

## Abstracts from posters which have not been published as full papers in this issue

### Macronutrient intakes in relation to socio-economic status in southern China

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Food frequency questionnaires and socio-economic data were collected from 921 men and women aged 25 to 66 in south China in a cross-sectional study of coronary heart disease risk factors. Dietary intakes, including total energy, protein, total fat, carbohydrate, alcohol and dietary cholesterol, were assessed for different socio-economic groups. The results showed that in older age groups intakes of all nutrients were lower than those in younger age groups in the same sex except for alcohol. Smoking had a profound effect on dietary intakes; total energy intake was higher in smokers (men 2462 kcal, women 2162 kcal) than non-smokers (men 2281 kcal, women 1992 kcal), especially in male smokers. In addition, all nutrient amounts except for carbohydrate were significantly higher in smokers than non-smokers in men. Occupation only affected the intakes of carbohydrate and alcohol in men. Retired persons consumed more carbohydrate than company staff, while women, those in business and farmers consumed the highest carbohydrate; homemakers and retired women were intermediate. Unemployed men had the highest alcohol consumption, and business men followed. Education level and household income were not determinants of nutrient intake. Socio-economic status and smoking were confounders or modifying factors in studies for diet in southern China.

### Cardiovascular disease (CVD), cancer and their association with food consumption and CVD risk factors in the Melbourne Chinese Cohort Study (MCCS)

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**Objective:** To study life style changes (including dietary habits) in relation to the development of cardiovascular disease and cancer in Chinese immigrants in Melbourne.

**Design:** A prospective cohort study. Information on demographic, CVD risk factor assessment, eating habits, food acculturation, food and nutrient intakes, was obtained at baseline in 1988–89, and repeated at follow-up in 1995–96.

**Subjects:** A total of 358 (182 men and 174 women) Melbourne Chinese aged 30 to 86 years cohort subjects were observed during the mean 7.90 years of follow-up. There were 8 new cases of CVD and 12 cases of cancer.

**Results:** Significantly higher mean age, age- and gender-adjusted systolic blood pressure (SBP) and waist-to-hip ratio were found in both CVD and cancer cases than in non-cases. Cancer cases had higher total body fat and plasma glucose, while CVD cases had higher diastolic blood pressure (DBP), plasma total cholesterol and LDL (low density lipoprotein). Subjects who developed CVD ingested more poultry, fish and cruciferous vegetables but less rice, than did non-CVD subjects. Cancer cases ingested more milk than non-cancer subjects. The percentage energy derived from protein and fat were higher, while that from carbohydrate was lower in CVD cases than in non-cases. The food acculturation index did not differ between cases and non-cases. On the basis of relative risk using the Cox model, poultry and cruciferous vegetables SBP, and LDL, were positively associated with increased CVD incidence. Age, body weight, blood glucose and milk intakes were positively associated with cancer morbidity rate, while higher intakes of red meat decreased the risk of cancer.

**Conclusion:** In this cohort, age related risk behaviors have similar significance for both cancer and CVD. Hypertension and hyperlipidaemia remained the determining risk factors for CVD development. Decreasing rice intake, increasing ingestion of poultry and cruciferous vegetables were possible dietary risks for preventing CVD in this study population. Greater ingestion of dairy milk and lower intake of red meat were related to cancer risk. Caution is required, however, in interpreting these findings in a study with few events.

**Risk factors of coronary heart disease in Kelantan**

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A total of 97 males aged 19–81 years residing in Pasir Puteh District, Kelantan, were interviewed and examined to determine the presence of risk factors for coronary heart disease (CHD). The procedures that were employed in the study include interviews using piloted questionnaires, 24-hour dietary recall, anthropometric measurements, biochemical analysis of blood and physical examination. The majority of the respondents were above 40 years and their mean income was RM414 per month; however, about 50% of them earned less than RM400 per month. Their household size varied from two to 14, with a mean household size of six. Anthropometric findings indicate that the mean height and weight of respondents were 163 cm and 58.8 kg, respectively. According to the body mass index evaluation, 70% were normal, 20% overweight and 10% obese. Blood analysis revealed that 19% of the respondents had cholesterol levels above 6.5 mmol/L, 59% had low level of HDL (< 1.155 mmol/L), 27% had high LDL (> 4.11 mmol/L), and 26% high trygliceride levels (> 1.9 mmol/L). In terms of dietary intake, 29% had an intake of less than 2000 calories per day and 16.5% consumed more than 3000 calories per day. Most respondents had protein intake within or above the recommended value. A total of 35% took more than 50 grams of fat or more than 20% of the total calories from fat based on the mean caloric intake of 2251. Dietary fat composition showed that there was a high intake of saturated fat and a low intake of mono and polyunsaturated fat. In conclusion, this study showed the presence of risk factors of coronary heart disease in the rural population.

**Risk factors in relation to diabetes mellitus among patients in Sibul Hospital, Sarawak**

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A total of 72 diabetic patients (24 men and 48 women) were studied to determine the common risk factors related to the disease. Respondents were restricted to Type II diabetes mellitus patients from the Chinese ethnic group, aged at least 35 years old, who came for treatment at the Diabetic Clinic, Sibul Hospital during the period of study. Data were collected using a questionnaire which included demographic characteristics, familial history of diabetes mellitus, dietary practices, health problems (hypertension and cardiovascular disease), lifestyle practices (physical activity, cigarette smoking and alcohol consumption), and socio-economic factors. Anthropometric measurements such as height, weight, waist and hip circumferences were taken. Data analyses was carried out using the SPSS (Statistical Package For Social Sciences) software. A majority of the respondents (44.4%) were  $\geq 65$  years old and 40.3% were found to be overweight (BMI = 25.0 – 29.9 kg/m<sup>2</sup>), while 30.6% were obese (BMI  $\geq 30.0$  kg/m<sup>2</sup>). A familial history of diabetes mellitus was found in 48.6% of the respondents. While 23.6% of respondents had symptoms of heart disease, 52.8% had hypertension as well. The majority of the respondents (72.2%) had a low level of education (primary level) and had occupations which require high energy expenditure. Most of the respondents (45.8%) had low monthly household incomes of RM400 to RM1,499. Some of the respondents (9.8%) smoked while 8.4% claimed to take alcohol. A majority of the respondents (88.9%) were found to perform some kind of light physical activity during their free time. In general, most of the respondents preferred to take foods high in sugar (49.6%), carbohydrate (87.5%), protein (73.0%), fat (53.3%), as well as foods high in fiber (84.0%). Factors such as age, weight, familial history, hypertension, educational level, household income, diet and low physical activity were found to have had a strong influence on Type II diabetes mellitus in this study population. Meanwhile, heart disease, occupation, cigarette smoking and alcohol consumption were found to have had little relationship with diabetes mellitus.

**The prevalences of cardiovascular disease (CVD) risk factors among rural adult males in Kemaman district, Malaysia**

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A cross-sectional study was conducted to examine the prevalences of cardiovascular disease (CVD) risk factors among 72 rural Malay adult male respondents from two villages in Kemaman district, Terengganu, Malaysia. The results of the study showed high prevalences of smoking (63.9%), overweight (22.3%), family history of CVD (16.6%), diastolic blood pressure greater than 90 mmHg (11.1%) and systolic blood pressure greater than 140 mmHg (9.7%) despite low prevalences of hypercholesterolemia (1.4%) and hyperglycemia (2.8%). Almost half (43.1%) of the respondents were categorized as physically active and 65.3% expended 2001 to 3000 kilocalories of energy per day. The study reflects the need to examine further prevalences of CVD risk factors in rural communities nationwide.

### **Intervention package to overcome the problem of obesity among 6239 schoolchildren in Kuala Lumpur, Malaysia**

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A total of 6239 children aged between seven and 17 years attending 22 primary and secondary schools in Kuala Lumpur were screened using a self-report questionnaire. Their heights and weights were measured using the electronic SECA beam balance. The racial distribution of the sample was 56.7% Malays, 33.8% Chinese and 8.1% Indians. Overweight was defined as weight for age +1 SD from the NCHS median and obesity when the weight for age was above 2 SD from the median. Cross checks were made to correct for height. Using these criteria, the prevalence of overweight was six percent ( $n = 373$ ), whereas the prevalence of obesity was 3.6% ( $n = 222$ ). An intervention package was prepared for the problem of obesity. The approach is to promote healthy eating in the school setting for all children. The education package included video tapes, handouts, talks, exercises and motivation packages.

### **Effect of different percentages of dietary fiber from rice bran in reducing risk of cardiovascular diseases in rats**

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It is well-known that increased intake of dietary fiber in an otherwise low-fiber diet can have beneficial effects in both humans and animals. These benefits include prevention or alleviation of maladies such as cardiovascular diseases, diabetes, diverticulosis and colon cancer. Studies have also shown that rice bran can be an excellent source of dietary fiber, protein, unsaturated fat, calcium, iron, thiamin, riboflavin and tocopherol. This paper examines the effects of different percentages of dietary fiber from rice bran on blood cholesterol, triacylglycerol and HDL-cholesterol levels of rats. The results showed that rats fed a diet with 20% dietary fiber derived from rice bran have significantly ( $P < 0.05$ ) lower blood cholesterol levels, triacylglycerol and increased HDL-cholesterol levels in blood compared to control fed 10% cellulose. However, rats fed 10% dietary fiber derived from rice bran do not have the same beneficial effects. It is interesting to note that the rats fed 10% fulfatted stabilized rice bran was also effective in lowering the blood cholesterol and triacylglycerol and increasing the HDL-cholesterol and triacylglycerol and increasing the HDL-cholesterol level. The hepatic fatty acid profiles were similar to 20% dietary fiber or 10% fulfatted stabilized rice bran. It would appear that at least two different mechanisms were involved in modulating blood cholesterol, triacylglycerol and HDL-cholesterol levels in this study, one dependent on dietary fiber dose and the other on rice bran fat..

### **Iron status in young Australians**

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Iron deficiency is still one of the most common micronutrient deficiencies throughout the world. At the time this study was conducted, very little information existed for Australian adolescents and young adults, although evidence suggested that this group was at high risk of deficiency. Iron intake and status were measured in 637 young people (228 males and 409 non-pregnant females) with a mean age of 25 years (range 15–32 years). Fasting blood samples were collected to determine serum ferritin, plasma iron and haemoglobin. Potential confounders such as recent blood donation, smoking and exercise habits were assessed by interview and questionnaire, and iron intakes were estimated by a semi-quantified food frequency questionnaire using Australian food composition data. In this study, 32% of young women had serum ferritin less than 15  $\mu\text{g/L}$  with the highest prevalence (41%) of low ferritin values in women aged 15–22 years. In this study's young female population, 14% had low plasma iron, and 6% had low haemoglobin. With an average daily iron intake of less than 12 mg, as many as 57% of the females had intakes less than their age and gender specific RDI and 20% consumed less than 70% of this RDI. For the men aged 15 to 32 years, 5%, 7% and 1% had low serum ferritin, plasma iron and haemoglobin respectively; the average dietary iron intake was above 14 mg/day and only 2% had intakes that were less than the RDI. In this group, 18% of the females were blood donors, 18–26% were smokers, and 23–33% exercised more than three hours a week. In the males, 8–23% were blood donors (more in the older age group), 20–27% were smokers and 44–51% exercised for more than 3 hours a week. For both men and women in this study, those who had lower haemoglobin and serum ferritin levels, exercised more, were more likely to be non-smokers and more likely to be blood donors. Dietary iron intake was lower in men with the lowest haemoglobin and there were trends for increasing serum ferritin and plasma iron with increasing dietary total and available iron intake. The results from this study suggest that young females (15–22 years) were at high risk of becoming iron deficient and supports earlier evidence that blood donation, heavy exercise and possibly low dietary iron intakes may be risk factors for iron deficiency.

### **Development of an iron supplementation program for the control of iron deficiency anemia in Indonesian infants and children**

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Recognizing the high prevalence of iron deficiency anemia (IDA) and its negative impact on child development, a program based on iron supplementation for children under five was developed. To prepare for a national program, an initial evaluation of iron syrup supplementation was given to 12 500 children of two districts in 1995. Its distribution was through existing health channels, namely integrated health posts and the health centre. Both daily and weekly schedules were tested using 15 mg doses of elemental iron for infants and 30 mg doses of elemental iron for children. Sub samples of children under five were tested for hemoglobin using the Cyanmeth method at the initial evaluation phase. The baseline prevalence of anemia was approximately 60%. After 2 months of supplementation, the prevalence of anemia was reduced to approximately 45% for the weekly group and approximately 30% for the daily group. Based on this finding, a large scale program for villages in 14 provinces in Indonesia classified as low poverty areas was started in 1996. This program provided children under five with daily iron syrup supplements for 2 months. Approximately 180 000 children were covered by this program. Based on the program experience, we have learnt that there are other options to control the high prevalence of IDA among young children. Efforts such as the use of iron syrup to expand and to improve the existing iron supplementation program should be considered. With a functional iron supplementation program, other important nutrients could be added to iron syrup for greater child health and nutrition benefit.

### **Nutritional status and parasitic infections among Orang Asli preschoolers in Kelantan**

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A nutrition and parasitological cross-sectional survey of preschool children aged 1 to 6 years from an Orang Asli village resettlement scheme in Kelantan was done. A total of 397 children were examined and anthropometric measurements were taken. There were 262 stool specimens collected and examined using a modified Stoll's technique. The nutritional status was poor, a prevalence of 32.3% underweight, 93.5% stunting and 13.1% wasting based on the NCHS reference values. Soil transmitted helminthic infections were predominant, and the prevalence rate of ascaris, trichuris and hookworm infection were 47.7%, 35.9% and 11.1% respectively. The intensity of ascaris infection were 64.5% (low), 27.3% (moderate) and 8.3% (high). Giardiasis was detected in 8.8% of the children. The intensity of ascaris infection was not associated with the observed nutritional anthropometric indicators. Thus other factors may contribute more to the poor nutritional status found. A community trial is presently being undertaken to confirm whether helminthic infections play an important role in the poor nutritional status. Presumptive-mass antihelminthic treatment might then be based more on a risk approach, treating only children identified as at risk of poor nutrition.

### **Eating disorders among female college students in Kelantan**

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The problem of eating disorders has not been widely studied in Malaysia, particularly in relation to anorexia nervosa and bulimia. It is the aim of this paper to report a preliminary study on eating disorders and nutritional status among female college students in Kelantan. A total of 861 female students ( $n = 861$ ) from Teachers Training College, College of Nursing and Universiti Sains Malaysia, were investigated regarding their eating habits, anthropometry, health status and psychological profiles. For dietary intake a 24-hour dietary recall was employed and anthropometric measurements consisted of weight, height, mid-upper arm circumferences and tricep skinfold thickness. In evaluating eating disorders and psychological profiles, a translated and validated eating attitude test and eating disorders inventory were used. The general health questionnaire was used to evaluate their health status. The results indicated that 52.3% of the respondents estimated their body weight to be less than 50 kg; however, upon actual measurement only 49.6% weighed less than 50 kg. Based on body mass index classification, the proportions of those with grade I, II and III thinness were 18.1%, 3.9% and 1.7%, respectively. About 67% of the respondents were within normal BMI (18.5–24.9 kg/m<sup>2</sup>). 22.5% of the respondents had their energy intake less than 1000 kcal per day. 11.5% felt guilty after eating a full meal, while 4.9% had a desire to vomit after eating. About 38% experienced irregular menstrual cycles and about 12.2% were following some form of dietary regimen to lose weight.

### Energy intake and energy expenditure among lactating women

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A study on energy intake and energy expenditure of 30 lactating women was carried out in Selama, Perak, Malaysia. The objective of the study was to determine the daily energy intake, energy expenditure and milk volume of the lactating mother. The study also assessed the relationship between body fat stores and milk production. Data were collected by using anthropometric measurements, 24 hour dietary recall, physical activity records, and a questionnaire on the background information of the respondents. Data on milk production was collected by weighing the baby before and after a feeding. The difference in weight, which is equivalent to the milk volume, was multiplied by the total number of feedings in 24 hours, to obtain the total milk volume per day. The mean age of the respondents was  $30 \pm 6.5$  years, ranging from 20–44 years of age. The age of the infants was in the range of 1–3 months. Percent of body fat was determined by measuring the thickness of the biceps, triceps, suprailiac and subscapular skinfolds. The mean body fat percentage was 21.4%, ranging between 18.1%–27.1%. There was no significant relationship between milk volume and percentage body fat. Around 6.6% of the respondents were classified as chronic energy deficient, indicated as having BMI below  $18.5 \text{ kg/m}^2$ , and 19.9% of respondents were in the overweight and obese categories (BMI > 25.0 and BMI > 30.0, respectively). There was no significant relationship found between the BMI of the mother and the milk volume. Mean energy intake and mean energy expenditure was  $2043.9 \pm 458.6$  kcal and  $3054.0 \pm 251.7$  kcal, respectively, which indicated a negative energy balance among the women. The energy intake of the mother correlated significantly with the milk production. Mean milk volume was  $604.4 \pm 113.5$  ml where the mean milk intake per day by the male infant was 616.2 ml and by the female infant was 576.6 ml. This study showed that milk production of Malaysian mothers was comparable with those studies found in other developing countries but lower than those found in developed countries.

### Assessment of nutritional status among a sample of elderly Chinese in a rural area

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The purpose of this study was to assess the nutritional status of a sample of elderly Chinese who were 50 years and older in a rural area in Terengganu. Fifty males and fifty female elderly who fulfilled the selection criteria were randomly selected from a list of names. Respondents were interviewed using a questionnaire. The nutritional status was determined using anthropometric measurements, 24-hour dietary recall and food intake frequency. Data were analyzed using SPSS and DEMETER programmes. The Pearson's correlation test, *T*-test and *F*-test were used to test the hypotheses. Most of the respondents (59%) were 60 years old and above with a mean age of 62.6. Most of them were Buddhists (59%), had a primary level of education (49%), were living with at least one family member (94%) and were still married (77%). The mean monthly household income was RM1242 and most of them (54%) had incomes of less than RM1000. The anthropometric results revealed that the mean body weight and height were higher for males than females. Based on the BMI, most of the males (70%) were classified within the normal range and more females (22%) were classified as overweight. Based on the WHR, there were more females (62%) who were classified at higher risk for obesity and chronic diseases. The frequency of food intake showed that 13 food items were frequently consumed, 34 food items were moderately consumed and seven food items were consumed less frequently. The dietary assessment showed that most respondents consumed more than 67% RDA for energy and most of the nutrients, except for calcium. Pearson's correlation test showed significant negative relationships between intakes of protein, iron, vitamin A and vitamin C and the respondents' ages. Household income was also significantly correlated with intakes of energy, carbohydrates and thiamin. The *T*-test revealed significant differences for intakes of protein, calcium, iron, vitamin A and vitamin C according to marital status. In general, the nutritional status for male elderly was better than for female elderly and the overall nutritional status could be considered to be fair. Nevertheless, appropriate strategies, food assistance and nutrition education programmes need to be formulated and provided to the elderly, especially to those who live alone and who are at a higher nutritional risk.

**Dietary pattern and nutritional status of Iban preschool children in Julau, Sarawak**

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The purpose of the study was to identify the dietary patterns and to assess the nutritional status of Iban preschool children and to determine their association with selected factors. A total of 119 preschool children aged above 1 year to 5 years were selected from ten long-houses in Julau, Sarawak, using stratified random sampling. Based on the 24-hour dietary recall, the intake of all nutrients with the exception of protein were below the Malaysian RDA. Their diet also lacked variety, particularly food sources of calories. Food sources of protein, vitamin and minerals were first introduced at a mean age of 11 months, whereas caloric sources were introduced at a mean age of 13 months. The dietary history showed that 86.6% of the children had been breastfed. The anthropometric measurements revealed that 44.5% of the children were underweight, 42.0% were stunted and 9.3% were wasted. There was a positive and significant association between parents' education, household income, food expenditure, household size and number of female members in a household with the children's dietary pattern. Parents' age, literacy level and occupation, including the above factors, except for household size, number of female members and father's education were positively and significantly associated with the children's nutritional status. The yield of hill padi and duration of storage, together with the number of chickens reared were also positively and significantly associated with the children's dietary pattern. The intake of calories, protein, thiamin, riboflavin and niacin were positively and significantly associated with the children's nutritional status. The age at which the children were first introduced to leafy and wild vegetables, fruits, caloric and protein sources were negatively and significantly associated with their nutritional status. Worm infestation was negatively and significantly associated with the children's mid-arm circumference for age. The above findings indicated that household composition and socio-economic status, late introduction of nutritious food and incidence of worm infestation were factors associated with malnutrition in the community. This is further complicated by poor dietary patterns which lack variety of food sources and inadequate food production.

**The effects of repeated frying on the rancidity level of RBD olein, red palm olein and soy bean oil**

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Oil rancidity may be caused by the chemical reaction in which the oil has been exposed to oxygen and heat for a period of time. The end product of this reaction will give unfavorable taste and odour. Oxygen reacts with the double bond of polyunsaturated fatty acid to produce peroxides. Free radical is one of the products of this reaction. Free radical is very reactive and can damage cell protein and membranes. Since oil is very important in food preparation and widely consumed, it is therefore the objective of this study to investigate the effects of repeated frying on the level of rancidity between three types of cooking oil (RBD olein, red palm olein and soy bean oil) and potato chips that have been fried in these oils. The samples were fried ten times at 180°C for 10 minutes per frying. The peroxide values of the samples were determined using Porim Test Method (1985) and the TBA value was analysed based on Tarladgis's method (1960). Results from TBA showed that soy bean oil was the first oil to become rancid (at second frying) followed by RBD olein (at fifth frying) and red palm olein (no sign of rancidity after ten times of frying). Red palm olein had the highest peroxide value after ten times of frying followed by soy bean oil and RBD olein. However the peroxide value of potato chips fried with RBD olein has the highest reading followed by red palm olein and soy bean oil. The difference in peroxide values obtained from these two types of samples was due to peroxide formed being unstable and could easily convert to another product. This study also showed that there was a significant relation between rancidity of the cooking oil and potato chips (potato chips with soy bean oil:  $P = 0.001$ ,  $R = 0.8756$ ; potato chips with RBD olein:  $P = 0.000$ ,  $R = 0.8619$ ; potato chips with red palm olein:  $P = 0.000$ ,  $R = 0.9326$ ). In conclusion, this study showed that soy bean oil became rancid faster than RBD olein and red palm olein and that the rancidity of food is influenced by the frying oil used.

### Microbiological status of food sold at UPM cafeterias

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A study was carried out to determine the level of bacteria in food served in the cafeteria at UPM (Universiti Putra Malaysia). Three cafeterias were selected for this study, namely, Kolej Kediaman Kelima, Kolej Tun Perak and Kolej Mohamad Rashid Cafeteria. The selection of the cafeterias was based on four types of common food (nasi goreng, nasi lemak, mi goreng and mihoon goreng) served at early morning (7.30 am) and the same food still available at mid morning (10.30 am). Enumeration of bacteria was carried out using an Aerobic Plate Count, the Coliform and *Escherichia coli* determination, and Coagulase positive *Staphylococcus aureus* test. Sanitation of the cafeteria was observed based on a structured questionnaire. Swab 'N' Check Method was used to determine the cleanliness of the utensils and premises in the cafeterias. The results showed that foods served at early morning (7.30 am) contained bacteria level of  $10^3$  to  $10^7$  cfu/g, the coliform between 1 to 7 MPN/100g, *E. coli* between 1 to 2 MPN/100g and *S. aureus* between  $10^2$  to  $10^3$  colony/g. The foods served at mid morning (10.30 am) contained bacteria levels of  $10^5$  to  $10^8$  cfu/g, the coliform between 2 to 27 MPN/100g, *E. coli* between 1 to 8 MPN/100g and *S. aureus* between  $10^3$  to  $10^4$  colony/g. The level of sanitation at the cafeterias were satisfactory. The level of cleanliness of the utensils and premises range between level 1 (clean) to level 4 (very dirty). The Pearson Correlation Coefficient showed no significant correlation ( $P > 0.05$ ) between bacteria content and the level of sanitation. The *t*-test indicates that the level of bacteria count in food served at 7.30 am and the same food served at 10.30 am was significant ( $P < 0.05$ ). The data suggests that foods served at early morning have lower bacteria content as compared to the same food served at mid-morning. Therefore, consumers should not eat the food sold 3 hours after preparation in order to avoid food poisoning.

### Effects of treatments on the nutrient composition and anti-nutritional factors of rubber seed (*Hevea brasiliensis*)

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This study was carried out to determine the nutrient composition and the anti-nutritional factors in rubber seed as well as *asam rom*, a traditional Malay food based on rubber seed. *Asam rom* was prepared by drying under the sun for 2–4 days followed by melting and then fermenting. Nutrient composition was determined using proximate analysis based on the AOAC (1980). The anti-nutritional factors analyzed were cyanide and trypsin inhibitor. The treatments applied in this study included removal of the rubber seed skin, soaking in water (24 h), boiling (30 min), drying in oven (80°C for 4 h), soaking (24 h) followed by drying (80°C for 4 h) and boiling (30 min) followed by drying (80°C for 4 h). The results of proximate analysis of rubber seed were as follows: 31.9% moisture, 1.3% ash, 29.6% fat, 5.3% crude fiber, 12.2% protein and 19.7% carbohydrate. The nutrient composition of *asam rom* was as follows: 19.5% moisture, 4.7% ash, 22.1% fat, 9.5% crude fiber, 11.6% protein and 32.5% carbohydrate. The compositions of the trypsin inhibitor and cyanide content obtained from rubber seed were  $15.1 \pm 2.5$  TIU/mL and  $55 \pm 0.9$  mg HCN/kg, respectively. All the heat treatments conducted were found to reduce the content of trypsin inhibitor in rubber seed, as much as 70–80%. The cyanide content was also found to be reduced after each treatment. Removal of the skin only resulted in small effect. About 50% of cyanide was destroyed when rubber seed was boiled followed by drying, soaking and drying. On the other hand, in *asam rom*, very little amount of cyanide was obtained ( $0.25 \pm 0.35$  mg HCN/kg) and trypsin inhibitor was not detected. In conclusion this study showed that various treatments applied can reduce the levels of cyanide and trypsin inhibitor in rubber seed and that it therefore has the potential to be processed as a food product.

**Inhibitory effects of *Bifidobacterium asteroides* and lactoferrin on the growth of *E. coli* 2520 *in vitro* and *in vivo***

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Diarrhea is one of the leading causes of illness and death among children in the developing countries. It is an important cause of malnutrition which in turn results in serious growth impairment. Continued breast feeding and ORS therapy during episodes of diarrhea seem to be the most effective way to minimise the risk of malnutrition. Alternatively, rice porridge that is widely consumed in Asian and South-East Asian countries has also been suggested by WHO to be a suitable food. In addition, supplementing the porridge with lactoferrin, an iron-binding protein and bifidobacteria may be functional in inhibiting the growth of these diarrheal-causing pathogens. Hence, this study was conducted with the objective of determining the effect of lactoferrin and bifidobacteria, either alone or together added to rice porridge, on the growth of a pathogenic *Escherichia coli* 2520 strain. *In vitro* study was conducted in a 96-well plate with each well containing a 250 µl mixture of rice porridge, lactoferrin or apolactoferrin and bacterial cultures of *E. coli* and *B. asteroides*. Both human and bovine lactoferrin at different concentrations were used. *E. coli* was applied at 10<sup>3</sup> cfu/g while *B. asteroides* was at concentration 10<sup>6</sup> cfu/g. Colony counting was done on TPY and MacConkey agar plates for *B. asteroides* and *E. coli*, respectively. Results showed that both *B. asteroides* alone and apolactoferrin alone were found to inhibit the growth of *E. coli* significantly ( $P < 0.5$ ). Inhibitory effect of apolactoferrin was demonstrated much earlier (6 h) than that of *B. asteroides* (24 h). Saturated lactoferrin even at the highest concentration did not display any inhibitory effect. However, *in vivo* study using 250 mice infected orally with *E. coli* 2520 demonstrated that not only apolactoferrin and *B. asteroides* but lactoferrin either alone or together with *B. asteroides* could reduce the fecal and colonic *E. coli* counts significantly ( $P < 0.5$ ). In conclusion, this study supports the proposal that the addition of lactoferrin, apolactoferrin and *B. asteroides*, alone or together as a mixture, could possibly be used as a method to reduce enteric infections, as well as fulfilling the nutrient requirement for children during episodes of diarrhea.

**Identification of antioxidants (flavonoids) from the tissue cultures of *Citrus mitis* (limau kasturi), rutaceae family**

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Identification of most flavonoid compounds (antioxidants) and determination of the tissue culture growth, callus of *Citrus mitis* (limau kasturi), Rutaceae family were studied. A combination of phytohormones, naphthaleneacetic acid (NAA) 1.0 mg/L (w/v) and kinetin (KN) 0.5 mg/L (w/v) as previously established by Gill *et al.* (1995) were supplemented to the basal medium of Murashige and Skoog (MS) (1962). Seed explants were obtained from mature fruits of *C. mitis*, while stem, root and leaf explants were aseptically obtained from young seedlings earlier grown *in vitro* at 28 ± 2°C for 5 weeks. Callus derived from stem explants showed the best response of callus growth compared to the other explants that showed only the occurrence of the organogenesis process. Determination of callus growth, cell viability and identification of flavonoids produced was performed only on *C. mitis* callus cultures. The callus that was cultured in dark conditions showed the best growth, was more friable and was golden cream in colour. There were also more viable cells present compared to the light condition. The flavonoids were determined by using the simple techniques of preparative thin layer chromatography (pTLC) with a development solvent (e.g. n-butanol:acetic acid:water (BAW, 4:1:5). The spots were obtained after exposure to either iodine or NH<sub>3</sub> vapour and detected under UV light. The callus derived from stem explants had two spots, one with Rf(x100) 43.4 (i.e. myricetin) and the other with Rf(x100) 94.7 (i.e. hesperitin) which are, respectively, under the flavonol and flavanone groups. Individual spots were carefully scraped by being dissolved in 3.0 mL absolute ethanol and centrifuged. The supernatant obtained was screened at 250–550 nm by using a spectrofluorometer for their chromatograms.