. Body composition was estimated once in 29 normal controls using the techniques of anthropometry, impedance and IVNCA. The influence of weight gain and other variables, ie psychological status, biochemical parameters, exercise and dietary composition, on protein repletion was examined. Methods of assessment of body composition were compared. The results demonstrated that in anorexia nervosa patients, protein was more completely replenished than fat when patients had reached 85% of average body weight for height and age. Weight gain was the only determinant of protein gain. There was no correlation with psychological, biochemical or exercise status nor with dietary composition. Direct methods, ie deuterium dilution and IVNCA, were shown to be preferable in determination of body composition in anorexia nervosa.

## **Body composition studies with intravenous nutrition**

RC Smith

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Intravenous nutrition is a complex nutritional support system which is used for patients who are unable to take food through the normal enteric route. The nutritional protocols are complex and the patients being studied have many complicating factors which make determination of outcome difficult to measure. Body composition measures have proven to be very accurate in determining appropriate protocols for patient care. Because most of the patients being studied have a short term nutritional problem, appropriate period of study was found to be two weeks. In this model we have been able to consistently measure small changes in groups of between 10-15 patients. A large change which may occur in a more severe case could be demonstrated in simple patients. This model has demonstrated that 0.3 g of nitrogen per kg per day and 40 kcal of energy are necessary to maintain body composition over a 14 day period. This nutritional input appeared to be similar whether the patient was in the post-operative non septic state or in the pre-operative depleted condition. Studies were undertaken to show that nutritional benefit of changing from all-glucose to a lipid containing solution did not affect the nutritional outcome of therapy. The nutritional gains seen over the first 14 day period were sustained in a longer study of a small group of patients who were studied at two weekly intervals for 3 months.

Subsequent to these studies it has been considered important to determine whether peripheral intravenous nutrition would be as effective as central intravenous nutrition. By adjusting the nutritional protocol such that it fulfilled the rules obtained by central intravenous studies we have demonstrated that peripheral iv nutrition can maintain body composition but that the amount of glucose required for this to occur is at least 30% of non-protein calories.

## **Body composition studies in intensive care patients: comparison of methods of measuring total body water**

LD Plank, DN Monk, R Gupta, G Franch-Arcas, J Pang and GL Hill

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Changes in total body water (TBW) were monitored in 12 critically-ill intensive care patients using four independent methods. Over the 10-day study period TBW measured by tritium dilution changed from  $51.3 \pm 2.5$  (SEM) kg to  $43.6 \pm 2.3$  kg, an average loss of  $7.7 \pm 0.8$  kg. A six-compartment model of the body incorporating measurements of protein by *in vivo* neutron activation analysis and fat and bone mineral by dual-energy X-ray absorptiometry was used to determine TBW by difference from body weight. The 10-day change in TBW measured by this approach was  $8.4 \pm 0.9$  kg which correlated well with the tritium dilution changes ( $r=0.84$ ,  $P<0.01$ ,  $SEE=1.83$  kg). The changes measured by single frequency and multi-frequency bio-electrical impedance analysis were not significantly different from the tritium results ( $9.7 \pm$

1.3 and  $8.2 \pm 0.8$  kg, respectively) although the prediction errors were high for both methods (SEE=3.29 and 2.72 kg, respectively) with correlations that were statistically significant for the single frequency approach but not for the multi-frequency approach ( $r=0.71$ ,  $P<0.01$  and  $r=0.45$ , ns, respectively). The high prediction errors render these impedance techniques inappropriate, at the present time, for monitoring total water changes in individual intensive care patients.

## **The significance of sarcopenia in relation to health**

Alex F Roche

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Sarcopenia is a lack of skeletal muscle. Knowledge of this condition is incomplete because an accurate method for the measurement of total muscle mass is lacking. In the absence of such a method, regional measurements are used commonly. When these are based on anthropometry, the values are inaccurate, but they are important because of their relationships to risk factors for some diseases and because large amounts of data are available. It is suggested that low values for the body mass index (BMI) indicate low values for fat-free mass (FFM) of which muscle is known to be a major constituent. Furthermore, low values for the BMI and the circumferences or areas of arm muscle are associated with increased mortality rates.

## **Causes of inadequate protein-energy status in thalassemic children**

Voravarn S Tanphaichitr, Budsaya Visuthi and Vichai Tanphaichitr

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Height-for-age, weight-for-age, triceps skinfold thickness (TST), mid upper arm circumference (MUAC), and mid upper arm muscle circumference (UAMC) were determined in 47 thalassemic children, ages ranging from 4-5 years. Their mean ( $\pm$ SEM) height-for-age, weight-for age, TST, MUAC, and UAMC were  $90.51 \pm 0.98$ ,  $79.91 \pm 2.33$ ,  $88.01 \pm 1.26$ ,  $83.02 \pm 1.37$  and  $80.09 \pm 1.59\%$  of standard values. Based on height-for-age of less than 95% of standard values and weight-for-age, TST, MUAC, and UAMC of less than 90% of standard values, the prevalences of protein-energy malnutrition (PEM) in these thalassemic children were 72.3, 74.5, 53.7, 75.6 and 82.9%, respectively. The causes of their inadequate protein-energy status were due to: (a) chronic hypoxia evidenced by the significantly positive correlations between haemoglobin levels and height-for-age ( $r=0.65$ ,  $P<0.001$ ), weight-for-age ( $r=0.58$ ,  $P<0.001$ ), MUAC ( $r=0.67$ ,  $P<0.001$ ) and UAMC ( $r=0.63$ ,  $P<0.001$ ); (b) zinc deficiency evidenced by significantly positive correlations between plasma zinc levels and height-for-age ( $r=0.26$ ,  $P<0.05$ ), MUAC ( $r=0.41$ ,  $P<0.005$ ), and UAMC ( $r=0.41$ ,  $P<0.005$ ) and significantly negative correlation between urinary zinc levels and UAMC ( $r=0.34$ ,  $P<0.02$ ); and (c) low energy intake, ie 65% of the mean recommended energy intake.

## **Body mass index and nutritional status: the effect of adjusting body mass index for the relative sitting height on estimates of the prevalence of chronic energy deficiency, overweight and obesity**

NG Norgan

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Low body mass index (BMI) has been proposed as a practical measure of adult chronic energy deficiency (CED), although it has well-known limitations. One of these is that its interpretation is complicated by the influence of body proportions, in particular the relative leg length. This has been quantified by examining data collected before 1970 of 349 adult Australian Aborigines following a largely traditional way of life. These Australian Aborigines exhibited low sitting height: stature ratios (SH/S),  $0.48 \pm 0.02$ , (mean  $\pm$  SD), range 0.41-0.54, ie they are relatively long legged, and low BMI,  $19.9 \pm 3.2$ , range 12-30 kg/m<sup>2</sup>. Thirty percent of individuals had BMI less than 18.5 kg/m<sup>2</sup>, a suggested cut-off for CED. The regression of BMI on SH/S was determined in men and women separately but found by covariance analysis not to be different and a common equation for both sexes was calculated. When BMIs were standardized to a SH/S of 0.52, a value found in Europeans and other Indo-Mediterraneans, the percentage classed as chronically energy-deficient fell to 7%. In Asians and indigenous Americans with their high SH/S, the percentage of the population with overweight and obesity could be overestimated and the extent of CED underestimated. In populations with a mean SH/S of 0.52, such as Europeans and Pacific peoples, standardizing SH/S to 0.52 would not effect the prevalence of CED or overweight and obesity but could move individuals across diagnostic boundaries as there is variability in SH/S in all population groups. In conclusion, when using BMI to assess energy nutritional status single cut-offs are not applicable to all individuals and population groups without allowance for the body form and type.

## **The body cell mass and altered protein energy metabolism in cystic fibrosis**

M Thomson, S Bucolo, B Thomas, T Holt and R Shepherd

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To further investigate the body cell mass (BCM) in CF. as the central metabolically active body compartment, and to determine if measures used as reference standards after comparative differences in protein energy metabolism, BCM was measured by K<sup>40</sup> analysis (n=144 CF, 69M, 71F, ages 0.3-17 years) related to age and gender control data (n=1478). Protein synthesis was studied by whole body C<sup>13</sup> leucine kinetics (LSYN, n=10 well nourished vs 7 undernourished CFs matched for Ht, Sex and FEV<sub>1</sub>). Energy expenditure (REE) was studied by indirect calorimetry (n=4 DF508 CF infants with no lung disease vs n=12 age, wt, ht and sex matched healthy infants). BCM was <1 SD below 50th centile in 75% of CFs although only 15

and 10% had weights or heights <1 SD below 50th centile. Mean LSYN and REE did not significantly differ between groups in absolute values or corrected for weight, height or surface area, but were accelerated ( $P < 0.01$ ) when corrected for BCM.

## **Hormones, body composition and cardiovascular risk**

Lars Sjostrom, Magne Alpsten, Bjorn Andersson, Bengt-Ake Bengtsson, Calle Bengtsson, Per Bjorntorp, Ingvar Bosaeus, Robert Jan Brummer, Badrul Chowdhury, Staffan Eden, Ingrid Ernest, Sten Holmang, Olle Isaksson, Henry Kvist, Leif Lapidus, Bo Larsson, Goran Lindstedt, Sven Lindstedt, Lauren Lissner, Lars Lonn, Per Marin, Kaj Stenlor and Jukka Tolli.

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Some 20 compartments of the body may be measured by CT and organ areas determined in 28 CT scans. Advantages of CT are described. While there have been extensive studies of hormones in pre- and postnatal growth, apart from evidence from disease, the role of hormones in adults has been less known. Data on growth hormone and sex hormones, from organ-oriented body composition studies, are summarised together with implications for the relation between body composition and cardiovascular risk. Sex-specific anthropometric equations allow estimation of LBM, visceral and sc AT with <20% error. In the obese such estimates show visceral AT to be a stronger risk predictor than other compartments or W/HR.

## **The effects of growth hormone on body composition**

Robert-Jan M Brummer and Bengt-Ake Bengtsson

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 151-155*

The action of growth hormone (GH) on longitudinal bone growth is well known and easily recognized. GH also has profound effects on body composition. Generally, GH increases the amount of body cell mass and extracellular water and decreases body fat. The lipolytic effect of GH was demonstrated in the 1930s when it was shown that pituitary extracts reduced body fat in rats. Recently, GH treatment has been shown to promote a redistribution of adipose tissue from the abdominal (android) to a more peripheral (gynoid) distribution. The reverse change has been demonstrated in patients with acromegaly after successful treatment. The anabolic action of GH was first demonstrated when nitrogen retention was observed after GH administration. GH seems to stimulate cell division and increase the amount of DNA in the muscle. In patients with acromegaly the overweight is partly explained by a significant increase in body cell mass and muscle volume, compared to matched controls, demonstrated by several independent methods of determining body composition. In GH-deficient patients, however, the overweight is due to an increase in adipose tissue mass and the body cell mass seems only decreased in subjects below the age of 55. The anabolic action of GH is accompanied by sodium and fluid retention, due to increased sodium pump activity. In acromegalic subjects extracellular water has been shown to be increased by up to 25%. However, in GH-deficient adults the extracellular fluid volume is

markedly decreased by approximately 15%. Replacement therapy with recombinant human GH in patients with GH deficiency restores the extracellular fluid volume by an initial rapid expansion of the fluid volume, followed by a slight decrease towards a new steady-state level.

GH has profound effects on body composition. Although body composition is determined by many factors including age and physical activity, changes in body composition can be helpful parameters in following the effect of GH in various body compartments.

## **Future technologies**

Brian J Thomas

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Research and development in the area of body composition has undergone considerable changes in the last decade. These changes have resulted in part from the improvement of established techniques - but also from the introduction of methods based upon principles new to body composition studies.

One can observe in recent developments a trend towards less invasive techniques, and cheaper, more portable instrumentation. There has also been a move towards improving the efficacy of the information obtained. The trend towards less invasive techniques, which includes lower dose, is particularly important when considering applications involving children.

The question of 'future technologies' needs to be considered against the background of these developments if one is to propose the direction of future research.

This paper considers possible new and modified technologies which may find application in the measurement of body composition. In addition, currently emerging technologies which need further research and development will be discussed. Examples of technologies examined in this paper include:

- a possible new approach to measurement of bone mineral density in neonates using laser beam transmission,
- possible modification of dual-energy X-ray absorption (DEXA) techniques for improved precision in the measurement of the relative lean/fat component, and
- the research required to validate the use of multifrequency bio-electrical impedance analysis for measurement of extracellular and total body water.

## **Quality control in body composition measurements**

B Stroud, DJ Borovnicar and DW Xiong

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The principles of quality control (QC) are not new; they have always been with mankind. At the most fundamental level QC can be defined as a state of mind in which we continually strive to analyse what we are doing in order to produce a 'product' which our peers will judge to be 'better'. Paradoxically, this simple concept is expressed in many different ways within the

multi-disciplinary team that makes up a body composition laboratory and very careful discussion is needed to ensure uniformity of technique and results. The situation is made even more difficult by the large range of equipment and techniques that are now available for the measurement of body composition. It is necessary to have a detailed understanding of the equipment and techniques and to have good communication within the group of workers. Good communication is essential to ensure that all members of the group have a clear understanding of the relevant guidelines and principles of QC and measurements, and to ensure that they are applied consistently throughout all the work of the laboratory. A detailed understanding of the equipment is necessary in order to define and implement simple tests that will monitor the most sensitive or troublesome features without imposing an undue burden upon the operator. There is a need for such tests to be automated as much as possible and, in general, there is a need for a more professional approach to the analysis of error and its propagation throughout an experiment. Inter comparisons of results between centres is a logical, but generally difficult requirement and some of the problems that arise would be simplified if equipment designs were more standardized. Finally, all these requirements need to be achieved within an environment that is continually changing with respect to the aims of the laboratory and the funding bodies.

## **Body composition by dual-energy X-ray absorptiometry—a review of the technology**

RH Nord and RK Payne

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 167-171*

This paper begins with a fundamental description of the dual-energy X-ray absorptiometry (DXA) technique for measurement of bone mineral. It describes how, in extending the technique to do accurate assessment of body fat and lean, it is important that material standards for fat and lean exist, and that a suitable model for fat distribution in the body be developed.

The computational steps employed in DXA and in the familiar underwater weighing (UWW) technique are compared and contrasted. Experimental data on over 350 human subjects shows that the percent fat results of DXA and UWW do not agree. However when both methods are used to determine body tissue density, there is good agreement. The authors suggest that the discrepancy may lie with the equations that are used in UWW to compute % fat from body density.

## **Dual-energy X-ray absorptiometry vs underwater weighing comparison of strengths and weaknesses**

RH Nord and RK Payne

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 173-175*

This paper discusses a number of strengths and weaknesses of two methods for determination of body fat, Dual-energy X-ray Absorptiometry (DXA) and underwater weighing (UWW). Several

error sources are theoretically quantified. One source of error in the UWW method, variation in bone mass fraction, is examined using data gathered on 219 human subjects who were measured by both methods. The experimental data show the expected linear form but do not exactly match the theoretical curves, indicating that all error sources are not completely understood. The data suggest a possible error in the Brozek equation which is commonly used to compute % fat in UWW.

## **A new equation set for converting body density to percent body fat**

RH Nord and RK Payne

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 177-179*

One source of error in the underwater weighing (UWW) method of body fat determination is variability in bone mass as a fraction of total nonfat mass. We examined this error theoretically and experimentally using data gathered on 219 human subjects who were measured by UWW and also by the newer technique of dual-energy X-ray absorptiometry (DXA). The experimental data suggest an error was made in the assumed bone mass fraction used in the derivation of the Brozek equation, the standard means of converting the body density values obtained in UWW to body fat percent. Using this new experimental data, a new equation (set) is proposed for use in UWW measurements.

## **The value and limitation of dual-energy X-ray absorptiometry**

JE Harrison, C Muller, SS Krishnan, SW Kooh, E Noriega, C Leslie and KG McNeill

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In population studies, in which patients and controls are of comparable size, bone mineral area density (BMD) gives reliable results for mean bone mass data although, with sequential data, BMD may under-estimate the degree of change in bone mass. In children BMD data should be reliable, provided that patients and controls, matched for age and sex, are also of the same size. With disease children may be small for their age so that low bone mass by BMD may be due to small body size and not necessarily to osteopenia. In these situations the bone mineral content (BMC) index may be more reliable than BMD. To assess bone mass status in individuals, BMC index, as well as BMD, should be used, particularly with adults at the extremes of body size (the very small or very tall).

## **Fat-free mass from dual-energy X-ray absorptiometry and from other procedures**

Alex F Roche, Shumei Guo, Rita Wellens, Wm Cameron Chumlea, Xiaoyin Wu and Roger M Siervogel

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 183-185*

Fat-free mass (FFM) values were obtained for 99 males and 114 females (8-68 years) who are participants in the Fels Longitudinal Study. These participants were assessed by dual-energy X-ray absorptiometry (DEXA) and by densitometry using (i) a multi-component model including measures of total body water (TBW) and total body mineral (Fels), (ii) a model with age- and sex-specific values for the density of FFM (Lohman), and (iii), a 2-component model (Siri). In males <25 years, the mean DEXA and Siri values were similar, but both were significantly smaller than the Lohman and Fels means. In females <25 years, the mean DEXA values are smaller than those from the other methods. In men aged 25-54 years, the mean DEXA and Fels means showed good correspondence, but the Lohman and Siri means were significantly smaller. In women aged 25-54 years, the DEXA means were considerably smaller than those from the Siri, Lohman and Fels models. At ages >54 years, the findings are tentative because of the small sample sizes but they indicate that the DEXA and Fels means are similar in men and that both are larger than the Lohman and Siri means. In women aged >54 years, the DEXA, Siri and Lohman means are similar, but they are smaller than the Fels means. In another overlapping group (50 men; 78 women; 18-67 years), FFM was obtained from TBW and from the Siri method. The technical errors for TBW-Siri comparisons were 1.7 kg (men) and 1.8 kg (women) with large coefficients of reliability (87%, men; 90% women). It was concluded that DEXA estimates of FFM are not interchangeable with those from the other methods tested. These findings are relevant to the selection of methods for the measurement of body composition and the interpretation of the literature.

## **Whole body measurement of C, N and O using 14 MeV neutrons and the associated particle time-of-flight technique**

S Mitra, JE Wolff, R Garrett and CW Peters

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 187-189*

Our aim has been to construct a portable prototype instrument for measuring the whole body composition in vivo of growing lambs in terms of fat, protein and water by determining the mass of carbon, nitrogen and oxygen present. A small and compact sealed tube neutron generator which has the capability of exploiting the associated particle time-of-flight technique has been used for prompt gamma 14 MeV neutron activation analysis of C, N and O. This technique allows only gamma rays generated by neutron reactions within a defined volume to be recorded and offers a superior signal-to-noise ratio over existing prompt gamma neutron activation techniques. Based on the results obtained from irradiating a 41.4 kg meat phantom, we anticipate that an instrument comprising the neutron generator and four 15 x 15 x 45 cm NaI(Tl) gamma ray detectors can be assembled to determine in vivo, protein, fat and water with precisions of 4.1, 5.4 and 1.2% (CV), respectively, within a 15 min scan. The radiation dose delivered would be ~0.03 mSv.

## **Errors in determination of total body protein by in vivo neutron activation of nitrogen due to non-uniform neutron fluence inside the patient**

Jukka Tolli, Lars Larsson and Magne Alpsten

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 191-194*

Total body protein can be estimated by in vivo neutron activation of nitrogen. The method is based on capture of thermal neutrons in a  $^{14}\text{N}(\text{n},\text{g})^{15}\text{N}$  reaction. Sources of error associated with this method, such as background subtraction, variations in detection efficiency, etc, are analysed. Different neutron reactions (absorption, elastic and inelastic scattering) cause the neutron fluence to decrease inside the body. The activation profile through the body is non-uniform which causes errors in the calculation of total body nitrogen. A reduction of nitrogen by 5% in a 3 cm thick volume near the body surface would result in an error in the determination of total body nitrogen of approximately 0.3%. The error induced by changes in thickness of the subcutaneous fat has also been estimated and the results show that a 5 mm change in subcutaneous fat thickness changes the count rate from nitrogen by 5%.

## **Problems associated with using in vivo proton ( $^1\text{H}$ ) magnetic resonance spectroscopy to quantify liver fat**

SJ Marks, RM Dixon, P Styles, NG Ryley and TD Hockaday

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 195-198*

In-vivo  $^1\text{H}$  magnetic resonance (MR) spectra of the liver were obtained in 8 patients admitted for liver biopsy. These patients had abnormal liver function and the presumptive diagnosis of fatty liver prior to biopsy. Two patients with NIDDM were also studied but liver biopsies were not performed as liver function was normal. The MR spectra, obtained on a 60 cm clear-bore 1.9 tesla superconducting magnet showed two  $^1\text{H}$  resonances, one from water and the other from repeating methylene protons -  $(\text{CH}_2)_n$  - in triglyceride. The lipid: water signal ratio was used to characterize tissues as subcutaneous fat (high lipid: water ratio), normal liver (low lipid: water ratio) and fatty liver (intermediate lipid: water ratio). The spectra obtained at the greatest depth from the probe surface  $\sim 4.5$  cm) was used as it was most likely to represent liver tissue.

Although all 8 patients were expected to have fatty liver only 2 had evidence of significant fatty changes on microscopy. This was assessed by counting the vacuoles of fat over the area of the biopsy specimen and quantitated as 'fat vacuoles per high power field' (f/hpf).

In the 2 patients with NIDDM, unusual stack plots suggested technical difficulties with IH MR spectroscopy for in-vivo assessment of fatty liver. The first patient, PT had a significant increase in lipid: water ratio on the spectra thought to represent liver (lipid: water  $\sim 65\%$  cf levels  $<3\%$  in normal liver and  $12.6\% + 26.5\%$  in those patients subsequently found to have fat on biopsy). This was later found on MR imaging to represent omental fat lying between the liver

and muscle layer. The second patient, OM had a large amount of subcutaneous fat overlying the area assessed. As seen on the stack plot, the probe depth was not great enough to pass through the subcutaneous fat and muscle layer to penetrate liver tissue.

There was a significant correlation between the lipid: water signal ratio and visible fat on biopsy in those patients who underwent liver biopsy. Difficulties experienced with probe depth suggests imaging would be necessary prior to spectroscopy to ensure liver tissue is actually assessed.

## **High frequency energy absorption and the measurement of limb muscle**

Alex F Roche, Rita Wellens, Shumei Guo, Roger M Siervogel, Michael D Boska, Allan Northeved: and Kim F Michaelsen

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 1: 199-201*

High frequency energy absorption (HFEA) is being developed as a portable, inexpensive, non-invasive procedure for the measurement of muscle mass within cross-sections of limbs. The instrument consists of a flexible coil 2.5 cm wide of which the length can be adjusted over a 10 cm range. A series of coils of different lengths has been constructed that are jointly suitable for limbs with circumferences ranging from 20 to 75 cm. To measure HFEA, a coil of appropriate length is attached to a 9v battery that, through an oscillator, produces a frequency varying from 15 MHz (longest coil) to 40 MHz (shortest coil). Zero readings, with the coil set at the same circumference as the limb, are obtained before and after HFEA is measured and they are used to adjust the observed values. HFEA, in theory, is related to the number of electrolytes deep to the coil and almost all these electrolytes are in muscle. Good precision has been demonstrated and the instrument has been successfully validated against saline solutions. A previous model was validated against magnetic resonance images with good results ( $r^2$  about 0.8). Further validation of the present model against magnetic resonance images is almost complete; these findings are presented.

## **Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 2**

### **Dietary fibre content and composition of vegetables in Taiwan area**

Su-Chien Chang, Meei-Shyuan Lee, Ching-Hui Li, Mou-Liang Chen

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 2: 204-210*

Fifty-three fresh vegetables frequently consumed in the Taiwan area were analysed for their

dietary fibre content by an enzymatic-gravimetric method. Of these vegetables, the total dietary fibre ranged from 0.7g (per 100g edible weight) in large cucumbers to 13.2g in lima beans. Further fractionation of total dietary fibre has shown that the majority of vegetables contain more insoluble fibre than soluble fibre with the exception of sponge gourds, burdocks and carrots. Soluble fibre in most vegetables contain mostly uronic acids while the insoluble noncellulose polysaccharides (INCP) fraction is composed mainly of xylose and galactose. Mushrooms are unique in that both their soluble fibre and INCP fractions consist mainly of glucose. These results of dietary fibre content and composition of vegetables are useful for dietary assessments in Taiwan and the Southeast Asian area.

### **Australian “Code of Practice for the Weight Loss Industry”**

M Wahlqvist and Consumer Advocacy and Financial Counselling Association (CAFCA) working party, Melbourne, Victoria, Australia

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 2: 211-219*

During the period 1993-1994 an Australian committee, concerned about the risks to consumers, and the standing of the industry, convened to develop a "Code of Practice for the Weight Loss Industry". This was catalysed by a report from the Australian state of Victoria's (Consumer Advocacy). The committee had representatives of consumer organisations, Government (State and Federal), Health Care Professions (medical, dietetic and clinical psychology) and Industry and was chaired by Professor Mark Wahlqvist of Monash University, Melbourne. It launched the Code on 24th May 1994 when key members of the industry signed an agreement. The principles of the Code are that there are agreed standards and rights for consumers: to be informed, to choose, to be heard, to redress where difficulties have arisen and to consumer education

and the objectives are:

1. To ensure that advertising gives accurate information about costs and the likelihood of success of programs.
2. To ensure that those providing weight loss programs deal openly, honestly and fairly with consumers.
3. To enable consumers to make informed choices about the products and services they purchase.
4. To achieve standardised and recognised training and qualifications for those providing weight loss programs.
5. To ensure that consumers are informed about their rights under the law and the Code of Practice before they enter into a contract.
6. To ensure timely and appropriate resolution of disputes within an established framework of dispute resolution mechanisms.
7. To ensure that weight management programs do not compromise health status.

This would appear to be the first time such a code has been agreed to by industry. It may serve as a model for other countries where there is an increasing prevalence of obesity and

expansion of the weight loss industry. If it fails as a voluntary code, the Consultative Committee has recommended that it be enshrined in law.

## **Use of food intake and body mass index (BMI) in the assessment of adult nutritional status in Viet Nam including a maternal-child analysis**

Ha Huy Khoi, Tu Giay

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 2: 220-224*

The authors have used food intake and Body Mass Index (BMI) to assess Vietnamese adult nutritional status. Chronic Energy Deficiency (CED) is prevalent in Vietnamese adults with an average percentage about 40%. The mean value of BMI in the 26-40 year old age group is 19.7 but it decreases thereafter except in urban areas. The change in the BMI curve distribution varies among adults living in rural, urban and mountainous areas. There seems to be a relationship between the BMI of mothers and the nutritional status of their children under the age of 5. Some findings revealed a relationship between maternal BMI and birth weight and between CED and health status. The proposed cut-off point of Ferro-Luzzi-James in the classification of CED was applied to data from Vietnam.

## **Estimation of losses of iodine during different cooking procedures**

Geetanjali Goindi, MG Karmarkar, Umesh Kapil, J Jagannathan

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 2: 225-227*

Iodine is an essential micronutrient. The human requirement of iodine is 150 mcg/ day. About 90% of this comes from food while 10% from the water. The most commonly used method of prophylaxis against iodine deficiency is via fortification of salt with iodine. At the beneficiary level iodised salt containing 15ppm of iodine is supplied. However, very few studies have been conducted to assess the losses of iodine during cooking procedures. Hence, a systematic study was undertaken with the objective to assess the losses of iodine during different cooking procedures. Fifty recipes commonly cooked in Indian families constituted the sample size. It was found that the mean losses of iodine during different procedures used was 1) pressure cooking 22%, 2) boiling 37%, 3) shallow frying 27%, 4) deep frying 20%, 5) roasting 6%, 6) steaming 20%. The findings of the present study indicate that further studies are needed in this field.

### REVIEW

## **Differences in nutritional status between vegans, vegetarians and omnivores**

Heather M Crockett

Well planned vegetarian diets effectively meet Recommended Dietary Allowances and are a 'healthy' alternative to meat eating. Lacto-ovo-vegetarian diets have similar nutrient composition to omnivore diets. Vegan diets may be low in vitamin B 12. The fat content of the vegan diet is significantly lower and the polyunsaturated:saturated fatty acid ratio higher than in the omnivore diet. The fibre content of the vegan diet is about twice that of the lacto-ovo-vegetarian diet which is about three times that of the omnivore diet. Protein and essential amino acid content of the vegan diet is adequate. Protein intake of vegans is lower than that in omnivores. Blood lipoprotein changes due to intervention with a lacto-ovo-vegetarian diet are favourable regarding coronary artery disease risk. Infants and children have special needs. Full discussion of the effect of vegetarianism on child growth is beyond the scope of this report. Several dietary guidelines are given; choosing a wide variety of foods is recommended.

## **The IUNS cross-cultural study of "Food Habits In Later Life"-- an overview of key findings**

Wahlqvist ML, Hsu-Hage BH-H, Kouris-Blazos A, Lukito W and IUNS study investigators: IUNS Committee on "Nutrition and Aging": ML Wahlqvist (Chairman), L Davies (Deputy chairman), BH-H Hsu-Hage, Y Horie, H Hermanova, A Kouris-Blazos, DM Prinsley, D Roe, NS Scrimshaw, N Solomons, B Steen, M-T Sun, A Trichopoulou, WA van Staveren, X-H Zhao;

Anglo-Celtic Australians: ML Wahlqvist, A Kouris-Blazos, BH-H Hsu-Hage, W Lukito; Greek Australians: A Kouris-Blazos, ML Wahlqvist; Greeks in Spata, Greece: A Kouris-Blazos, A Trichopoulou, E Polychronopoulos, ML Wahlqvist; Swedes in Gothenberg, Sweden: B Steen, E Rothenberg, O Augustsson, BG Eriksson, V Sundh, B Warne; Japanese in Japan: Y Horie, K Horie, K Sugase, R Inai, Y Kasugai, T Teshima, H Nishikawa; Filipinos in Manila, Philippines: P de Guzman; Chinese in Beijing, China: D Roe, Y Wang; Chinese in rural and urban Tianjin, China: S Xi, M-T Sun, G-F Gu.

The need to understand the nutritionally related health problems of elderly people in developing countries became more apparent following a WHO Workshop in Hyderabad, India, in 1986. On behalf of WHO, Dr Gary Andrews published a study of the social and health status of elderly people in the Western Pacific in 1986. For all of the difficulties in cross-cultural comparisons, there were enough great and important differences in social factors and self-perceived health indicators to make a case for further cross-cultural studies on a wider international scale.

The IUNS Committee on "Nutrition and Aging" began to address the way in which the cross-cultural aspects of nutritional assessment and the social and health status methods could be applied using the socio-anthropological approaches. A project to study "Food Habits In Later Life" was formulated. Communities where there was a concentration on food culture and its relationship to health were recruited into the project to be assessed non-invasively, without the

limitations that collection of biological specimens might impose. Results from 13 elderly communities in Australia, China, Greece, Japan, the Philippines, and Sweden studied in 1988-1992 have now been documented in book form. This book also brings together some cross-cultural studies of the elderly which have considered food and health at the same time as the IUNS project: these studies are the EC SENECA study, a study by the National Institute of Nutrition and Food Hygiene in Beijing of six Chinese communities with distinctive food patterns, a New Zealand-Australian study of two communities and studies in Central America. The IUNS study itself has the attributes of an ecological investigation and the related limitations. The ethnological and anthropological focus, however, represents an advantage in that the range of variation of the nutritional exposure under consideration is much greater among populations than within any particular population. The IUNS study is unique in the scope of the variables studied. Some of these study communities will be followed prospectively to take advantage of what a cohort study can provide in the elderly.

### **Serum Lipids of castrated rats given hormonal replacement and fed diets with added soybean oil or palm oil**

Ima-Nirwana S, Jamaludin M, Khalid BAK, Z Merican and Baharom S

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 2: 244-248*

The effects of castration with/ without testosterone replacement in male rats, and ovariectomy with oestrogen replacement in female rats, on serum lipids were studied. Simultaneous feeding with diets fortified with 20% weight/ weight (w/ w) soybean oil (Sb) or palm oil (P0) were done to determine the influence of these oils on serum lipids in castrated and sex hormone replaced rats. Two month old male and female *Rattus norvegicus* rats were given the above treatment for 4 months, and their sera assayed for lipid profile. Castration increased HDL-cholesterol (HDLchol) and total cholesterol (Tchol) concentrations. Testosterone or oestrogen replacement in male and female rats respectively increased HDLchol and decreased LDL-cholesterol (LDLchol) concentrations. Testosterone replacement also decreased Tchol concentration back to noncastrated levels, and reduced serum triglycerides (TG) to lower than non-castrated levels. Addition of Sb or P0 to the diet increased the LDLchol in the testosterone or oestrogen replaced male and female rats, but there was no difference between the two groups. P0 raised serum TG of the testosterone replaced group compared to control and Sb groups. In conclusion, testosterone and oestrogen were found to have favourable effects on serum lipids. Sb and P0 did not differ in their effects on lipoprotein cholesterol and Tchol, but P0 raised serum TG as compared to Sb.

### **Improvement of liver function in rats subjected to hepatotoxin by a crude protein derived from leaves of Cajanus indicus**

Prantosh Bhattacharyya, Sarmistha Dutta, Kalyan Bose, & Debasis Ghoshal

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 2: 249-250*

Rats subjected to hepatotoxicity with CCl<sub>4</sub> were treated with crude protein isolated from Cajanus indicus. It was observed that after treatment with the protein for seven days serum bilirubin and GPT were reduced significantly ( $P < 0.001$ ) compared to CCl<sub>4</sub> control. GOT, however, showed no appreciable change.

## **Physiological differences of soluble and insoluble dietary fibre fractions of brown algae and mushrooms in pepsin activity in vitro and protein digestibility**

Y Horie, K Sugase and K Horie

*This study was presented in part at the 15th International Congress of Nutrition on, Adelaide, Australia, Sept, 1993. Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 2: 251-255*

Soluble and insoluble dietary fibre fractions were separated from Konbu, Wakame and Hijiki seaweeds and Shiitake, Hiratake and Yanagimatsutake mushrooms, respectively, and the effects of the fractions on pepsin activity in vitro and of those from Wakame on apparent protein digestibility in vivo were studied. Addition of each dietary fibre fraction inhibited pepsin activity in vitro in all the dietary fibre fractions tested, particularly the inhibition by soluble dietary fibre fractions being significantly greater, by 62-99%, than that by insoluble dietary fibre fractions, by 22-36% ( $P < 0.01$  in each food). This suggests that soluble dietary fibres in algae and mushrooms are likely to play a different physiological role from insoluble dietary fibres. Measurement of viscosity of each soluble dietary fibre fraction resulted in the correlation of viscosity with the inhibition of pepsin activity by the soluble fraction. Young adult rats given a normal protein diet containing 5% of the soluble dietary fibre fraction derived from the Wakame seaweed showed a greater decrease in apparent protein digestibility by 9.4% than those given the diet containing 5% of the insoluble one ( $P < 0.01$ ). This may have resulted in the significantly lower body weight gain of the former rats than that of the latter rats.

## **Iodine content of salt in National Capital Territory of Delhi**

U Kapil, S Bhasin, G Goindi, D Nayar

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 2: 257-258*

Iodine deficiency disorders (IDD) constitute a major public health problem in India. The most commonly used method of prophylaxis against iodine deficiency is via fortification of salt with iodine. The Government of India has issued ban notification on sale of non iodated salt in Delhi since 1984. The present study was conducted to assess the iodine content of iodised salt consumed by beneficiaries in Delhi, with the aim to strengthen the IDD control programme activities implemented by the state government. A total of 763 salt samples, collected from an equal number of households constituted the study sample. It was found that 82.4% of the salt

samples had an iodine content of 15 ppm and above. Eleven percent of the salt samples had iodine contents between 10 ppm and 15 ppm and 5% had less than 10 ppm of iodine. The results of the present study indicate that there is a need to continue monitoring the quality of iodised salt at different levels of distribution and consumption to ensure the success of the activities of the National Iodine Deficiency Disorder Control Programme (NIDDCP).

## **Diet and oral cancer - a case control study**

MPR. Prasad\*, TP Krishna\*, S Pasricha\*, MA Quereshi\*\*, K Krishnaswamy\*

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 2: 259-264*

Apart from strong genotoxic carcinogens, other environmental factors are implicated in both causes and prevention of cancers. A hospital based case control study was conducted to examine the role of diet in the aetiology of oral and oropharyngeal cancers. In this article, past dietary intake and nutrient estimates, obtained through diet history method and biochemical nutritional status at the onset of the disease are presented. The results of the study suggest that poor dietary intake of vegetables and fruits coupled with low estimated intake of betacarotene, thiamine, riboflavin, folate, vitamin C, iron and copper, modify the risk potential. The biological indicators of the nutritional status such as plasma vitamin A, E, red cell folate and plasma zinc were significantly reduced in cases and yielded moderate risk estimates. The risk estimates though of moderate magnitude are of importance in relatively homogeneous subjects with respect to diet and nutrition.

The findings are in line with several other epidemiological observations. The combined effects of micro nutrients appears to be protective in countering the adverse effects of exogenous exposures to tobacco. The protective role of vegetables and fruits is of potential interest in terms of etiologic causes and prevention.

## **The effects of McDonalds, Kentucky Fried Chicken and Pizza Hut meals on recommended diets**

Nasseem M Malouf, , Stephen Colagiuri

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 2: 265-269*

The objective was to study the effect of three common takeaway meals on recommended healthy diets. New South Wales Department of Health recommended diets of 5020, 6275, 9205 and 12,540 kilojoules were used. An evening meal from each of these diets was substituted with one of three common fast food chain takeaway meals 1, 2, 3 and 5 times per week. The 3 takeaway meals were from McDonalds, Pizza Hut and Kentucky Fried Chicken. The effects of each of these meals on average daily kilojoule, fibre, fat, P/S ratio, protein and carbohydrate intakes were assessed.

The takeaway meals were high in fat and kilojoules and low in fibre and therefore contravened the Dietary Guidelines for Australians. Addition of these meals increased average

kilojoule consumption and the percentage energy contribution of fat and decreased the P/S ratio and fibre intake. The magnitude of these deleterious effects was directly proportional to the number of times the meals were included each week and inversely proportional to the energy content of the diet. The adverse effects were greatest with the McDonalds and Kentucky Fried Chicken meals.

Takeaway meals may be convenient but the meals which were tested were too high in fat and kilojoules and too low in fibre to be a regular part of a balanced diet. Even one takeaway meal per week adversely affects the lower kilojoule recommended healthy diets.

## **Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 3**

### **Cardiovascular risk factor prevalence in three Chinese communities in 1989**

Xuxu Rao, Bridget H-H Hsu-Hage, Mark L Wahlqvist, Yihe Li, Xiaoqing Liu, Kui Zhang, Tiehan Kuang, Daolin Zhang, Zongrong Dai, and the Australia-PR China Collaborative Health Study team

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 3: 278-286*

The cardiovascular risk prevalence of 935 adult Chinese living in Chauzhou, Meizhou, and Xinhui cities of Guangdong Province, China, is reported. The three communities are geographically separated, and represent the three major dialect group in Guangdong Province (Teochew, Hakka and Cantonese respectively) which are also the major donor populations of overseas Chinese to Australia and South East Asia. Taking into account historical data, the conventional cardiovascular risk factor prevalence of these combined communities in China as a whole is on the increase and approaches or even exceeds that in Western Society. However, the three communities are not very alike in their prevalences of individual conventional cardiovascular risk factors, notably for hyperlipidaemia (most prevalent in Chauzhou), hypertension (most prevalent in Chauzhou men at 12.4% and least in Meizhou women 5.0%) and cigarette smoking (most prevalent in Xinhui men at 72.7% and least in Xinhui women, 0%). They are similar in stature, body weight, BMI, and waist-to-hip ratio, with very low prevalences of overweight/obesity, or abdominal obesity. An understanding of the contributors to sub-ethnic difference in cardiovascular risk should emerge with further study of these Chinese populations.

### **Continuing medical education in clinical nutrition**

Neil Paget

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 3: 301-303*

To achieve better promotion and acceptance of clinical nutrition at all levels of public and medical education requires involvement in educational services based on sound educational theory and practice. Adult learning theory has established principles that support effective learning which, in turn, influence people's attitudes and behaviour. Application of these principles in Continuing Medical Education implies that as much emphasis must be placed on the educational skills necessary to produce self-directed lifelong learners as on clinical content. This article presents guidelines to assist in the planning and implementation of activities in clinical nutrition, and offers illustrative examples from other disciplines.

Review article

## **Diet, hyperlipidaemia and cardiovascular disease**

Jonathan M Hodgson, Mark L Wahlqvist, Bridget Hsu-Hage

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 3: 304-313*

Reviewed here are results of intervention studies examining relationships between diet and hyperlipidaemia, or diet and cardiovascular disease (CVD). A reduction in the intake of saturated fatty acids (SFAs) and trans-fatty acids (TFAs), and an increase in the intake of polyunsaturated fatty acids (PUFAs), are favourable to lipoprotein status. Where a reduction in total fat intake is achieved by a reduction in dietary SFAs, there would appear to be a favourable effect on CVD events and mortality, although the evidence for this from intervention studies is not strong. Adequate dietary PUFA intake, both  $\omega 6$  and  $\omega 3$ , may be associated with reduced risk for CVD events more via pathways other than those which operate through lipoproteins. Other macronutrients including carbohydrates, proteins and alcohol can have significant effects on lipoproteins, although the effects of dietary intervention with these nutrients on coronary and total mortality are virtually unknown. Non-nutrient components of foods with small lipid lowering properties may be cumulatively important in an overall diet. In relation to food, results of secondary intervention studies provide support for a beneficial role of plant food and fish in reducing coronary and total mortality. Therefore as far as both hyperlipidaemia and CVD are concerned, the total dietary approach may be more important than the single nutrient approach.

## **The relationship between linoleic acid level in serum, adipose tissue and myocardium in humans**

Peter T Sexton, Andrew J Sinclair, Kerin O'Dea, Andrew J Sanigorski, Jan Walsh

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 3: 314-318*

A cross-sectional study of 80 consecutive cases at necropsy was undertaken to determine the relationship between linoleic acid in the serum, adipose tissue and myocardium of humans. The sample consisted of 55 males and 25 females aged 7 to 92 years who had died from cardiac and non-cardiac causes in the Southern Region of Tasmania, Australia. Fatty acids were extracted

from samples of serum, adipose tissue and myocardium and separated using capillary gas liquid chromatography. Means and standard deviations were calculated for each of the main fatty acids in the three tissues studied. In serum and adipose tissue, there were significantly higher levels of linoleic acid ( $p < 0.001$  and  $p < 0.001$  in serum and adipose tissue, respectively) and total n-6 fatty acids ( $p < 0.002$  and  $p < 0.001$  in serum and adipose tissue, respectively) and significantly lower levels of oleic acid in females than in males ( $p < 0.001$  and  $p < 0.05$  in serum and adipose tissue, respectively). In serum and adipose tissue, the ratio of total n-6 to total n-3 fatty acids was significantly higher in females than males ( $p < 0.02$  and  $p < 0.001$  in serum and adipose tissue, respectively). In myocardium, there were significantly higher levels of oleic acid ( $p < 0.05$ ) and linoleic acid ( $p < 0.001$ ) and significantly lower levels of arachidonic acid ( $p < 0.001$ ) and docosapentaenoic acid ( $p < 0.02$ ) in females than males. Total n-3 fatty acids in myocardium were significantly lower in females ( $p < 0.001$ ) resulting in a significantly higher ratio of total n-6 to total n-3 fatty acids in females ( $p < 0.001$ ). Highly significant Pearson correlations were found between levels of linoleic acid in adipose tissue and myocardium ( $p < 0.0001$ ), between adipose tissue and serum ( $p < 0.001$ ) and between serum and myocardium ( $p < 0.001$ ). The proportion of total polyunsaturated fatty acids (PUFA) in the myocardium was inversely related to the proportion of monounsaturated fatty acids ( $p < 0.001$ ) and inversely related to the proportion of saturated fatty acids ( $p < 0.001$ ). There was a significant positive correlation between the ratio of linoleic acid to linolenic acid in all three tissues. This study showed that there was a very strong relationship between the level of linoleic acid in adipose tissue and myocardial tissue, which suggests that dietary linoleic acid influences the level of myocardial linoleic acid. These findings support the hypothesis that dietary linoleic acid has a direct influence on myocardial membrane linoleic acid levels.

## **Nutritional status of women and children in Malaysian rural populations**

Osman Ali & Zaleha Md Isa

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 3: 319-324*

This study was conducted to investigate the nutritional status of the rural population in Malaysia, especially women and children. A total of 262 women aged 18 and over and 183 children aged 2-6 years were selected using multistage cluster sampling from four locations in rural areas. It was found that the prevalence of malnutrition among children 2-6 years old ranged between 25.5% in the Malays Felde settlement scheme to 80% in the Orang Asli settlement. Malnutrition was associated with worm infestations, bottle feeding and early weaning. More than 30% of Orang Asli women were malnourished compared to less than 15% of Malay Felde settlement women. On the other hand, Malay women in the land settlement scheme had a higher risk of developing overweight and diabetes. Goitre was found among 11.5% of children; however, no cretinism was found. Breast feeding was still a common practice among rural mothers, but inadequate health education tended to reduce the duration of breast feeding and increased early weaning. Upgrading women's status in the rural areas will ultimately improve the nutritional and

health status of the children and community as a whole.

## ***Abstracts from a conference on healthy eating, aspartame, and chronic non-communicable disease. Beijing, and Shanghai, 1994***

### **Preventive nutrition and health: an Asia-Pacific perspective**

Mark L Wahlqvist

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 3: 325*

The economics and socio-demography of the Asia-Pacific region are changing rapidly. With these changes come changes in the food supply, food intake and related health advantages and problems. The nexus between protein-energy malnutrition in the young is being replaced by a nexus between nutrient excess, with associated food component deficiencies, and non-communicable disease in an ageing population. A food supply which is abundant, refined and fatty characterises the present situation. The early expressions of abdominal fatness, with its attendant metabolism dysfunctions and health sequelae, are indicative of the transitional health problems. These include cardiovascular disease, diabetes, certain cancers, osteoporosis and immune deficiency. Urbanisation and population pressures will be eased by innovations in food production and food technology, with attention to the full risk-benefit equation for individuals and the need for an environmentally sustainable food supply. Prevention will depend on how well the region manages each of these dimensions.

### **Nutrition transition in China: the growth of affluent diseases with the alleviation of undernutrition**

Xiao-Shu Chen, and Ke-You Ge

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 3: 287-293*

Since 1950, the annual GNP in China increased from 104 to 1401 Yuan per capita, while household real purchasing power quadrupled. In addition, food production and distribution also rose. China's improved standard of living has brought about several health changes: a reduction in diseases of poverty (high infant mortality, communicable disease, nutritional deficiency), the doubling of life expectancy from 35 years in the 1950s to 67 (male) and 71 (female) years, but it has increased diseases of affluence, such as obesity and cardiovascular disease. The three leading causes of death in China today are cancer, cerebrovascular disease, and myocardial infarction, while deaths from tuberculosis and acute infectious illness are markedly reduced. About 60 million of the population suffer from hypertension and a quarter that number has diabetes. Because China is a vast territory with different levels of development and types of diet, pockets of nutritional deficiency remain; about 35 million people are undernourished. While most of the

population receive sufficient macronutrients to satisfy the Chinese RDA, they frequently lack micronutrients. Childhood rickets and iron deficiency anaemia are prevalent in rural regions and close to half of the children under three years of age in the autonomous regions and provinces suffer from these conditions.

Chinese diets are changing. They are becoming more westernised and people are consuming more food of animal origin. This is most noticeable in cities where, in 1988, fat accounted for 30% of the caloric intake (up from 26% in 1981). In urban areas about 10% of woman and 5% of men are now obese. China is encouraging citizens to eat a variety of foods along more traditional lines, with plant foods constituting the bulk of intake, and a lesser amount of food of animal origin. In 1993, the State Council approved a national position paper entitled "Outlines for China's Food Structure Reform and Development in the 1990s". The government hopes that this will lead to a healthier national diet by the year 2000.

## **Studies on the relationship between changes in dietary patterns and health status**

Zhao Faji, Guo Junsheng, and Chen Hongchang

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 3: 294-297*

In order to study the relationship between dietary composition and health and disease, we investigated retrospectively the changes in diet composition, health status and disease specific mortality of the Shanghai population from 1950 to 1985. The results showed that remarkable changes occurred in dietary composition, health status and disease mortality. The energy from grain products decreased from 80-83% in the 1950s to 68-72% in the 1980s, and the energy from animal foods increased from 6.5-8.5% in the 1950s to 17.5-18.0% in the 1980s. With the changes in dietary composition, notable changes also occurred in the nutritional composition of the diet. From the 1950s to the 1980s, energy from fat was increased from 16.3-20.1% to 24.0-28.0%, and the energy from carbohydrates decreased from 72.0-73.5% to 62.2-65.8%. Almost certainly as a result of the changes in diet, health status and disease mortality also changed. For example, the average height in males of 18-20 years old increased from 164.89 cm in 1955 to 167.33 cm in 1974, and the average life span of males and females increased from 42.0 years and 45.6 years in 1950 to 72.1 years and 76.4 years in 1985, respectively. At the same time, the rank order of mortality causes also changed. Before 1950, the first three causes of death were measles, tuberculosis and senility, but in 1985 they were malignant tumours, cerebrovascular disease, and ischaemic heart disease. In particular, the mortality from ischaemic heart disease is now higher than in Japan. The causes of these changes may be the changes of dietary composition and nutritional composition of diet, although there are other factors. Therefore, changes in dietary composition which maintain or improve life expectancy, yet decrease the burden of chronic non-communicable disease is required.

## **Diabetes mellitus: classification, therapeutic aspects, interventions**

## **and complications**

Edward S Horton

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 3: 325*

Diabetes mellitus is a major cause of morbidity and mortality and is increasing in prevalence in many populations around the world. The most common form of diabetes is non-insulin dependent (NIDDM or Type II) diabetes, comprising over 90% of cases. Gestational diabetes mellitus (GDM) and impaired glucose tolerance (IGT) may be forerunners of NIDDM and when they are diagnosed appropriate interventions should be taken to prevent or delay progression to NIDDM.

Although the pathogenesis of NIDDM is not fully understood, at least three factors are important: a genetic predisposition, the presence of insulin resistance, and a defect in pancreatic B-cell function. Conditions associated with the development of insulin resistance increase the risk of NIDDM greatly. Chief among these are obesity, advancing age and decreased physical activity. Moderate degrees of weight reduction and increased physical activity are associated with decreases in plasma insulin, improved insulin sensitivity and lower plasma glucose levels. Appropriate diet, weight reduction and exercise programs are the first step in the prevention and treatment of NIDDM. If these are unsuccessful, oral hypoglycaemic agents or insulin therapy should be used to achieve blood glucose levels as close to normal as possible.

The Diabetes Control and Complications Trial has demonstrated conclusively that improved glycaemia in patients with insulin dependent diabetes (IDDM) is associated with a marked reduction in the development and progression of retinopathy, nephropathy and neuropathy as well as improved lipid profiles. It is logical to assume that these beneficial effects of improved glycaemic control will also apply to patients with NIDDM. Since many patients with NIDDM are not diagnosed, it is important to increase awareness of this disease, identify high risk populations and previously undiagnosed cases and implement life style changes in diet and physical exercise that will reduce the risk of developing NIDDM or provide effective treatment.

## **The epidemiology of diabetes mellitus**

Luo Bang Yao

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 3: 326*

Diabetes Mellitus is associated with external and internal factors. External factors include diet, nutrition, virus infection, urbanisation, immigration from industrial countries, intellectual profession and chemical agents. Internal factors are inheritance, race, obesity, ageing, and immune and neuro-endocrine status. About 10% (12 million) of the world's 120 million diabetics live in China and more than 90% of Chinese diabetics have Type II (NIDDM) diabetes. China's diabetic population is the second largest in the world (after the US). Incidence in China is climbing rapidly; onset increases after age 40 and peaks in the seventh decade. There is no gender difference; males and females are affected equally. The incidence of diabetes is 3-40

times greater in persons with a diabetes-positive family history. Even though the prevalence rate in China is low, a large reservoir of known and unknown diabetics exists. About a three quarters of China's diabetic population remain undiagnosed because many (around 50%) remain asymptomatic. Treatment of diabetes is improving but complications occur and many patients die from complications rather than the disease. Complications increase with age and they include microvascular disease, ketoacidosis, and neuropathy.

Glucose provides the body with energy. Glucose in the blood binds to a carrier protein which facilitates transportation and passage across cell membranes. It moves from areas of higher (extracellular) to lower concentrations (intracellular). Insulin controls glucose passage into the cell. When extra- and intracellular concentrations are equal, passage does not occur. Glucose in the cell is phosphorylated by hexokinase to glucose-6-phosphate (G-6-P) and little intracellular glucose remains free. G-6-P cannot exit the cell; it remains until metabolised to pyruvate or lactate (depending on oxygen levels). The final metabolic step is conversion via the tricarboxylic acid cycle to carbon dioxide and water. If G-6-P in the cell increases, glucose phosphorylation slows, and free glucose builds up in and outside the cell. Normally, unused glucose is stored as glycogen, mainly in liver and muscle. When glycogen capacity is exceeded, glucose is converted to triglycerides and stored in adipose tissue.

Aspartame, a sweetener 200 times sweeter than sugar, does not affect blood glucose homeostasis. It is safe for persons with chronic renal failure and diabetes. It has been approved for use in the general population, including pregnant women and children. It has no effect on plasma concentrations of insulin, cortisol, growth hormone and prolactin. The FDA and regulatory agencies of over 100 countries have approved its use.

## **Weight loss in severely obese subjects prevents type II diabetes and reverses insulin resistance and early type II diabetes**

Jose F Caro

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Obesity is associated with several disease states: diabetes, hypertension, abnormal cholesterol levels, and insulin resistance. Insulin resistance occurs when normal amounts of body insulin produce inadequate physiologic responses. Insulin resistance is common in type II (adult-onset) diabetes where it is associated with Syndrome X (hyper-insulinemia, hypertension, hypertriglyceridaemia, and atherosclerosis), possibly due to under compensation. Higher insulin concentrations for given glucose levels suggest the presence of insulin resistance and a glucose (mg/dl)/ insulin (p/ml) ratio lower than 6 (the SIMPDEX) is diagnostic. SIMPDEX investigations may be of value in evaluating insulin resistance in both non-obese and obese individuals. Since insulin resistance induces many metabolic derangements, special diets, exercise and weight loss need to be initiated in its management.

Impaired glucose tolerance (IGT), which affects 11-22% of the adult US population is also associated with obesity. Restricting caloric intake reduces IGT and lowers plasma glucose concentrations in the short-term. Dieting and weight loss may prevent or delay the onset of type

II diabetes. One of our studies indicates that type II diabetes, a genetic condition of unknown genotype, can be reversed or improved by weight loss. At present there is no effective drug for the treatment of insulin resistance, so weight loss and improved fitness remain the cornerstones of treatment.

## **HLA gene and clinical study of insulin dependent diabetes mellitus (IDDM) in Chinese individuals**

Wang Heng

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The prevalence rate of diabetes in China was 0.67% in 1980. For the last ten years, the prevalence rate has increased 0.1% every year. The total number of diabetics in China is enormous, in the range of 12-15 million people; 10% have insulin dependent diabetes (IDDM) and 90% have non insulin dependent diabetes (NIDDM).

**1) HLA Typing** DR3 was statistically increased in Chinese IDDM patients; relative risk 7.89, Fisher's  $p = 5.91 \times 10^{-6}$  corrected  $p = 4.14 \times 10^{-6}$ . DR3 is increased in most Caucasians and American Blacks, but not in Japanese individuals.

**2) HLA-DQA1 and B1 alleles contribute to susceptibility to IDDM** IDDM is strongly associated with the presence of arginine in position 52 of the DQ  $\alpha$  chain and absence of aspartic acid in position 57 of the DQ  $\beta$  chain in Caucasians. To confirm this association in Chinese, extensive oligonucleotide dot blot hybridisation of PCR-amplified DQA1 and DQB1 genes were studied using samples from 48 IDDM patients and 46 healthy non diabetic control subjects. DQ  $\alpha$  52-Arg and DQ  $\beta$  57-non-Asp are strongly associated with IDDM susceptibility as compared with controls ( $p < 0.001$  and  $0.006$ , respectively). DQ  $\beta$  57-non-Asp homozygosity is associated with increased susceptibility to IDDM. DQ  $\beta$  57-Asp homozygosity is associated with protection against IDDM; 14.6% of IDDM patients were homozygous for DQ  $\beta$ -Asp, compared with 0% of American patients; 22.9% of IDDM patients were homozygous for DQ  $\beta$  57-nonAsp, compared with 96% of American diabetic subjects in a previous study. These results suggest that the effect of the DQ  $\beta$  57-Asp variation on Chinese IDDM susceptibility is not as remarkable as in Caucasians, and there may be other alleles which contribute to IDDM susceptibility in Chinese individuals.

**3) Familial Aggregation and HLA Typing of Pedigrees in IDDM** In 280 cases with IDDM positive family histories of diabetes have been found to be present in 26.8% of IDDM probands. The prevalence of diabetes in relatives has been shown to be 68% in first degree relatives, 28% in second degree relatives and 4% in the third degree relatives. HLA data support the hypothesis that IDDM is a multigenic hereditary disorder.

**4). Clinical Features of Microvascular Complications in Long Term IDDM** One hundred sixty three individuals with IDDM of more than 10 years in duration were followed. Most complications were microvascular, such as proliferative retinopathy (39/163, 23.9%) and nephropathy (19/163, 11.7%).

We have found that the development and degree of microvascular complications depend on the age of onset, diabetes duration and the long term glycaemic control. Especially, microvascular complications were found to be significantly influenced by glycaemic control in the first ten years after onset.

## **Dietary intervention to reduce body weight in obese individuals: the usefulness of aspartame**

George L Blackburn, Beatrice S Kanders, and Philip T Lavin

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As China becomes more westernized, the incidence of obesity and diet related disease will increase. One strategy frequently used in treating obesity is to consume nutrient-modified foods. This study investigated the effect of using nutrient-modified foods containing the high-intensity sweetener aspartame on long-term control of body weight. Specifically, we evaluated whether the addition of foods and beverages containing aspartame to a multidisciplinary weight control program would improve weight loss and long-term control of body weight. One hundred sixty three obese women aged 20 to 60 years were placed on a 19-week balanced deficit diet (1000 + 200 kcal/d) and randomly assigned to either consume or abstain from aspartame-sweetened foods and beverages during the active weight loss (AWL) phase. Participants were encouraged to continue to consume or abstain from aspartame during the 2.6 year maintenance phase. Data were collected at 19, 71, and 156 weeks from baseline.

Women in both treatment groups lost a mean of 10% of body weight (10 kg) during the 19 weeks of AWL. Among participants in the aspartame group, aspartame consumption was positively associated with weight loss ( $p=0.05$ ). During maintenance (week 71), participants in the aspartame group had a 3.1% weight regain, while those in the non-aspartame group regained an average of 4.9%. By week 156, participants in the aspartame group had regained an additional 2.4% (net weight loss from baseline of 5.1%) compared with a gain of 5.4% (net weight loss from baseline of 0.3%) in the non-aspartame group. Using multivariate analysis, the aspartame group retained significantly less weight during maintenance week 71 ( $p=0.05$ ) and week 156 ( $p=0.01$ ) than the non-aspartame group.

Among individuals consuming aspartame during a 19-week weight loss program, consuming more aspartame was associated with a greater weight loss. At weeks 71 and 156 of maintenance, participation in a multidisciplinary maintenance program that incorporated aspartame-sweetened products was associated with better long-term control of body weight. These results suggest that the high-intensity sweetener aspartame may aid in the long-term control of body weight and should be considered by the Chinese as a strategy for the treatment and prevention of obesity.

## **NutraSweet: an overview of metabolism, safety, and usefulness**

Christian Tschanz, Harriett H Butchko, Wayne Stargel, and Frank Kotsonis

NutraSweet brand sweetener (L-aspartyl-L-phenylalanine methyl ester), known generically as aspartame, provides the clean, sweet taste of sugar to products but without the calories. NutraSweet is unique among high-intensity sweeteners because it is metabolised by enzymes in the gastrointestinal tract to three naturally-occurring dietary components - aspartic acid, phenylalanine, and methanol. NutraSweet provides very small amounts of these components to the everyday diet compared with common foods.

Prior to its approval by regulatory agencies around the world, the safety of NutraSweet was demonstrated by extensive metabolism, pharmacology, and toxicology studies in animals. In addition, studies were done in healthy humans, including both adults and children, as well as in special subpopulations, including obese individuals, diabetics, lactating females, and individuals who have an impaired ability to metabolise amino acids, such as individuals for the genetic disease, phenylketonuria, and individuals with renal and liver disease. The results of these studies demonstrated that NutraSweet is a remarkably safe sweetener.

In addition, since NutraSweet provides the sweetness of sugar without the calories, it may be a useful part of a diabetic meal plan, and it has been shown to be useful in promoting body weight control. As there are greater cross-cultural exchanges, including dietary patterns, both from East to West and West to East, this may be especially important to the Chinese people to help prevent the development of diseases associated with diet in the Western culture.

## **High-intensity sweeteners: overview of safety and toxicology**

John A Thomas, Ph.D. and Lin Xiong, MD

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Bulk sweeteners are generally carbohydrates, providing energy (calories) and bulk to food. On the other hand, high-intensity sweeteners possess a sweet taste, but are non-caloric and provide essentially no bulk to food. There are several different high-intensity, low-calorie sweeteners. Some of the sweeteners are naturally-occurring, while others are artificial or synthetic. The chemical formulas of the different sweeteners vary considerably, but generally they are relatively low molecular weight substances. They may range from simple dipeptides (eg, aspartame) to complex organic molecules (eg, stevioside). Most of the more commonly available high-intensity sweeteners and/ or their metabolites are rapidly absorbed in the gastrointestinal tract. For example, acesulfame-K and saccharin are not metabolised and are excreted unchanged by the kidney. Sucralose, stevioside, and cyclamate undergo degrees of metabolism, and their metabolites are readily excreted. Gastrointestinal flora may, in part, assist in the metabolic breakdown depending on the parent compound. Unlike the other high-intensity sweeteners, aspartame is not absorbed intact but is metabolised in the gastrointestinal tract to naturally occurring dietary components.

The potential toxicity of a particular high-intensity sweetener varies. None of the more highly used high-intensity sweeteners are mutagenic, but large doses of cyclamate or saccharin in rodents have been associated with the production of bladder tumours. There is no evidence of

the available high-intensity sweeteners being teratogenic or embryotoxic. High-intensity sweeteners are often non-cariogenic-- they do not support growth of oral cavity micro-organisms, and hence may be useful in preventive dentistry. Thus, the use of safe, high-intensity sweeteners in food products provides the Chinese people the opportunity to enjoy sweetness of sugar without the extra calories or cariogenic potential.

## ***Abstracts from the 4th Australasian Clinical Nutrition Society (ACNS) Scientific Meeting, Sydney, September 25, 1994***

### **Developing an “Essentials of Nutrition” manual for medical students**

P Craig, L Campbell, P Baume

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**Background:** Nutrition has not been a major focus of the undergraduate medical curriculum at the University of NSW. The position of nutrition co-ordinator, appointed in 1987, was not renewed after 1991. A review of the curriculum in 1988, updated in 1994, revealed an appreciable nutrition content in the course, which was not labelled as ‘nutrition’ and not linked together to form a comprehensive nutrition module.

A nutrition manual was prepared for medical students in 1990. It contained nutrition material considered important for medical graduates, but not included in the undergraduate course at that time. The subsequent lack of a nutrition co-ordinator meant that students were seldom, if ever, referred to the manual. A tool which would help students to integrate and use important nutrition concepts was required.

**Aim:** The aim was to prepare a practical guide on nutritional assessment and the management of common nutritional problems encountered in practice by the newly graduated doctor. The purpose was not to cover all nutrition principles comprehensively; rather to alert the graduate to existing resource material, which could be easily accessed in everyday practice.

**Methods:** The structure of the manual was based on a general nutrition assessment model, including basic elements of physical assessment and anthropometry, clinical, dietary, and laboratory assessment. The same basic model was used for several common nutrition-related conditions, with different elements receiving more or less emphasis, depending on their importance to that condition. A management outline was also included for each condition. Where possible, experts in these areas within the Faculty were involved in the preparation. Key information on reference values, useful tools such as dietary questionnaires, case studies, and relevant, succinct articles on the rationale behind decisions were included in the resource section. A list of relevant further reading was also included.

**Results:** So far, nutritional assessment and management outlines have been prepared for obesity, hyperlipidaemia, diabetes, food allergy/ intolerance, for the elderly and children. Their

value as reference tools are currently being evaluated.

## **Clinical nutrition in postgraduate medical education**

Mark L Wahlqvist

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There are opportunities for health improvement in each of the major disciplines of medicine through engagement in clinical nutrition, general medical practice, paediatrics, internal medicine, surgery, psychiatry, obstetrics and gynaecology and investigative services. This may apply at the primary, secondary and tertiary levels of health care. At present, some major gains are being made in general practice, internal medicine and surgery. The RACGP and the RACP now formally recognise nutrition in their training programmes; it is possible to undertake advanced training in nutrition for the FRACP. More work is required in training posts, rotations between them, and ultimate career development. But, as a first step, each teaching hospital in Australia could be reasonably expected to have an identifiable appointee on the senior medical staff in clinical nutrition. This would then provide a resource for further training inside and beyond the hospitals. What would a physician in clinical nutrition do? At Monash Medical Centre, the Clinical Nutrition and Metabolism Unit (CNMU) directs the following clinical programmes, both inpatient and ambulatory:

1. Eating and body composition disorders
2. Complex metabolic problems and inherited metabolic disorders (eg. lipid disorders, osteogenesis imperfecta, PXE)
3. Bone health
4. Nutrition support for wasting disorders (oral, enteral, TPN)

The Clinical Nutrition & Metabolism Unit personnel are also actively involved in health promotion through the hospital's Health Promoting Hospitals project and in other ways.

At the postgraduate level, clinical nutrition cannot prosper unless the scholarship of the discipline prospers through research and publication, and through the promotion of the relevant special society.

## **Antigen absorption: food, fire or fuel?**

KR Kamath

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The epithelium of the gastrointestinal tract is constantly exposed to a variety of antigens. In healthy individuals, only small amounts of ingested dietary antigens are absorbed. The normal immune response to absorbed food antigens is one of tolerance, which enables food antigens to play their nutritive role without causing disease (antigens as food). Breakdown in tolerance results in a spectrum of abnormalities, including food sensitive enteropathy and food intolerance

(antigens as fire). When food sensitive enteropathy is subclinical, continued ingestion of the offending food antigen results in tolerance and resolution of the enteropathy. We have observed this phenomenon in infants with soy protein (SP) enteropathy. In a significant proportion of these SP tolerant infants, the development of tolerance to SP can be prevented by interrupting the SP feeds by cow's milk protein (CMP) feeds. Is the breakdown in tolerance to SP induced by CMP in these infants an example of CMP acting as fuel for the fire of SP? While genetic constitution seems to be the major player in the heightened IgE responsiveness in atopic disorders, environmental factors such as breast feeding, immune responsiveness and epithelial integrity of the gut at the time of introduction of new food antigens to the diet and additive effects of different dietary antigens in potentiating gut mucosal injury seem to be more important in the pathophysiology of food sensitive enteropathies in infants.

## **Food allergy and food intolerance in young children**

Velencia Soutter, Anne Swain, Robert Loblay

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Adverse reactions to food are common in young children. A clear understanding of the differences between food allergy (immunological) and intolerance (non-immunological) is necessary in order to plan investigation and dietary management.

A food allergy is an IgE-mediated reaction to one or more food proteins. Food allergies occur in highly atopic infants and young children who have eczema and cause an immediate reaction around the mouth which may be followed by vomiting, hives, swelling, breathing difficulty and shock. Because specific antibodies are present in the blood, skin prick testing is a reliable way to confirm a food allergy but must be interpreted carefully in the clinical context.

Egg, cow's milk and peanuts are the three most common food allergens. Sensitisation occurs in the first 3-4 months of life, through breast milk or via direct feeding. Avoidance and advice to deal with accidental contact are the only forms of treatment. Food allergies tend to remit with time, but may persist in very atopic children. In 68 children with eczema, the incidence of food allergies was 79% before 10 months and 23% at 7 years. Allergy to more than two foods is very uncommon. In a separate study of people with eczema, food chemical intolerance reactions were shown to irritate the rash in 47%.

Food intolerance is a reaction to chemical substances found in many foods. Symptoms are dose-related and may be cumulative from eating a range of foods containing the same substance. Symptoms include irritable behaviour, headaches, gastrointestinal symptoms, rhinitis, leg cramps, recurrent hives or aggravation of asthma and eczema. Symptoms can be isolated or occur in any combination and vary with time. The reaction can be within thirty minutes or up to 48 hours after eating a problem food. Although preservatives and the salicylates are most likely to cause reactions, the range of substances that affect a sensitive person is highly individual. Fruit, fruit flavoured food and drinks and savoury snacks are likely to be implicated from the history. Food chemical intolerance can only be assessed by means of an appropriate elimination diet and challenge protocol. Blood and skin tests are not helpful or appropriate to identify

problem foods.

Atopic infants and young children can have a complicated food reaction history due to the coexistence of food allergies and food chemical intolerance

## **Assessment of isoflavones on serum lipids and lipoproteins**

DM Colquhoun, BJ Hicks, GE Kelly

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Epidemiological studies suggest that phenolic compounds, flavonoids and isoflavonoids prevent coronary heart disease. There are over 3000 of these compounds occurring naturally. They are reported to have oestrogenic, antioxidant and antiatherosclerotic activity. To assess the mechanism of the putative cardio-protective effect of these phenolic compounds, we assessed the effect of supplementation on serum lipids and lipoproteins in humans. The major isoflavones, daidzein and genistein, were given 100 mg per day in tablet form, a dose less than in some Asian and Mediterranean diets. Twenty-three healthy subjects (13 male, 10 female) aged 28 to 67 years not on cholesterol-lowering nor hormonal drugs were enrolled in a blind crossover study. Subjects were allocated either a placebo or an active concentrate for one month, then switched to the alternative tablets. The results found no significant difference in total cholesterol between treatment or placebo phases and baseline (baseline- 6.28 mmol/L, Isoflavone- 6.12 mmol/L, placebo 6.21 mmol/L). Similarly the other lipid parameters measured (triglycerides, HDL, Lp(a), Apo A1 and Apo B) also showed no significant change from baseline. Isoflavone supplementation did not favourably effect serum lipids nor lipoproteins in this group of healthy volunteers. Modification of lipid profile is unlikely to be the mechanism of the putative cardio-protective effect of isoflavones.

## **Varying content of polyphenols in olive and other edible oils - a neglected aspect of nutrition and cardio-protective diets**

DM Colquhoun, BJ Hicks, AW Reed

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The traditional Mediterranean diet may be high in monounsaturated fat and is associated with a lower incidence of coronary heart disease (CHD). The monounsaturated fat is largely derived from olive oil. The polar fraction of the oil contains over one hundred minor constituents. There are 10 polyphenols that occur frequently in olive oil. Phenols have antioxidant, vasodilator, anti-arrhythmic activities and may elevate high density lipoprotein (HDL).

The total polyphenolic content of three grades of olive oil and 10 commercially available vegetable and seed oils were estimated by spectrophometric analysis. Extra virgin olive oil had the greatest amount of polyphenols. Other olive oils and macadamia oil had levels of polyphenols approximately 20% of the extra virgin level. The other oils had either half this level or no detectable polyphenols.

Polyphenolic content in edible oils varies considerably. The content may be of biological significance, and relevant in designing an optimal cardio-protective diet.

## **Potential benefits and concerns for Otago vegetarians**

D Alexander, M Ball, J Mann

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Vegetarians have a lower incidence of a number of chronic diseases, such as coronary heart disease, diabetes, obesity, gallstones and arthritis<sup>1</sup>. However, there is concern that some people eating a vegetarian diet may not obtain an adequate intake of some nutrients, particularly iron and vitamin B12. In New Zealand the recommended daily intake (RDI) for iron follows the Australian Recommendations and is 12-15 mg for adolescents and menstruating women, and 7 mg for men and post-menopausal women<sup>2</sup>. Recent studies indicate that median intake of New Zealand women is below this<sup>3</sup>. Individuals on a diet with poor iron bioavailability, or women with high menstrual losses might be particularly at risk of developing iron deficiency.

The nutritional intake of 50 adult vegetarians (5 vegans) and 50 age-sex matched omnivorous controls was assessed using twelve day diet records. Protein, fat, saturated fat and vitamin D intake were significantly lower in the vegetarians, particularly in the vegans. Dietary fibre was higher in the vegetarians, and intake of calcium and zinc was similar, although vegans had a lower calcium intake. Mean (SD) iron intake in the vegetarians and vegans of 16.8 (4.8) mg/day was significantly greater than that of the omnivores - 14.6 (4.3) mg/day (P<0.02). All the iron consumed by the vegetarians was non-haem; for the omnivores 10% was haem iron.

Serum ferritin concentrations were significantly lower in male vegetarians than omnivores; mean (SD) - 36.6 (36.0) and 105.4 (78.7) ng/ml respectively, P<0.01 and significantly more had values below 12 ng/ml (P<0.001), despite having iron intakes well above the Recommended Nutrient Intake (RNI). Female vegetarians also had lower ferritin concentrations; mean (SD) 13.6 (7.5) compared to 33.6 (54.3) ng/ml, P<0.01, and medians of 12.3 and 15.5 ng/ml respectively, but similar numbers of women had values below 12 ng/ml (42% and 39%) regardless of whether they were vegetarian or not.

Vitamin B12 intake appeared significantly lower in the vegetarians, and all the vegans had intakes below the RNI. Thirty-five percent of the long-term vegetarians and vegans had serum vitamin B12 concentrations below the reference range.

Thus, although the vegetarians had diets nearer to the recommended diet with a lower fat and salt content and more fibre, a significant number need advice to improve their haematological status, as do some omnivores. Recommended intakes of iron may also need to be higher for vegetarians, particularly men.

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## **Nuts a balanced food: an important component of an anti-atherosclerotic diet**

David M Colquhoun

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Nuts have been part of the human diet from prehistoric times through to the present day. In contemporary hunter gatherer communities, wild beans and nuts are the major sources of vegetable protein. Indeed in some groups, nuts are the major dietary staple. In the Mediterranean countries from the dawn of civilisation through to the present day nut consumption has been a regular part of the diet.

Regular nut consumption is associated with low risk of coronary heart disease (CHD) and this has been found in two independent epidemiological studies. Nut consumption five or more times per week was associated with 53% risk reduction of CHD in a six year follow up of 31,000 participants in the Adventist Health Study. The five year follow up of 35,000 white women in the Iowa Women's Study showed a 40% risk reduction in regular nut consumers.

There have now been five studies that have shown a decrease in total cholesterol and LDL with preservation of HDL when saturated fat and carbohydrates are replaced with nuts. A diet reasonably high in fat but enriched with nuts is generally as effective as an American Heart Association Phase II or III cholesterol lowering diet.

Nuts generally are rich sources of monounsaturated fat, predominantly oleic acid. The Macadamia nut is the richest diet source of palmitoleic acid. A diet enriched with oleic acid is associated with decreased susceptibility of oxidation of LDL, improvement of fluidity of the HDL which is associated with a greater ability to stimulate cholesterol efflux from cells, and an increase in the fluidity of LDL which decreases the atherogenicity. Nuts are also rich sources of arginine and have a favourable lysine:arginine ratio which is associated with less diet induced atherosclerosis beyond the serum cholesterol level reduction. Nuts are also rich sources of fibre, magnesium, potassium and possibly boron.

Nuts have been consumed by humans since the dawn of time and recent studies show that regular consumption is associated with a low incidence of CHD. Metabolic studies show that regular nut consumption is associated with lowering of serum cholesterol and there may be other metabolic benefits in addition to cholesterol lowering. Nuts are a food source rich in many components. They may help prevent atherosclerosis, enhance the flavour of food and should now be considered as an important component of a cholesterol antiatherosclerotic diet.

## **Studies on lipoprotein(a) in a Melbourne Anglo-Celtic population**

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**Background:** A high level of serum lipoprotein(a) [Lp(a)] is now widely recognised as an independent risk marker for atherosclerosis and 300 mg/L is the generally accepted risk threshold value. Recently, there has been an increased interest in the distribution of Lp(a) levels in various ethnic populations.

**Aims:** This study investigates the distribution of Lp(a) in a Melbourne Anglo-Celtic population and assesses the relationship between Lp(a) and other lipids.

**Methods:** Serum Lp(a) was examined in 348 Anglo-Celtic Australians (male 157 and female 191), aged 24-86 years and resident in Melbourne. Serum Lp(a) was quantified using an in-house immunoturbidimetric assay on a Cobas Fara analyser (Roche). Apo(a) isoforms were identified by SDS polyacrylamide gel electrophoresis.

**Results:** The distribution of Lp(a) concentrations was highly skewed towards lower levels in this Anglo-Celtic population with 36% of the values being less than 100 mg/L and 68% below the generally accepted risk threshold of 300 mg/L. Apo(a) phenotypes S3, S4 and S5 (homo- and heterozygous) forms were identified in 48% of this population, with the lower molecular weight isoforms (F, B, S1 and S2) comprising 52% of the total. Correlations between Lp(a) and other lipid indices are shown in the table.

**Spearman partial correlation coefficients (adjusted for age) between Lp(a) concentrations and lipid indices**

Lp(a) levels	Total	Male	Female
Cholesterol	0.09	0.13	0.07
Triglyceride	-0.11*	-0.17*	-0.06
HDL	0.03	0.03	0.04
LDL	0.14*	0.2*	0.09
LDL/HDL Ratio	0.07	0.09	0.06

\*p<0.05

**Comments:** The highly skewed distribution of Lp(a) and the inverse relationship between Apo(a) isoforms and Lp(a) concentrations in this population compares with other studies of Caucasian populations. A negative correlation between Lp(a) and triglycerides was confirmed. A positive relationship was found between Lp(a) and LDL but in both these instances, applied to the male cohort only. No correlation was found to exist between Lp(a) and any of the other lipid parameters.

**A forecast on the incidence of cardiovascular disease in a Sikh population**

HS Dhindsa and D Sullivan

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Despite a high rate of vegetarianism, the male Sikh population in Sydney has a higher atherogenic lipoprotein profile than the general Australian population. We have previously found

that the risk of cardiovascular disease (CD) in male Sikhs is significantly higher than that of their female partners. The aim of this study was to assess the total risk of CD in the Sikh community.

The subjects of this study were 102 (51 pairs) non-smoking married Sikh couples of age 25 to 70 years. Data on behavioural variables were collected by administering a questionnaire. Differences in the diets of male and female subjects were mainly in the drinking habits and vegetarianism. Blood pressure (BP) measurements were recorded before taking fasting blood samples for lipoprotein measurements. Age, sex, BP (systolic), smoking status, diabetic status, total cholesterol (TC) and high-density cholesterol (HDL) were used to calculate the expected percent incidence of CD in the Sikh population over next ten years as well as the standard expected percent risk of CD according to data from Framingham Heart Study data.

These preliminary results show that the risk of CD in the Sikh population in Sydney is expected to be significantly higher (almost double) than the estimated value for the population without risk factors ( $p < 0.005$ ) especially in females and younger males. The risk of CD in Sikh males are also expected to be significantly higher than Sikh females ( $p < 0.0005$ ). More data are being collected to increase the sample size of this study.

#### The mean values of the CD expressed as the percentage risk over next 10 years

	Age Years	BP Systolic	BP Diastolic	TC	HDL	Diet % Veg	Alcohol % Drinking	% Risk Standard*	% Risk Sikh**	p-value *vs **
Female	39.4	120.3	75.5	4.99	1.19	21.6	5.9	1.05	2.6	<0.005
51	±13.6	±19.8	±13.8	±0.97	±0.31			±1.04	±4.0	
Male	42.7	125.1	80.7	5.40	1.00	11.8	58.8	3.80	6.9	
51	±13.8	±16.9	±10.4	±0.98	±0.20			±3.80	±6.3	<0.005

### The effect of medium chain triglycerides on postprandial glucose and lipid metabolism in NIDDM and hypertriglyceridaemia

RDG Neely and DR Sullivan

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An exaggerated postprandial lipaemia may contribute to the increased risk of coronary artery disease associated with non insulin dependent diabetes (NIDDM) and hypertriglyceridaemia. Dietary substitution of medium chain triglycerides (MCT) may reduce postprandial lipaemia, as these are not re-esterified after absorption and are not incorporated into chylomicrons. However, preferential hepatic oxidation of medium chain fatty acids may adversely affect postprandial glucose metabolism via the glucose-fatty acid cycle. To investigate this possibility, indirect calorimetry was used to measure postprandial rates of glucose and fat oxidation over 9 hours in 13 hypertriglyceridaemic patients (5 NIDDM and 8 normal glucose tolerance; mean fasting plasma triglyceride  $3.8 \pm 0.4 \text{ mmol.l}^{-1}$  who were given isocaloric oral glucose ( $40 \text{ g.m}^{-2}$  body surface area) and fat ( $40 \text{ g.m}^{-2}$ ) loads containing glucose and long chain triglycerides alone (G + LCT) or glucose and a mixture of LCT and MCT (each  $20 \text{ g.m}^{-2}$ ; G + LCT + MCT) in a single-blind randomised crossover study. The oral glucose and fat loads were well tolerated by all subjects. When compared to G + LCT, the early (<6h) postprandial increase in glucose oxidation was reduced following G + LCT + MCT ( $p < 0.05$ ) while fat oxidation showed a

reciprocal increase ( $p < 0.05$ ). Postprandial triglyceride responses (9 hour incremental area under curve) were reduced by  $52.4 \pm 6.8\%$  (mean  $\pm$  SEM;  $p < 0.002$ ) following G + LCT + MCT, however glucose responses were unchanged in all subjects. We conclude that partial isocaloric substitution of MCT for LCT may lead to a marked reduction in postprandial lipaemia in hypertriglyceridaemic NIDDM and non-diabetic subjects without short-term adverse effects on glucose metabolism.

## **Postprandial lipoprotein metabolism in a subject with non insulin dependent diabetes mellitus and fish eye disease**

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There is an increased risk of coronary artery disease (CAD) in subjects with non-insulin dependent diabetes mellitus (NIDDM). Risk factors such as exaggerated postprandial lipaemia, elevated plasma triglycerides and reduced high density lipoprotein-cholesterol (HDL-C) are commonly seen in NIDDM. We have investigated the postprandial response following an oral fat load (40g fat, 40g CHO/m<sup>2</sup> body surface area) in a female hyperlipidaemic subject with NIDDM and an extremely low HDL-C level (0.1 mmol/L; <10% normal). The latter is caused by the HDL-deficiency disorder fish eye disease (FED), a condition where subjects are not at increased risk of CAD. Triglyceride-rich lipoproteins (TRL) of  $d < 1.006$  g/ml and a  $d > 1.006$  g/ml fraction (lipoproteins of intermediate, low and high density) were isolated by ultracentrifugation. HDL-C was measured after precipitation of apolipoprotein B-containing lipoproteins. Results were compared to control hypertriglyceridaemic (HTG) subjects with NIDDM ( $n = 2$ ). In all subjects, plasma total cholesterol (TC) and triglycerides (TG) increased postprandially and remained elevated over the 9 hr study, while HDL-C fell at 3 to 5 hr, and returned to fasting levels by 9 hr. Fasting HTG in controls was due to elevated TRL-TG (2.5 mmol/L), while fasting HTG in FED was due to an increased  $d > 1.006$ -TG but fasting TRL-TG (0.6 mmol/L) was within normal limits. In all subjects, the postprandial increase in plasma TG was due to TRL-TG levels which remained elevated at 9 hr. TRL-TG increased 1.7 mmol/L from baseline in both FED and controls. The postprandial  $d > 1.006$ -TG and apoB levels remained stable at 3.4 mmol/L and 2.36 g/L, respectively, in FED and 0.6 mmol/L and 1.35 g/L, respectively, in controls. We conclude that the overall pattern of postprandial changes in NIDDM are similar in the subject with FED compared to control subjects, despite the 10-fold difference in HDL-C and differences in TG distribution between TRL and the  $d > 1.006$  g/ml fraction.

## **Selected mineral interactions in women with child bearing potential**

Argiratos V, Abdallah SM and Samman S

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A significant amount of evidence suggests that micronutrient supplements are associated with a

reduced risk of pregnancy complications, including birth defects in humans and animals. Although positive arguments can be made for the implementation of supplementation in some women, a significant concern is that widespread supplementation may inadvertently lead to the consumption of excessive levels of some nutrients that would produce toxicity, deficiency or adverse mineral-mineral interactions.

We carried out 2 studies in women with child bearing potential to determine the effect of Ca supplements on Zn absorption and also the effect of Zn supplements on Cu metabolism.

To determine the effect of Ca on Zn absorption, the Zn tolerance test, which is the plasma Zn response to an oral Zn challenge, was used. Nine healthy subjects underwent 3 tests in random order, each time consuming either 4.5 mg elemental Zn, Zn with 600 mg elemental Ca as carbonate or as citrate. Venous blood samples were obtained at 30 min intervals for 4 hours. The area under the plasma Zn curve following the co-ingestion of Zn with Ca carbonate and Ca citrate was significantly lower ( $P < 0.017$ ) than when Zn was ingested alone. The substantial decrease in Zn absorption (80%) following the co-ingestion of Zn with the 2 Ca salts suggests that elemental Ca is the inhibiting factor.

In the second study, 6 healthy volunteers were asked to supplement their habitual diet with 50 mg of elemental Zn per day for 12 days. Zn concentrations were measured in the erythrocytes (E) and in the plasma by atomic absorption spectrometry. Cu status was assessed by the marker enzyme, E-superoxide dismutase (SOD). Zn concentrations in plasma and erythrocytes tended to increase ( $18.3 \pm 1.4$  vs  $20.1 \pm 1.0$   $\mu\text{mol/L}$  and  $35.6 \pm 3.4$  vs  $36.5 \pm 2.4$   $\mu\text{g/gHb}$ , respectively) however, E-SOD activity showed a significant decrease following supplementation ( $2371 \pm 168$  vs  $1843 \pm 76$  U/gHb,  $P < 0.02$ ). Thus, a detrimental effect of increasing Zn intake on Cu bioavailability is reflected by a reduction in the activity of E-SOD within 12 days of supplementation with Zn (4xRDI). Given the recent interest in Zn as an antioxidant, the aim of increasing the intake of Zn in the hope of promoting the cellular antioxidant potential must be balanced against the subsequent and rapid decrease in the activity of SOD.

If mineral supplementation is to be implemented, more information about mineral interactions is required and caution should be exercised to ensure that the total intake from supplements and the diet is not excessive.

## **Boron excretion in men: intra and inter individual differences**

MR Naghii, AP Verus and S Samman

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Numerous studies suggest that boron (B) interacts with other nutrients and plays a regulatory role in the metabolism of minerals, such as Ca, and subsequently bone metabolism. Although the mechanism of action has not been defined, it may be mediated by increasing the concentration of steroid hormones such as  $\beta$ -oestradiol (For review, see Naghii & Samman, *Prog Fd Nutr Sci* 14, 331-349).

The B content of foods is determined by different geological conditions and agricultural methods and therefore intake varies greatly. In the absence of universally applicable food

composition data, a reliable way of estimating B intake is by its urinary excretion (of iodine, fluoride). The aim of this study was to determine the magnitude and variation in B excretion in a group of healthy men (average age: 26y; BMI, 24; n=18). The subjects were not taking any form of medication or supplements and they were asked to maintain their habitual diet during the trial. Twenty four hour urine collections were obtained on 2 occasions separated by 3 weeks. B was analysed spectrophotometrically.

The mean concentration of urinary B was in the range 0.4-3.5 mg/day and the concentration was similar within individuals when expressed in absolute terms, relative to creatinine excretion or relative to body weight as shown in table.

**Urinary boron and creatinine excretion (mean  $\pm$  SE, n = 18)**

	<b>Occasion 1</b>	<b>Occasion 2</b>
Urinary B (mg/d)	1.87 $\pm$ 0.15	1.90 $\pm$ 0.23
Creatinine (mmol/d)	14.6 $\pm$ 0.7	15.4 $\pm$ 1.2
B/creatinine (mg/d)	0.13 $\pm$ 0.01	0.13 $\pm$ 0.01
B/body weight (mg/kg)	0.03 $\pm$ 0.01	0.03 $\pm$ 0.01

Excretion of anionic trace elements, such as B, is mainly through the urine and the magnitude of the daily intake is reflected by the 24-hour excretion. Any variation in B excretion (and therefore intake) is thought to be influenced by the concentration of B in the water supply, individual food preference, and ingestion of B as an ingredient of many personal-care products and food preservative. Based on our results, B intake in this group of subjects was approximately 2 mg/day and showed little variation in the short term.

**Is erythrocyte alkaline phosphatase activity a marker of zinc status?**

CL Soto, LJ Cooke, ZI Ahmad, E Farmakalidis & S Samman

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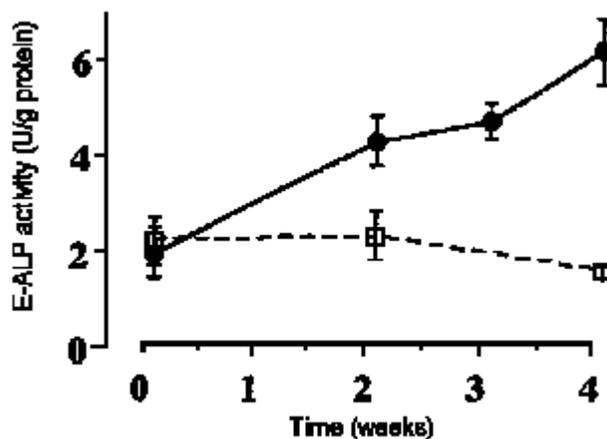
Alkaline phosphatase (ALP, EC 3.1.3.1) is a dimeric protein with each subunit containing two Zn atoms: a tightly bound atom which is essential for its structural integrity and a second, less tightly bound atom which is involved in the catalytic process. The activity of ALP in erythrocytes (E) decreases as a result of a low Zn diet which suggests that this enzyme may be a marker of Zn status. To investigate this further, we determined the response of E-ALP in healthy subjects following supplementation with 50 mg Zn (4.2 x RDI) daily for 4 weeks. If E-ALP is to be accepted as a marker of status, its activity should decrease with Zn depletion and subsequently increase during supplementation.

Ten male volunteers, took part in a trial lasting 4 weeks. Six subjects were asked to consume 50 mg Zn (as 220 mg Zn sulphate) and 4 subjects were not supplemented. E-ALP and indices of Zn status were determined.

Apparent compliance, as assessed by capsule count was 97.5 $\pm$ 2.4% (Mean  $\pm$  SE). All subjects were within the acceptable range of BMI and based on the 7 day weighed record data,

their Zn intake was adequate. A small but significant increase in plasma Zn was observed with supplementation ( $P < 0.05$ ), whereas, there was no significant change in E-Zn over the same period. Plasma and E-Cu showed no change. As shown in the figure, the activity of E-ALP increased in all supplemented subjects ( $P < 0.0001$ ).

Consistent with previous results, our data further support the hypothesis that E-ALP is a marker of Zn status as it has been shown to decrease in deficiency and increase during supplementation. The small change observed in plasma Zn is not biologically significant in view of the many documented factors which influence its concentration. No significant change in E-Zn was observed supporting the suggestion that E-Zn do not reflect changes in Zn status possibly because of the strict intracellular regulation of Zn concentrations. We suggest that measuring changes in metalloenzymes activities of erythrocytes may be a more useful approach for determining Zn status.



## Body composition in chronic anorexia nervosa

KM Kingham, JD Russell, BJ Allen & MA Allman

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Up to 25% of patients with anorexia nervosa (AN) can be considered chronic (1) and mortality among these is estimated to be as high as 20% (2). Little is understood about this patient group and there is need for a prognostic indicator for chronicity. The aim of this study was to examine clinical history and measure body composition in chronic anorexic women. This group could then be compared to both normal and other studied AN populations and relationships between clinical indicators and body composition examined.

Seven females were studied, from a total of 19, who fulfilled DSM-III-R criteria for the diagnosis of AN, with the exception of menstrual status. The average age was 34 ( $SE \pm 4$ ) yrs and duration of illness 17 ( $SE \pm 3$ ) yrs. A normal population was selected based upon having the same age as the subjects. In a subject interview, demography, medical history, diet history and weight related behaviours were recorded. Total body nitrogen was determined using in-vivo neutron-activation analysis (3) together with anthropometric measurements (4).

The chronic AN group showed significant depletion of both protein and fat compartments compared to the normals and was not dissimilar to that seen in studies of acute AN patients requiring refeeding (see table). Dietary energy intake was 50% of that recommended and although vitamin intakes were largely adequate, zinc intake was less than 40% of recommended for five subjects and iron less than 66% for three. No relationships between clinical indices and body composition were detected. A participation rate of 37% highlights the difficulties in studying this particular group, and more subjects will be required to further examine the existence of a predictive relationship between body composition and clinical history.

<b>Variables</b>	<b>Normals n=7 mean ± SE</b>	<b>Chronic AN n=7 mean ± SE</b>	<b>Acute AN (5) n=32 mean ± SD</b>
Body mass index (kg/m <sup>2</sup> )	21 ± 0.5	16 ± 0.7	15.4 ± 1.3
Nitrogen index	0.981 ± 0.04	0.775 ± 0.04	0.735 ± 0.11
Nitrogen/ lean body mass (g/kg)	36.3 ± 0.9	32.1 ± 1.1	--
Percent body fat	26 ± 1.3	16 ± 2.2	15.2 ± 5.0

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## Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 4

### Overview of the thrifty genotype hypothesis

Kerin O'Dea

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The thrifty genotype hypothesis was proposed by Neel in 1962 to explain the increasing incidence of diabetes in the western world. Since then it has been invoked frequently to explain the epidemics of obesity and non-insulin dependent diabetes (NIDDM) in populations all over the world as they have made the rapid transition to a westernised lifestyle in the twentieth century. An examination of the archaeological record indicates that human populations were exposed to nutritional stresses throughout history (both as hunter-gatherers and agriculturalists) which could have selected strongly for a "thrifty" metabolism. The metabolic basis of the

“thrifty” genotype has been attributed to selective insulin resistance, in which the gluco-regulatory pathways of insulin action are affected primarily, thereby promoting compensatory hyperinsulinaemia and overstimulation of those pathways less affected by insulin resistance such as those involved in fat deposition. Both physical inactivity and an energy-dense diet high in saturated fat and fibre-depleted carbohydrate have been shown to increase insulin resistance. Thus, key components of the western lifestyle act to exacerbate insulin resistance and facilitate weight gain, which itself also worsens insulin resistance. Finally, Hales and Barker have argued provocatively for a “thrifty” phenotype as the major predisposing factor in NIDDM: that poor nutrition in the perinatal period is associated with increased risk of NIDDM in adulthood, mediated either through sustained effects on  $\beta$ -cell function or insulin sensitivity. The difficulties in differentiating between “nature” and “nurture” in the aetiology of this complex condition cannot be overstated.

## **“Civilisation” and the thrifty genotype**

John S Allen and Susan M Cheer

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Over the past 30 years, Neel’s “thrifty” genotype concept has received much support from investigators interested in diabetes and the health consequences of changing from traditional to more westernised diets. In many cases, the “thrifty” genotype was interpreted in a local context by people working in a limited geographical area. It is increasingly clear, however, that the “thrifty” genotype effects are present in populations throughout the world. In fact, there is a good chance that the majority of the world’s population do indeed carry the “thrifty” genotype, although since a westernised diet is far from universally available, the negative consequences of the genotype have yet to be expressed.

Diabetes, obesity, and other diseases may indeed be the price paid for civilisation in the context of a “thrifty” genotype. We point out, however, that the negative consequences of the “thrifty” genotype seen in modernising populations with westernised diets today do not necessarily provide an explanation for why the “thrifty” genotype disappeared from some populations (mostly European and European-derived) in the past. Our assumption is that given its broad distribution today, the “thrifty” genotype was once universal in human populations; the problem then, is to explain the evolution of the “non-thrifty” genotype in those populations in which it is no longer seen.

The idea that “civilisation” has worked to select out (or relax selection for) the “thrifty” genotype is untenable, although this is the view accepted implicitly by most workers in the field. To be fair, it should be pointed out that they are mostly concerned with explaining the presence, not absence, of diabetes and other diseases in certain populations, and the “thrifty” genotype serves this purpose.

There are several reasons to not accept the face validity of the idea that civilisation has selected out the “thrifty” genotype:

- 1 The notion that agricultural populations are less susceptible to food stress and famine than

hunter-gatherer populations is quite contentious; in fact, the conventional wisdom has been at various times that agricultural populations are more susceptible to food shortages and are more prone to famine;

- 2 The dietary history of Europe, the part of the world where the “thrifty” genotype is least common, indicates that most people, most of the time lived under conditions of food stress; we will briefly review data pertaining to the Roman, Anglo-Saxon, and Medieval periods;
- 3 Agricultural populations in New World civilisations probably had diets that were no worse than those found in their Old World counterparts; the Old World diet of today and of the past 200 years or so is, of course, one greatly modified by the introduction of plants from the New World.

In summary, the idea that civilised populations have provided a flush dietary environment for thousands of years is insupportable, and opportunities for the expression of negative sequelae of the “thrifty” genotype in European populations, for example, have occurred only relatively recently (less than 100 years). In other words, all things being equal, a typical consumer in the year 1650 say, no matter where he or she lived, would have benefited more from possessing a “thrifty” genotype, than from not possessing it. But given that today most European populations would appear to have a “thrifty” genotype frequency of less than 10% (and some much less), and the opportunities for strong selection against the genotype have been relatively rare over the past few hundred years, how can we explain the high frequency of the “non-thrifty” genotype in these populations? We see four possible explanations:

1. *The traditional explanation.* It is absent in Europe because they have had the benefits of a westernised diet for centuries and paid the price for civilisation long ago. As discussed above, there are problems with this explanation.
2. *Chance.* The “thrifty” genotype may have been lost in these populations due to a genetic bottleneck at some point or some other random evolutionary factor. This seems unlikely given that there are good reasons to expect that it would be selected for; also it is difficult to test.
3. *Social factors.* In a complex, large-scale society, access to food and especially quality food may be influenced by factors far different from those seen in a hunter-gatherer society. After a period of food shortage, who comes out best in the end may depend less on metabolism and more on social status and economic power. This could lead to a relaxation of selection for the “thrifty” genotype, but it seems unlikely that it could have played a major role given that elites in a society are by definition rare.
4. *Interaction with another specific nutritional factor.* In most formulations of the “thrifty” genotype concept, the characterisation of the “civilised diet” is usually done in very general terms. However, particular dietary factors could interact with the “thrifty” genotype making it far less beneficial to its possessors. We suggest one such dietary factor- lactose.

Besides the “thrifty” genotype, Europeans are out-of-step with most of the rest of the world in that they (or at least most of them) can digest lactose (the sugar found in mammalian milk) throughout their lifetimes, and do not turn off the production of the enzyme lactase at weaning as most normal mammals do. Selection for this ability is clearly associated with the herding of

cows and other milk-producing animals, who provide a good, potentially steady nutritional source. More critically in the European context may be that lactose facilitates the absorption of calcium, and in high-latitude areas with low sunlight, acts as a substitute in calcium metabolism for vitamin D, which is normally synthesised with exposure to sunlight. Consumption of lactose therefore protects against rickets and other diseases or conditions associated with low calcium intake.

We have looked at more than 40 populations for which data are available concerning both lactose absorption rates and type II diabetes rates. Overall, there is an absence of populations exhibiting high lactose absorption rates and high diabetes rates. For the total sample, the (negative) correlation between lactose absorption and diabetes rate is significant although not particularly high. If we remove from consideration populations that were not likely to have had westernised diets (eg, in PNG, Africa, perhaps in Northern Canada) at the time of diabetes assessment, then the correlation is much stronger. Further, although the data for the Pima and Papago are in the “right” direction (ie, very low lactose absorption rates and high diabetes rates), their inclusion in the data set reduces the correlation as derived from the rest of the world’s populations, since their diabetes rates are almost double that for any other population. In summary, diabetes rates and lactose absorption rates are highly negatively correlated in populations with a westernised diet.

Why should this be the case? At a metabolic level, there is no direct link between the two. Whether or not one produces lactase in adulthood has nothing directly to do with how one deals with glucose in blood. In individuals with type II diabetes, there is no correlation with lactose absorption ability. However, studies indicate that although lactose is a disaccharide (glucose-galactose; the galactose is converted to glucose in the liver), it is absorbed very quickly into the bloodstream and is metabolised essentially as a simple sugar. Furthermore, the insulin response to lactose in milk is five times higher than would be expected, and approaches that for straight glucose. If there is a primary difference between westernised and traditional diets, it is the substitution of simple sugars in the diet in place of complex carbohydrates.

Since the correlation between lactose absorption and the “non-thrifty” genotype cannot be explained physiologically, then perhaps an historical explanation is worth considering. The consumption of lactose was selected for in certain populations, perhaps due to the combined effects of milk availability, high latitude, and the facilitation of calcium uptake. Individuals who consume milk do have an increased simple sugar load relative to that typically seen in a hunter-gatherer diet. Thus the ability to consume lactose constituted a change in the environment in which the “thrifty” genotype was expressed. Although there was not necessarily an overall increase in the quality of the diet or in calories available in these populations, there was a dietary stress that could have lead to selection against the “thrifty” genotype, especially if the short-term benefits of consuming lactose (which would have a greater influence in early life) outweighed the long-term benefits of the “thrifty” genotype.

## **Insulin resistance and low metabolic rate: do they cause obesity?**

Boyd Swinburn

Insulin resistance and obesity have genetic determinants which are separate and probably polygenic. Under certain environmental conditions, both probably offer selective advantages for survival. Under modern environmental conditions, a genetic predisposition to both would result in marked insulin resistance and be a major risk for the development of NIDDM. A low relative metabolic rate and a high insulin sensitivity have been shown to predict weight gain. However, upon the weight gain these “metabolic risks” appear to normalise thus raising doubts about whether these factors are truly aetiological. The thrifty genotype hypothesis remains a valid construct to explain the presence of common, genetically-determined factors which are currently detrimental to health, however, the original mechanisms proposed by Neel of an “efficient” metabolism or hyperinsulinaemia need considerable rethinking in light of 30 years of evidence.

## **Role of amylin in the regulation of energy metabolism in health and disease**

Garth JS Cooper

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Islet  $\beta$ -cells play a central role in the regulation of most cells in the body through secretion of the hormone insulin. These cells are now known to secrete a second hormone-like protein, amylin, which is the major protein present in the islet amyloid which accumulates in almost all patients with non-insulin-dependent diabetes mellitus.

Amylin stimulates the breakdown of glycogen and opposes the actions of insulin in skeletal muscle and liver through alterations it evokes in the activity of key regulatory enzymes such as glycogen phosphorylase and glycogen synthase. It acts as a noncompetitive antagonist of insulin in skeletal muscle, and is able to induce a state of insulin resistance and suppressed insulin secretion when administered to living animals. It has also been shown to potently increase blood concentrations of glucose and lactate, probably through stimulation of the indirect Cori cycle. These actions of amylin are consistent with a view that it is a physiological regulator of carbohydrate metabolism, acting in concert with insulin to promote the redistribution of carbohydrate from muscle glycogen to long term stores in adipose tissue.

It has been postulated that amylin is a newly-recognised endocrine hormone which regulates fuel metabolism in association with other metabolic, endocrine and neural influences. Moreover, excessive pancreatic production leading to elevated blood concentrations of amylin has now been shown to occur in numerous animal models, as well as in humans with impaired glucose tolerance and obesity. This defect has been advanced as a mechanism underlying the insulin resistance which accompanies, and may well cause these conditions.

This presentation will review currently available evidence concerning the role of amylin in the physiological and pathological regulation of fuel metabolism. In it, the author submits that relative hyperfunction of pancreatic islet  $\beta$ -cells, giving rise to hyperamylianaemia as well as

hyperinsulinaemia, is a key mechanism underlying the metabolic changes which characterise and define the “thrifty” genotype.

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## Ethnic comparisons in diabetes and insulin levels

David Simmons

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 4: 346-348*

The prevalence of non insulin dependent diabetes mellitus (NIDDM) is increasing exponentially. While the genetic causes of NIDDM remain unclear, the differences in prevalence of NIDDM over time, between and within different ethnic groups highlight the importance of environmental factors in the development of NIDDM in any given individual. Besides the classical risk factors for NIDDM such as obesity and indolence, the role of intra-uterine over-exposure or deficit of nutrients is increasingly felt to be of importance in the aetiology of NIDDM. Indeed, ethnic differences in hyperinsulinaemia, can be detected at birth in some populations. *In utero* exposure to increased fuel supply may be of particular importance in Polynesian and American Indian populations. If this is so, efforts to control NIDDM will take several generations to be successful.

## Intrauterine nutrition and adult disease

Jane Harding

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 4: 349*

Professor Barker and colleagues have published a large series of epidemiological studies showing that body size and shape at birth are strong predictors of the subsequent risk of developing several adult diseases including coronary artery disease, hypertension, chronic lung disease and non-insulin dependent diabetes. These effects of birth phenotype are independent of other known risk factors, and grow stronger with increasing age. We have put forward the hypothesis that intrauterine nutrition determines birth phenotype, and it also determines the programming of a number of key homeostatic systems in a way which predisposes to adult disease. Thus the association between birth phenotype and adult disease is determined by nutrition of the fetus before birth. Although the mechanisms are not yet known, animal studies are beginning to demonstrate that intrauterine nutrition does affect fetal growth, cardiovascular and metabolic status. Intrauterine nutrition also may have effects that last over more than one generation.

There is extensive evidence from animal studies that intrauterine nutrition affects birth phenotype. In sheep, severe maternal undernutrition for just 10 days in late gestation (term = 145 days), results in fetuses with greatly enlarged hearts and kidneys, but small lungs. Maternal undernutrition around the time of conception results in a fetus that grows relatively slowly in late

gestation and is partially protected from these effects. Development of coronary artery walls may also be altered by the same maternal nutritional insult.

We also have evidence in fetal sheep studies that intrauterine nutrition affects fetal metabolism and cardiovascular status. Slowly growing fetal sheep are relatively insulin resistant *in utero*. Fetuses undernourished for 10 days in late gestation develop hypertension during the 10 days of refeeding. Preliminary results also suggest that the relationship between birth size and blood pressure persists in lambs for at least the first few months after birth.

The effects of intrauterine nutrition are not just confined to later life of the affected fetus. Rats marginally undernourished for seven generations take three generations of nutritional rehabilitation to reach the size of control animals. Those re-fed at weaning in the first generation may become obese. Similarly, in human studies severe maternal undernutrition in early pregnancy has been associated with an increased rate of obesity in the offspring. Reports from the Dutch famine suggest that baby girls exposed to undernutrition *in utero* in early gestation themselves give birth to small babies. Thus the effect of intrauterine undernutrition may extend over at least two generations, making interpretation of some genetic studies very difficult.

Intrauterine nutrition clearly affects fetal growth, metabolic and cardiovascular status before birth. These effects may persist after birth and even over subsequent generations. The mechanisms by which intrauterine nutrition predisposes to adult disease remain to be explored.

## **Strong and weak linkages in the thrifty genotype hypothesis**

Paul T Baker

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Evidence for a substantial variability in the frequency of NIDDM among Pacific island populations is now well documented. Data from the published studies support the hypothesis that this variability is in part the result of genetic differences between the populations. In the past it has been hypothesised that these differences were the result of variation in a single gene. This hypothesis appears now to be abandoned. Hopefully the high level of research currently proceeding on the human genome will soon produce some clear loci linkages to the disorder.

Whether there are one or several genes involved in producing the population differences, a major evolutionary question is how natural selection processes resulted in such population differences. Indeed, major population variability in NIDDM frequency has been recently observed in a wide variety of identifiable populations and ethnic groups. Given the clear evidence that a reasonably affluent life style is a prerequisite for the high levels of NIDDM it seems probable that even more variability in population frequency rates will soon appear as new populations increase in affluence.

The close association of increased wealth to altered diets, increased body weight and rising rates of NIDDM has made James Neel's thrifty genotype hypothesis a very attractive explanation for the very high rate in such groups as Polynesians, Micronesians, Native Americans and Australian Aborigines. Neel has in recent years become more dubious of his own hypothesis and in a 1989 publication termed it a soft hypothesis noting that "non-insulin

dependent diabetes mellitus is undoubtedly quite heterogeneous in aetiology”.

In a 1984 publication I explored in a preliminary fashion the inter-relationship between the demographic and genetic history of the Pacific islanders and the degenerative disorders which had become common by that time. The conceptual structure of the “thrifty” genotype seemed to fit well with the rapid and massive weight gains demonstrable in Polynesians and Micronesians. However, the linkage of NIDDM to a feast and famine history fit only some of the groups. This evidence, along with the more recent studies which demonstrate a lack of consistent physiological and biochemical linkages, suggests that a detailed examination of the Pacific populations in terms of the postulated steps of the selected process is desirable.

It has been shown that the Polynesians, and to a lesser extent Micronesians, have very heavy weights and large BMIs. Indeed it appears that Samoans are, as a population, the heaviest group in the world with the greatest average BMI. Extensive studies of the possible causes for these high weights have been conducted and will be described in detail in the lecture. The evidence suggests an ability to gain weight with a rapidity which only occurs under conditions of forced feeding in other groups. Exercise reduction below critical levels and binge eating appear the most significant behaviour associations with high body weights.

The survival and reproductive advantages which are presumed to exist for individuals who can rapidly increase in fatness is that the energy stored will keep them alive and active during periods of food shortage. Such food shortage periods can be documented for small island groups in the typhoon areas of the Pacific and can be assumed to have occurred numerous times during voyaging.

A second advantage which has not been fully considered in relation to the level of fat is the insulative value during cold exposure. Data showing the insulation and calorie saving value of subcutaneous fat will be presented at the lecture. This may also be quite significant for the explanation of high fat levels in North American natives since their ancestors passed through quite cold areas and mortality from cold exposure was possible. However, for Pacific islanders the important aspect would have been the caloric savings gained during voyaging and fishing. It should be noted that sea mammals, including those restricted to tropical waters, have very heavy subcutaneous layers of fat which are used for insulation and for energy during travel without food.

These behavioural and physiological data provide strong evidence for the suggestion that evolutionary selection would have favoured genes that produced rapid fat and muscle gain. However, it is not obvious to me why this should result in high levels of NIDDM. Certainly there is an association between BMI and NIDDM in some populations, but the linkage appears to be weak. Thus the Nauru population which has a much lower average BMI than the Samoan group with a similar exposure to affluence and imported food have a frequency of NIDDM which is several times the Samoan rate. These findings do not mean that the unusually high levels of NIDDM among some Pacific populations lack a strong genetic basis but it is likely that the selection for the ability of some Pacific populations to rapidly increase body fatness is not a sufficient cause for the unusually high frequencies occurring in selected populations.

## **Thrifty genotype concepts and health in modernising Samoans**

Stephen T McGarvey

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 4: 351-353*

Thrifty genotype concepts are described and applied to the case of increasing overweight with modernisation. The prevalence of overweight (BMI  $\geq 30$  kg/m<sup>2</sup>) among American Samoans and Western Samoans is increasing substantially as described in surveys conducted in 1976-82 and in 1990-91. There is a possible role of insulin and the sympathetic nervous system in weight gain and energy balance. The thrifty genotype concept provides important hypotheses which can be applied to concrete studies among modernising Samoans.

## **Polynesian body size: an adaptation to environmental temperature?**

Philip Houghton

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 4: 354-356*

A computer simulation of exposure at sea in the tropical Pacific supports the hypothesis that humans colonising this region have been subject to strong directional selection for a large muscular body. This is advanced as an explanation for the typical Polynesian phenotype, and suggestions are made linking this phenotype with the metabolic disorders of gout and non-insulin dependent diabetes mellitus.

## **Cultural elaborations of obesity - fattening practices in Pacific societies**

Nancy J Pollock

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 4: 357-360*

Fattening rituals in Pacific societies are examined within a discussion of the cultural aspects of obesity as a disease of modernisation. Those rituals contributed to a strong aesthetic value of large body size and light skin, while also incorporating the symbolic value of food. They may have enhanced survival value of a genetic potential in the face of irregular diet. Today with a more regular diet available only the negative aspects of large body size prevail.

## **Patterns of colonisation and the “thrifty” genotype in Pacific prehistory**

Alexandra A Brewis, Geoffrey Irwin and John S Allen

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 4: 361-365*

The seemingly distinctive markers of Polynesian biology - serologic, molecular, anatomical, and

developmental - have been argued to have emerged from the special circumstances of colonisation and early settlement of the region. Models point to the microevolutionary impact of mortality selection while voyaging, small founding group size forcing bottlenecks, and subsequent relative isolation of groups introducing heterogeneity through genetic drift within Polynesia. These ideas have drawn on a melange of ideas about the colonising experience to construct evolutionary narratives, including that of the “thrifty” genotype in Polynesia. The substantial problem is that there previously has been no independent theory of colonisation and inter-island contact for the region. We critically examine which microevolutionary forces would have impacted prehistoric Polynesians in terms of an independent navigational theory of colonisation, and map out the expected biological/ evolutionary sequelae. This theory suggests that Remote Oceania was settled by directed return voyages, that the tempo of population expansion was probably rapid, that voyaging continued after settlement, that whereas episodes of colonisation were directed to safety, subsequent inter-group voyages followed the pattern of mutual inter-island accessibility. The implication is that mortality selection would not have been the predominant force shaping the Polynesian genotype; the development of survival sailing strategies were designed to remove these very risks. This makes it unlikely that the specific experience of Polynesian colonisation would promote an efficient insulin mechanism, and so explain, for example, the high incidence of Type II diabetes mellitus in contemporary Polynesian groups.

## **Body mass index and cardiovascular risk factors in Pacific Island Polynesians and Europeans in New Zealand**

Judy McNulty and Robert Scragg

*Asia Pacific Journal of Clinical Nutrition* (1995) Volume 4, Number 4: 366

Relationships between body mass index (BMI) and cardiovascular risk factors were compared between European and Pacific Island (Polynesian) New Zealand residents in a cross-sectional survey of 510 (279 European, 231 Pacific Island) Seventh-day Adventist church members. Participants were recruited while attending annual camp meetings or churches and response rates were 72% for Pacific Islanders and 95% for Europeans. The age range was 39-90 years. Age adjusted BMI was higher in Pacific Islanders than Europeans (mean(SE): 32.8(0.3) v 25.6(0.3),  $p=0.0001$ ). Among Europeans, BMI was positively associated ( $p<0.05$ ) with systolic and diastolic blood pressure, triglyceride, total cholesterol, LDL cholesterol and fasting glucose, and negatively associated with HDL cholesterol. In contrast, BMI was only significantly ( $p<0.05$ ) associated with systolic and diastolic blood pressure, and with HDL cholesterol in Pacific Islanders. Associations were stronger in Europeans compared to Pacific Islanders, there being a significant difference ( $p<0.05$ ) between Pacific Islanders and Europeans in ethnic specific regression coefficients for systolic blood pressure, triglyceride, and total cholesterol. We conclude that BMI has a weaker association with cardiovascular risk factors in Polynesians than Europeans. These results suggest that interventions to decrease BMI levels in Polynesian populations may not decrease risk of cardiovascular diseases to the same extent as in European

populations.

## **Body mass index: is it an appropriate measure of obesity in Polynesians?**

B Swinburn, P Craig, B Strauss and R Daniel

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 4: 367*

The body mass index (BMI) is commonly used as an estimate of obesity with 20-25 kg/m<sup>2</sup> being considered normal. Polynesians, as individuals and populations, are often described as overweight or obese based on BMI criteria. We derived body fat measurements by bioimpedance methods in 129 adult Cook Island Polynesians and a representative sample of 505 adult Caucasian Australians using the same equation (Lukaski). As a group, the Cook Islanders were heavier (91.5 ± 2.5 kg for men, 78.9 ± 2 kg for women) compared to the Caucasians (80.7 ± 1 kg for men, 66.4 ± 1 kg for women; p < 0.0001 for both). Heights were similar and therefore the BMI values (kg/m<sup>2</sup>) were also higher in the Cook Islanders (29.6 ± 0.7 and 29.8 ± 0.7 versus 26.4 ± 0.2 and 25.3 ± 0.2; p<0.0001). Body fat, however, was lower in Cook Island men (22.0 ± 1.0% versus 25.2 ± 0.4%; p<0.01) and similar in Cook Island women (31.2 ± 1.0% versus 33.0 ± 0.3%). The following table of body fat estimations at equivalent BMI values shows that across the range Polynesians are leaner on a weight for weight basis:

At BMI	Body fat (%) for males		Body fat (%) for females	
	Polynesian	Caucasian	Polynesian	Caucasian
20 kg/m <sup>2</sup>	4.9	7.1	15.9	25.9
25 kg/m <sup>2</sup>	13.7	21.4	23.7	32.5
30 kg/m <sup>2</sup>	22.5	35.7	31.6	39.2
40 kg/m <sup>2</sup>	40	64.2	47.2	52.5

In conclusion, at any given BMI Polynesian men and women are leaner than Caucasians. If these data are confirmed with more definitive body composition studies, the BMI definitions may need to be altered for Polynesians, in which case a BMI of up to about 30 kg/m<sup>2</sup> could be considered normal.

## **Do Pacific Islanders still believe that “Big is Beautiful”? Body size perceptions among Cook Islanders.**

H Matangi, B Swinburn, P Craig, T Matenga-Smith, G Vaughan

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 4: 368*

In the traditional Polynesian societies, obesity is a mark of beauty, prestige, good health, wealth

and high social ranking. Previous studies have noted that very large body sizes were particularly common amongst families of chiefs and those of high status. However, Westernisation in Polynesian societies has brought with it not only the Western perception of body size where beauty, health and high status is equated with a thin body size, particularly for women, but also increasing problems of obesity and its related diseases.

The main aim of this study was to determine the attitudes and perceptions of body size among Cook Islands Maori living in Rarotonga in comparison with a matched Australian Caucasian sample.

The survey took part in the Tutakimoa village in Rarotonga with a response rate of 74% (83 females, 49 males). Subjects were weighed and measured to obtain their body mass index (BMI = weight in kg/ (height in m<sup>2</sup>). Using a modification of the distorting camera technique, two graded sets of photographs (one female, one male) with calculated BMIs were prepared. The photographs were laid out in order of increasing size and subjects were asked to indicate the body size which best represented their actual and preferred body size. Subjects were also asked to identify the most healthy and attractive sizes for their own and the opposite sex and the acceptable range of body size for each sex. The Australian sample were matched for sex, age and BMI.

Cook Islands (CI) women were the most accurate in their perception of their current size (measured BMI for both groups = 29.9, perceived by CI = 29.2, perceived by Aust = 34.7). All groups preferred to be smaller, particularly women (preferred BMI for CI women = 23.4, Aust women = 23.6, CI men = 27.8, Aust men = 25.2). Although Cook Islanders chose larger ideal sizes than Australians for both male and female body sizes, the ideal sizes tended to increase with age particularly for CI women.

Results indicate that Cook Islanders perceive a larger body size as ideal which is probably quite appropriate given the greater lean body mass in Polynesians. However, of note is that younger CI women had similar perceptions of ideal body size to Australian women. This suggests that the gradual reduction in the ideal and acceptable body sizes experienced in Western societies is being adopted by young Cook Islands women.

## **Metabolic markers of hyperinsulinaemia in normotensive Maori and Caucasian New Zealanders**

T Maling, K van Wissen, R Toomath and R Siebers

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 4: 369-370*

New Zealand Maori are hyperinsulinaemic and insulin resistant, compared with age- and blood pressure-matched Caucasians and are therefore an important group in which to study previously described metabolic correlates of insulin resistance, including plasma urate, triglycerides and erythrocytic sodium. Only fasting triglycerides were associated with hyperinsulinaemia. Erythrocyte sodium and plasma urate were not correlated with fasting or stimulated insulin in either race. The reduced fractional urate clearance in Maori, compared with Caucasians, was

positively correlated with fractional lithium clearance (proximal tubular sodium reabsorption), suggesting an ethnically expressed dependence of urate clearance on proximal tubular sodium reabsorption. Our findings indicate the need for caution in the generalisability of the variously described “markers” of hyperinsulinaemia.

## **Cigarette smoking and socio-economic indicators as determinants of body fatness in three Southern Chinese communities of China**

Linda Grievink, Bridget H-H Hsu-Hage, Xuxu Rao, Mark L Wahlqvist, Yi-He Li, Kuei Zhang, Tie Han Kuang, Dao Lin Zhang, Zong Rong Dai

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Number 4: 376-383*

Obesity is one of the major risk factors for cardiovascular disease and non-insulin dependent diabetes mellitus. This study describes cigarette smoking and the socio-demographic differences of body fatness in three sub-ethnic distinctive communities in Guangdong Province, China. In this study, 935 adult Chinese (Chauzhou - 203 men and 111 women; Meixian - 169 men and 140 women; Xinhui - 194 men and 118 women) were randomly sampled from three communities. A standard protocol was used to measure stature, body weight, waist and hip circumferences. Body mass index (BMI) and waist-to-hip circumference ratio (WHR) were calculated as measures of total body fatness and abdominal body fatness, respectively. The questionnaire was self-administered and demographic and lifestyle factors were assessed. WHR was positively related to age in men ( $p=0.0001$ ) and in women ( $p=0.0001$ ) while BMI was associated with age only in women ( $p=0.0001$ ). In women, WHR was significantly related to education levels after adjusting for age and BMI ( $p=0.0300$ ). In men, BMI differed by educational level, after adjusting for age and WHR ( $p=0.0329$ ). BMI was significantly associated with occupational status in men, after adjusting for age and WHR ( $p=0.0004$ ). Gross household income was significantly associated with WHR in men, after adjusting for age and BMI ( $p=0.0469$ ). Male smokers had a significantly lower mean BMI than the non-smokers, after adjusting for age and WHR ( $p=0.0037$ ). Marital status was not related to body fatness measurements after adjusting for age and WHR. The differences in body fatness in Chinese living in Southern China can not be totally explained by educational level, occupational status, marital status, gross household income and cigarette smoking, particularly in women. Age was the only consistent predictor of abdominal body fatness in both men and women and also of total body fatness in women.

## **Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Supplement 1**

### **Dietary recommendations and guidelines which take into account**

## **maintenance, prevention and survival**

Mark L Wahlqvist

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Supplement 1: 1-6*

There is a growing interest in nutritional and non-nutritional factors which affect the various stages of life in different ways and how these factors, operative in one stage, have their consequences in later stages. To address these questions has required the command of large and longitudinal data sets about human populations, an understanding of and ability to manipulate gene expression, and the sophistication of detailed food component chemistry. Moreover, it is now clear that there are more fields of food-health relationship than heretofore presumed, such as those that relate to menopause, immune function and cognitive function. Nutritional factors may operate antenatally, in early childhood, during the growth spurt, in the reproductive phase of womanhood, and in much later life. The contextual framework for nutritional thinking is changing in relation to stage of life, including biological as well as chronological age, and in relation to other non-nutritional variables. For example, modest increases in physical activity allow more flexibility in the human diet. Avoidance of substance abuse (tobacco, alcohol, unnecessary medication, meganutrient intakes), allows marked improvements in health in some populations, whilst others continue to be at great risk and require related food intake recommendations. Also of importance throughout life are social, anthropological, economic and educational factors. For example, social activity can stimulate the preferred use of food, and a function of eating is to stimulate social activity-- this interactive bidirectionality between nutritional and non-nutritional factors for health has been appreciated through the modelling of food-health relationships in studies of the aged and cross-culturally. To minimize adverse nutritional effects, a lifespan and contextual approach to nutrition is required.

## **Recommended dietary allowances for growth, development and performance**

Paul A. Lachance

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Supplement 1: 7-12*

Sufficient scientific evidence has accumulated in our understanding of the impact of the quality of the diet during growth and development to suggest changes in the RDAs. We now recognize that: the quality of the prenatal diet has dramatic impact on growth and development in utero, on birth weight, and on infant mortality and on morbidity during childhood; the diet of the infant, especially during the first three years, has profound effects on the intellectual and physical (work capacity) performance potential during adolescence, and affords a decrease in the probability of morbidity and mortality; the quality of the diet during growth and development throughout adolescence has a life-long potential in the thwarting of chronic degenerative diseases. The implication is a decrease in health care costs and an increase in productivity. Certain limiting nutrient RDAs will need to be updated accordingly.

## **The nutrient intakes of Chinese children and adolescents and their impact on growth and development**

Ye Guang-Jun

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Supplement 1: 13-18*

Considerable improvement has taken place in the growth and development of children and adolescents in China since 1949, and even since 1931, with the notable exception of war-time. There are interesting comparisons with Japan, with developing and developed nations, which provide insights into preferred eating patterns for children. These are borne out by intra-China analyses of rural and urban populations (urban generally fairing better), of majority Han and minority groups, of socio-economically advantaged and disadvantaged, and of regional populations. Energy intake and food nutrient density need, as expected, to be adequate. But particular problems remain, especially with iron, and Vitamin B-2, and probably with calcium, Vitamins A, B-1 and C intakes, although more often for marginal than frank deficiency. A “two-peak phenomenon” is also emerging in China, where about 80% of children aged 0-4 in urban areas, and 20-45% in rural areas, are only-children; this is that overfatness may co-exist with undernutrition. Primary health care in China is increasingly challenged by these dilemmas.

## **Dietary pattern and physical development in China - based on the 1992 national nutrition survey**

Keyou Ge

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Supplement 1: 19-23*

Based on information gathered in the 1992 Chinese national nutrition survey, the energy consumption on average is about adequate for the whole population. Dietary protein and fat have increased, and now provide 11.8% and 22.0%, respectively, of the total dietary energy. The adequacy of nutrient intake, expressed as percentages of RDA, is higher for urban populations than for rural, and higher for high income groups than for low income groups. Child growth has improved substantially compared to ten years ago. However, there are still 32.6% of preschool children with stunted growth and 17.7% are underweight. Rural children have a higher incidence of chronic energy deficiency (CED) than their urban counterparts. The improvement in children's growth and the increase of overweight adults are in line with the country's overall food production and the average food consumption of the population. The difference between urban and rural nutritional status deserves more attention.

## **Eating patterns-- a prognosis for China**

Chen Chunming

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Supplement 1: 24-28*

China has shifted its dietary patterns because of economic change. As people have more money to spend they buy more processed food which tends to be energy-dense and nutrient-poor. There are substantial differences in dietary patterns between urban and rural populations. Rural residents tend to maintain the basic traditional diet, while urban and richer rural residents tend to consume more high-fat food and processed sugar-based foods. If no action is taken to intervene or guide people's food consumption behavior: consumption of cereals, sugar and vegetables will decline; poultry consumption will increase; and the demand for beef, mutton, eggs and milk will increase. An analysis of food consumption in Shanghai during 1950-1982 revealed the mortality rate of heart disease, cerebrovascular disease and cancer were positively correlated with meat, egg and sugar consumption and negatively correlated with cereal consumption. The projections for chronic disease based on demographic change, risk factor and disease estimations indicate that by the year 2030 in China, there will be annually 800,000 deaths by coronary heart disease, 3 million from strokes and 1.7 million due to lung cancer. These figures call for the government and public to take timely actions to avoid over-consumption of animal foods. Although disease pattern change is related to a series of factors, the role nutrition plays in health promotion and disease prevention should not be underestimated.

## **Benefits of physical activity on nutrition and health status: studies in China**

Chen Ji-Di

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Supplement 1: 29-33*

The significance of physical activity for fitness is that it may change risk factors for chronic disease and improve functional and psychological status. Rational nutrition and scientific training are prerequisites for safe and useful exercise. Even mild iron deficiency anemia can affect physical capacity. Intensive exercise has been found to increase serum and erythrocyte lipid peroxide levels. Moderate exercise decreases the blood lipid peroxides and increases free radical elimination enzyme (SOD, GSH-Px, CAT) activities. Elite athletes have significantly lower Malonic dialdehyde (MDA) levels and higher SOD and GSH-Px activities. Zinc deficiency not only leads to an increase in free radical generation and lipid peroxidation and a depression of SOD activity, but also is harmful to immune function. Exercise can exacerbate the damage induced by iron deficiency or zinc deficiency. Long term diet restriction by gymnasts to control weight showed detrimental effects including growth retardation, menstrual disturbances, malnutrition, mental stress and muscle weakness. Comprehensive nutrition promotes growth rate and corrects malnutrition without a body fat increase in athletes. Exercise benefits the growth and development of bone and muscle and enhances muscle strength. The prevention of obesity is particularly important during periods of rapid growth. The establishment of an exercise life style during childhood will favor the best health.

## **Nutrition and exercise--a consensus view**

Ron Maughan

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Supplement 1: 34-38*

The ability to perform exercise is impaired if the diet is inadequate. Conversely, performance may be improved by appropriate dietary manipulation. The primary need for the diet of athletes in training is to meet additional nutrient requirements imposed by the training load. Many athletes consider that a high protein diet is essential to stimulate muscle growth and promote repair. Evidence shows that hard exercise increases the protein requirement, but athletes eating a varied diet in sufficient quantity to meet their energy demands will obtain adequate protein. Carbohydrate is the main fuel used by the muscle in hard exercise, and carbohydrate intake must be sufficient to enable the training load to be sustained. During each strenuous training session, depletion of the glycogen stores in the exercising muscles and in the liver takes place. If this carbohydrate reserve is not replenished before the next training session, training intensity must be reduced, leading to corresponding decrements in the training response. It is recommended for athletes in training that carbohydrate should account for 60-70% of total energy intake, but the type of carbohydrate consumed is not crucial. With regular training, there must be an increased total energy intake to balance the increased energy expenditure. Provided that a reasonably normal diet is consumed this will supply more than adequate amounts of protein, minerals, vitamins and other micronutrients. Possible exceptions are iron and calcium, especially when energy intake is restricted to control body weight. There is no good evidence to suggest that specific supplementation with any of these dietary components is necessary or that it will improve performance. Attention must be paid, however, to ensure an adequate water intake during training: dehydration will reduce performance. The body does not adapt to dehydration.

Consumption of a high-carbohydrate diet for the few days before competition with a reduction in the training load can double the muscle glycogen content and is generally known to be effective in increasing endurance performance. There is some evidence that the muscle glycogen content may also influence performance in events lasting only a few minutes. A high muscle glycogen content may be important when repeated sprints at near maximum speed have to be made. There is scope for nutritional intervention during exercise only when the duration of events is sufficient to allow absorption of drinks or foods ingested and where the rules of the sport permit. The primary aims must be to ingest a source of energy, usually carbohydrate, and fluid for replacement of water lost as sweat. Carbohydrate-electrolyte (sodium) drinks are the most effective way of achieving this. Each athlete must establish by trial and error the most suitable dietary programme for training and competition.

## **Food selection and guidance for physically active people**

Louise Burke

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Supplement 1: 39-44*

The everyday nutritional goals of athletes and physically active people reflect the special, and often increased, nutrient requirements arising from the commitment to regular exercise, as well as the practical challenges of achieving these goals in a busy lifestyle. Issues include achieving

and maintaining a body weight and body fat level that is appropriate for optimal sports performance and health, as well as meeting increased requirements for protein and some micronutrients such as iron and calcium. While inadequate intakes of vitamins will impair exercise importance, the current view is that additional vitamin supplementation will not improve exercise performance. Attention to fluid and carbohydrate intake will be an important factor in exercise performance and recovery from exercise, particularly high intensity exercise which is carried out in hot conditions for prolonged periods. Guidelines to promote optimal fuel and fluid status include strategies before, during and after exercise. The dietary guidelines of many developed countries which emphasise dietary variety, based on high-carbohydrate, reduced-fat eating, provide an appropriate blue-print for the athletes diet'. Since sportspeople are well recognised and often hero-worshipped within the community, they provide a worthy example of the potential benefits of a well-chosen diet.

## **Diet and dental caries**

Stephen H.Y. Wei

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Supplement 1: 45-50*

Dental caries prevalence is on the increase in transitional societies in the same way as chronic non-communicable diseases, having been largely controlled in developed societies. The lessons of dietary cariogenicity and preventive strategies, through dental hygiene and fluoride are still to be incorporated into the health policies and practices of many countries, and applied to at-risk populations, like immigrants, in developed nations. Preferred fluoride delivery systems are under active discussion. There is particular concern about nursing practices in early life, and, in later life, adequacy of dentition and of the problems of gingival disease need to be addressed.

## **The science of nutrition -- the metaphysics of food**

Paul Saltman

*Asia Pacific Journal of Clinical Nutrition (1995) Volume 4, Supplement 1: 51-54*

With respect for the differences between and among nations, there are universal principles on which public health nutrition policy should be based. An adequate food supply containing sufficient energy and all of the essential nutrients should be available and affordable. This may include nutrient-restored or fortified food products and supplements. The foods must be coherent with the cultural needs and desires of consumers. Public and private agencies, like schools and food industries, must provide exciting and accurate nutritional information in the classroom and by mass media. Individuals must have an accurate knowledge to make healthy dietary selections. The special needs of particular sub-populations, such as prenatal mothers, infants, children, adolescents, women, and the elderly, should be emphasized and addressed. Individuals should be encouraged to assume personal responsibility for their health. The avoidance through healthy lifestyles of obesity, anorexia and nutritional deficiencies should be encouraged. The sensual

pleasures of food and the joy of eating with family and friends should be emphasized and enhanced. We should celebrate the complexity and diversity of our foods and cultures. We should be free to enjoy the foods that bring us health and pleasure. We should have scientific nutritional knowledge to maximize our human potential.

# **Asia Pacific Journal of Clinical Nutrition (1996) Volume 5, Number 1**

## **Intestinal flora and human health**

Tomotari Mitsuoka

*Asia Pacific Journal of Clinical Nutrition (1996) Volume 5, Number 1: 2-9*

There is a growing interest in intestinal flora and human health and disease. The intestines of humans contain 100 trillion viable bacteria. These live bacteria, which make up 30% of the faecal mass, are known as the intestinal flora. There are two kinds of bacteria in the intestinal flora, beneficial and harmful. In healthy subjects, they are well balanced and beneficial bacteria dominate. Beneficial bacteria play useful roles in the aspects of nutrition and prevention of disease. They produce essential nutrients such as vitamins and organic acids, which are absorbed from the intestines and utilised by the gut epithelium and by vital organs such as the liver. Organic acids also suppress the growth of pathogens in the intestines.

Other intestinal bacteria produce substances that are harmful to the host, such as putrefactive products, toxins and carcinogenic substances. When harmful bacteria dominate in the intestines, essential nutrients are not produced and the level of harmful substances rises. These substances may not have an immediate detrimental effect on the host but they are thought to be contributing factors to ageing, promoting cancer, liver and kidney disease, hypertension and arteriosclerosis, and reduced immunity. Little is known regarding which intestinal bacteria are responsible for these effects. A number of factors can change the balance of intestinal flora in favour of harmful bacteria. These include peristalsis disorders, surgical operations of stomach or small intestine, liver or kidney diseases, pernicious anaemia, cancer, radiation or antibiotic therapies, immune disorders, emotional stress, poor diet and ageing.

However, more importantly, the normal balance of intestinal flora may be maintained, or restored to a normal from an unbalanced state, by oral bacterio-therapy or by a well balanced diet. Oral bacterio-therapy using intestinal strains of lactic acid bacteria, such as lactobacillus and bifidobacteria, can restore normal intestinal balance and produce beneficial effects. Benefits include suppression of intestinal putrefaction so as to reduce constipation and other geriatric diseases; prevention and treatment of diarrhoea including antibiotic-associated diarrhoea; stimulation of the immune system; and increased resistance to infection.

## **Selection criteria for probiotic microorganisms**

Patricia L Conway

*Asia Pacific Journal of Clinical Nutrition (1996) Volume 5, Number 1: 10-14*

Probiotics are preparations of live microorganisms which beneficially affect the host by improving the properties of the indigenous microbes. Since the human intestinal flora plays an important role in health and disease of man, probiotics are used to improve intestinal health and to stimulate the immune system. The microbes commonly used as probiotics for humans are the lactic acid bacteria (LAB). In early studies the strains used for fermenting milk products for human consumption were frequently used as probiotics. Subsequently, it was realised that it would be more appropriate if the strains originated from the human intestinal tract and that in addition to LABs, other microorganisms could be used either singly or in combination. Today, strict selection criteria are employed to obtain functional probiotic strains. It is generally agreed that the strain should be of host origin, well characterised, able to survive the rigours of the digestive tract and possibly colonise, biologically active against the target as well as to be stable and amenable to commercial production and distribution. In addition, information on dosages and evidence of efficacy needs to be obtained. *In vitro* and *in vivo* studies are frequently combined to allow investigation of the various parameters, and ultimately clinical trials are required. Although lactic acid bacteria have been generally recognised as safe, the question of safety is discussed for LAB and non-LAB probiotic strains in terms of potential pathogenicity of the strains and risk to the individual and the community. Finally, even though the techniques for genetic manipulation of many probiotic strains are available, it is not envisaged that this issue will be addressed in the near future because of regulatory implications. It is proposed that when this type of selection criteria is employed, probiotics strains with demonstrable efficacy can be obtained.

## **Short-chain fatty acids produced by intestinal bacteria**

David L Topping

*Asia Pacific Journal of Clinical Nutrition (1996) Volume 5, Number 1: 15-19*

The colon is the major site of bacterial colonisation in the human gut and the resident species are predominantly anaerobes. They include potential pathogens but the greater proportion appear to be organisms which salvage energy through the metabolism of undigested carbohydrates and gut secretions. The major products of carbohydrate metabolism are the short chain fatty acids (SCFA), acetate, propionate and butyrate. In addition to general effects (such as lowering of pH) individual acids exert specific effects. All of the major SCFA appear to promote the flow of blood through the colonic vasculature while propionate enhances muscular activity and epithelial cell proliferation. Butyrate appears to promote a normal cell phenotype as well as being a major fuel for colonocytes. Important substrates for bacterial fermentation include non-starch polysaccharides (major components of dietary fibre) but it seems that starch which has escaped

digestion in the small intestine (resistant starch) is the major contributor. Oligosaccharides are utilised by probiotic organisms and in the diet, act as prebiotics in promoting their numbers in faeces. High amylose starch is a form of RS and it appears to act as a prebiotic also. Although there is evidence that probiotics such as *Bifidobacteria* metabolise oligosaccharides and other carbohydrates, there appears to be little evidence to support a change in faecal SCFA excretion. It seems that any health benefits of probiotics are exerted through means other than SCFA.

## **Production of anti-microbial substances by probiotics**

Charumati Mishra and John Lambert

*Asia Pacific Journal of Clinical Nutrition (1996) Volume 5, Number 1: 20-24*

Bacterial antagonism has been recognised for over a century but in recent years this phenomenon has received more scientific attention, particularly in the use of various strains of lactic acid bacteria (LAB). Antimicrobial compounds produced by LAB have provided these organisms with a competitive advantage over other microorganisms. Lactic acid bacteria have a natural ecological niche in many foods as well as in the intestinal tract. The efficacy and spectrum of antimicrobial products of lactic acid bacteria are broad and include lactic and acetic acid, hydrogen peroxide, carbon dioxide, diacetyl as well as bacteriocins or bacteriocin-like substances. Further screening for agents with a broad spectrum of activity is required. This will involve genetic or protein engineering of such compounds to commercialise these agents.

## **Safety of probiotic bacteria**

DC Donohue, S Salminen

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In recent years interest has been renewed in health promotion and disease prevention by the incorporation of probiotic bacteria into foods to counteract harmful bacteria in the intestinal tract. There is considerable interest in extending the range of foods containing probiotic organisms from dairy foods to infant formulae, baby foods, fruit juice-based products, cereal-based products and pharmaceuticals. New and more specific strains of probiotic bacteria are being sought. Traditional probiotic dairy strains of lactic acid bacteria have a long history of safe use and most strains are considered commensal microorganisms with no pathogenic potential. It cannot be assumed that these novel probiotic organisms share the historical safety of the traditional strains. Before their incorporation into products new strains should be carefully assessed and tested for the safety and efficacy of their proposed use. As yet, no general guidelines exist for the safety testing of probiotics. Different aspects of the safety of probiotic bacteria can be assessed using a panel of *in vitro* methods, animal models and human subjects.

## **Properties of *Lactobacillus casei* Shirota strain as probiotics**

Masami Morotomi

Lactic acid bacteria are generally non-pathogenic. Before their presence became well known, lactic acid bacteria had been used empirically for the production of yoghurt and other types of fermented foods. Lactic acid bacteria are widely distributed in nature as a member of the indigenous intestinal microflora in man and mammals. Since Metchnikoff hypothesised the role of lactic acid bacteria in longevity in the early 1900's, the relations between lactic acid bacteria and human health have been studied from various view points. Today, as a term and a concept, 'probiotics' is used for 'a live microbial feed supplement which beneficially affects the host'.

*Lactobacillus casei* Shirota strain was isolated from human intestine in 1930. It has been used in the production of fermented milk since then. A number of animal and clinical studies indicating its effect in maintaining normal function of the digestive tract and inhibition of the growth of intestinal pathogens were reported. A focus of research is now the anti-tumour activity of this strain. That this topic is drawing special attention reflects the increasing health consciousness of the general public and the resulting awareness of cancer problems as well as the possibility and importance of 'dietary prevention' of cancer.

Parenteral administration of the Shirota strain is known to have anti-tumour and immuno-stimulating activities on experimentally implanted tumours. The same effects have been confirmed with oral administration. The oral administration of Shirota strain inhibited the growth of the subcutaneously implanted Meth A fibrosarcoma in mice. It also inhibited the growth of Meth A or Colon 26 implanted into the wall of mouse large intestine. Furthermore, by oral administration, a growth-inhibitory effect was observed in chemically induced tumours. In a clinical study, prophylactic effects of oral administration of Shirota strain on the recurrence of superficial bladder cancer have been reported.

The probiotic properties of the Shirota strain, as a lactic acid bacteria for cancer chemoprevention have increasing potential.

## **Upper gastrointestinal tract disease and probiotics**

John Lambert and Ron Hull

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Diseases of the oropharynx, oesophagus, stomach and duodenum are common. This review discusses the microflora of the upper gastrointestinal tract with particular reference to lactic acid bacteria and the effect of acid suppression. Probiotics can survive in these sites and evidence is presented for potential roles in disease prevention and treatment, particularly with regards to peptic ulcer disease, *Helicobacter pylori* infection and gastric cancer.

## **Gut flora and mucosal function**

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The mucosal lining of the gastrointestinal tract is the route through which ingested nutrients are absorbed. It also serves to separate potentially toxic luminal contents and flora. These functions appear to be mutually incompatible, but are achieved by regional specialisations in epithelial structure and organ function. Enteric bacteria interact with enterocytes by influencing cellular electrolyte transport and tight junction permeability in the colon. The products of bacterial metabolism are essential for colonocyte nutrition.

## **Probiotic control of diarrhoeal disease**

Peter H Katelaris

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Probiotics have been suggested to be of use in many diarrhoeal disorders, particularly in the prophylaxis and treatment of infectious diarrhoea. Several different preparations are available commercially and they are widely used but consistent scientific documentation of their efficacy is lacking. Although their putative mode of action is not known, non-pathogenic organisms may prevent or displace enteropathogens from colonising the gut. *In vitro* studies suggest that some probiotics may exert a direct inhibitory effect on pathogenic organisms. There is some clinical evidence suggesting a possible role for probiotics in the prophylaxis of infectious diarrhoea in some circumstances, but there is little evidence of a beneficial effect in the treatment of established diarrhoea, except in cases of relapsing *C. difficile* infection. There are no convincing data at present demonstrating efficacy of probiotics in non-infective diarrhoeal disorders. Although the use of probiotics in diarrhoeal diseases is conceptually appealing, their use for this indication is not clearly supported by the available scientific literature at present. Further research into the role of the human microflora in diarrhoeal diseases is needed to aid the selection of appropriate non-pathogenic bacteria for clinical studies. Well conducted controlled clinical trials are then needed in order to determine the place of probiotics in the prevention and treatment of diarrhoeal disorders.

## **Prevention of colon cancer: role of short chain fatty acids produced by intestinal flora**

Graeme P Young

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Any polysaccharide, whether starch or fibre (ie non-starch polysaccharides) may be fermented in the large bowel by resident microflora (anaerobic bacteria). Amongst other substances, the short chain fatty acid butyrate is produced during fermentation. Butyrate is important in the maintenance of normal epithelial biology; it is probably the means by which dietary fibre prevents colonic epithelial atrophy. Starch which escapes digestion in the small intestine (resistant starch) also prevents colonic epithelial atrophy. Dietary fibres differ greatly in their physicochemistry and also in their biological effects. As a general rule, resistant starch

(especially of type 2) tend to behave more like soluble than insoluble nonstarch polysaccharides. In humans, resistant starch results in substantial production of butyrate in the colon. Butyrate can be shown to have “antitumour” effects at various levels (cell and molecular), and this could explain the important inverse association between starch intake and colon cancer incidence (on a country by country basis). The nature of the variables affecting butyrate production from dietary polysaccharides by resident microflora need to be explored with a view to better understanding the practical application of this to cancer prevention.

## **Probiotics and colon cancer prevention**

Graeme H McIntosh

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This review examines some of the evidence regarding probiotic bacteria as agents to reduce the risk of colon cancer in humans. While some of the evidence using rodent models of colon cancer is convincing for a reduction in cancer incidence and burden with the introduction orally of such bacteria as *Bifidobacterium longum*, *Lactobacillus acidophilus* and gg, convincing evidence in humans is more difficult to find. It consists of epidemiological studies or marker intervention studies using faecal enzymes, faecal bile acids or urinary/ faecal mutagens from microbial activity as measures of cancer risk, following probiotic introduction. Taken together these sources of data provide limited support for the hypothesis that probiotic bacteria are effective in cancer prevention.

## **Probiotics and stabilisation of the gut mucosal barrier**

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Probiotic bacteria are used to treat disturbed intestinal microflora and altered gut permeability which are characteristic to many intestinal disorders. Examples include children with acute rotavirus diarrhoea, subjects with food allergy and patients undergoing pelvic radiotherapy. Altered intestinal microflora has been treated by oral intake of probiotic bacteria which are able to survive gastric conditions, colonise the intestine, at least temporarily, by adhering to the intestinal epithelium. Such probiotic microorganisms appear to be promising candidates for the treatment of clinical conditions with abnormal gut microflora and altered gut mucosal barrier functions.

