

DP26-09

STUDIES ON THE MICROBIOLOGICAL, NUTRIENT COMPOSITION AND ANTINUTRITIONAL CONTENTS OF FERMENTED MAIZE FLOUR FORTIFIED WITH BAMBARA GROUNDNUT (VIGNA SUBTERRANEAN L)

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The nutrient composition, antinutritional factors, and microflora in spontaneously-fermenting maize flour fortified with Bambara groundnut were examined over a period of 72h. Titratable acidity, as well as pH changes, was obtained at 12-h interval during fermentation by adventitious microorganisms present in the fortified product. Results obtained showed that microflora gradually changed from Gram-negative enteric bacteria, molds, lactic acid bacteria and yeast to be dominated by Gram-positive lactic acid bacteria (LAB) and yeasts. All undesirable microorganisms, such as coliforms and molds, which were present at the start of fermentation, were totally eliminated by 24h of fermentation. Yeasts and LAB numbers in the fortified dough varied between 4.44 and 7.36 log cfu/l. LAB number increased from 5.40 to 7.36 log cfu/l during fermentation. Yeasts increased from 4.44 to 5.60 log cfu/l. The product pH decreased with concomitant increase in moisture, fat, ash, fiber and titratable acidity with increasing Bambara-groundnut addition. Bambara-groundnut addition caused only minimal changes in the proximate composition with the exception of protein content, which increased remarkably from 18.40% to 21.68% with 30% Bambara-groundnut addition. Boiling, sprouting and fermentation significantly decreased the tannins and trypsin inhibitor levels. Boiling Bambara-groundnut for 20 min before incorporation into the maize flour imparted a desirable flavor. Organoleptic evaluation revealed that the foods were well accepted. Based on the findings, the application of Bambara-groundnut fortification to traditional foods can promote nutritional quality of African maize – based traditional foods with acceptable rheological and cooking qualities.

DP27: Food Cultures, Cuisines & Indigenous Diets II

DP27-01

ANALYSIS OF FACTORS RELATED TO BMI/A OF LACTO-OVO-VEGETARIAN AND NON VEGETARIAN CHILDREN UNDER FIVE IN JAKARTA YEAR 2008

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RATIONALE AND OBJECTIVES: Children under five are susceptible to be under nutrition and not suggested to have vegetarian diet. The objective of this study is to understand the factors related to BMI/A of lacto-ovo-vegetarian and non vegetarian children under five.

MATERIALS AND METHODS: Cross-sectional design is used and samples are collected by purposive sampling. Total samples are 148 children under five (75 vegetarian, 73 non vegetarian). Weight balance (Seca model 872, accuracy 0.1 kg), length board, microtoice, 24 hours food recall and food frequency questionnaire are used for collecting data.

RESULTS AND FINDINGS: The analysis of polynomial logistic regression shows 5.3% vegetarian children under five are obese, 13.3% overweight, 25.3% at risk of overweight, 56% normal and 12.3% non vegetarian children under five are obese, 8.2% overweight, 21.9% at risk of overweight, 57.5% normal.

CONCLUSION: There is no significant difference in BMI/A between lacto-ovo-vegetarian and non vegetarian children under five.

DP27-02

VEGAN DIET AND PESTICIDES

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RATIONALE AND OBJECTIVES: In this study vegan diet was evaluated from the toxicological point of view. Our special interest lies in cumulative exposure to selected pesticide metabolite residues found in foods of vegetarian origin. Based on present estimations, Finn's chronic exposure to pesticide residues is well below the acceptable daily intake (ADI), however, calculations have been made on pesticide residues not on their metabolite residues found in foods. Further, earlier dietary exposure estimations have been based on food intake of general population and not on dietary intake of vegetarians, i.e. the group with highest consumption.

MATERIALS AND METHODS: Food intake between vegans (n=20) and their matched controls were obtained using 5-day food records. Nutrient intake was calculated by using Nutrica computer program. Statistical significance of the differences between the matched pairs were assessed by Student t test for paired samples or by Wilcoxon's test. Probabilistic cumulative modeling was carried out for a selected set of parent compounds and their metabolites.

RESULTS AND FINDINGS: Vegans consumed significantly higher amounts of fruits and berries, roots, vegetables, pulses and nuts, which is reflected in their dietary intake of pesticide metabolites. In order to validate this, biomonitoring of selected set of metabolites will be carried out.

DP27-03

EFFECTS OF FASTING DURING RAMADAN ON CHILD GROWTH AND NUTRITION IN RURAL WEST JAVA, INDONESIA

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OBJECTIVES: The effect of Ramadan fasting on health and nutrition is well studied for adults but not for children. In this study, we aimed to determine the effect of fasting on child growth and nutritional intake.

MATERIALS & METHODS: Eighty-eight children, aged 6 to 14, who completed Ramadan fasting in 2003, were recruited for this study conducted in 2004; among them, 72 completed the one month of fasting. The weights of the children were measured on the 1st, 8th, 15th, 22nd, and 29th days of Ramadan and 7 days after the end of Ramadan. Height and MUAC were measured on the 1st and 29th days of Ramadan. Nutritional intake during Ramadan was measured for each child by food weighing.

RESULTS: The children's weights decreased gradually from the 1st to the 29th day of fasting with an average decrease of 0.92 kg. One week after Ramadan, however, the children's weights increased by 1.28 kg because of a big festival (Lebaran). The average height gain during Ramadan was 0.41 cm, which was slightly lower than the mean height increment in other months. The nutritional intake decreased during Ramadan, which may have contributed to the weight loss of the children.

CONCLUSION: A small but significant decrease in growth was observed among the children who completed Ramadan.

DP27-04

MICROBIOLOGY OF FRESH CUT FRUITS SOLD ON THE GHANAIAN MARKET

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RATIONALE & OBJECTIVES: The processing and vending of fresh-cut fruits contributes to the consumption of fruits and vegetables, because such provides convenience as well as affordable prices at the unit packages. However, the processors and vendors operate under unhygienic condition. The study was done to access the microbiological quality of fresh-cut fruits on the Ghanaian market and its implication for food safety.

MATERIALS & METHODS: Fresh-cut pawpaw, watermelon and pineapple were purchased from three different areas in Accra for microbial analysis. Both the fruits and their packaging materials were analyzed for the following counts: Salmonella-Shigella count, Coliform count, Staphylococcus count, mold and yeast count, Escherichia Coli count and Total Viable count using the pour plate technique.

RESULTS & FINDINGS: The exterior of the packaging materials had higher counts than the fruits. Organisms isolated and identified were Aspergillus spp, Fusarium spp, Penicillium spp, Erwinia spp, Staphylococcus spp, Streptococcus spp, Bacillus spp, Pseudomonas spp, Salmonella spp, Shigella spp, Escherichia coli and Yeast. Total Viable count and mold and yeast counts were the highest with the least being the Salmonella-Shigella count.

CONCLUSION: Fresh cut fruits processed by market or road side vendors have high microbial contamination. Processors should be educated on hygienic practices and good processing methods to reduce possible food –borne illness.

DP27-05

FOOD SECURITY & DIETARY ADEQUACY: CANADIAN INUIT PRESCHOOL CHILDREN

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RATIONALE & OBJECTIVES: A high prevalence of food insecurity has been noted in the few Arctic communities which have participated in food security assessments, raising concerns regarding food security throughout the Arctic, where unemployment rates and market food costs are extremely high. Furthermore, dietary change and nutrition transition are ongoing concerns among Indigenous Peoples of the Canadian North. Therefore, an Inuit Child Health Survey, with a focus on nutritional health, was conducted in Nunavut Territory, Canada.

MATERIALS & METHODS: A cross-sectional survey of preschool children, aged 3-5 years, was conducted with children recruited through local health center vaccination lists. A total of 383 Inuit children and their parents/guardians from 16 Nunavut communities participated in the survey between August 2007 and September 2008. Bilingual and trained interviewers conducted interviews with the child's caregiver and completed questionnaires about the child's diet, health history, household conditions and food security. Food security was assessed using a USDA questionnaire that had been slightly modified by Indian and Northern Affairs Canada through consultation with Inuit community members. Correlates of food insecurity evaluated included household crowding, age and gender distribution of household members, social assistance and other socioeconomic indicators, access to and consumption of traditional food, region, and measures of child growth. Assessment of dietary adequacy was done using the Estimated Average Requirement (EAR) cut point method as outlined in the Institute of Medicine's Dietary Reference Intakes (DRIs). The method requires a statistical adjustment of the nutrient data in order to compare it to the EAR. Some nutrients such as calcium, vitamin D and fiber were compared to Adequate Intakes (AI) as defined in the DRIs. The extent of traditional food use was evaluated using a food

frequency questionnaire. Dietary quality assessment included the extent to which dietary habits followed the Canadian Food Guide recommendations and the degree of consumption of high sugar and high fat food and sugar beverage consumption.

RESULTS & FINDINGS: Results are embargoed until presentation to communities is completed in May of 2009, in accordance with participatory research methods and memorandum of agreement. Full details of results will be provided at the ICN 2009.

CONCLUSIONS: The results will help lead to appropriate nutritional health interventions and promotion strategies for Inuit children in the Canadian High Arctic.

DP28: Nutrition & Infection II

DP28-01

EFFECT OF L-LYSINE ON ACUTE DIARRHEA IN LOW-INCOME PERI-URBAN SUBJECTS IN ACCRA, GHANA

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RATIONALE AND OBJECTIVES: Animal studies show lysine deficiency strongly enhances diarrheal incidence. Lysine administration blocks gastric emptying and stress-induced diarrhea. The effect of lysine on acute diarrhea in low-income peri-urban subjects is examined.

MATERIALS AND METHODS: In a double-blind, randomized-controlled, 16-week lysine supplementation trial (n=90 men, women, children each), baseline and post-test data on health status, anthropometry and parameters of stress, blood and immunology, were collected. Weekly morbidity was monitored, and total episodes and days ill from diarrhea were estimated. Chi-square and non-parametric tests were conducted.

RESULTS AND FINDINGS: Lysine-supplemented children had 21 diarrhea episodes versus 36 in placebo, odds ratio (OR) of 0.56 (p=0.038, 0.32-0.97). Mean days ill in lysine-supplemented children (0.043±0.05) were significantly lower (p=0.022) than placebo (0.073±0.06). No differences were observed in total episodes and mean days ill in men or women.

CONCLUSION: Lysine-supplemented children had significantly lower episodes and mean days ill from diarrhea than placebo.

DP28-02

PREVENTION OF UPPER RESPIRATORY TRACT INFECTION BY ZINC AND VITAMIN A SUPPLEMENTATION

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RATIONALE & OBJECTIVES: Previous studies have reported reduction in acute lower respiratory infections by zinc and vitamin A supplementation. This study investigated the effect of zinc and vitamin A supplementation on upper respiratory tract infections (URTI) prevention in Indonesian preschool children.

MATERIAL AND METHODS: 826 children aged 2-5 years in Semarang were entered into a randomized, double-blind supplementation trial and were given 10mg daily of zinc or placebo for 4 months, started 2 months before vitamin A supplementation. URTI symptoms were recorded every 3 days for 4 months.

RESULTS: Vitamin A supplementation reduced (23%) URTI episodes, while zinc supplementation did not. Children

receiving both zinc and vitamin A had the lowest number of URTI episodes. Vitamin A supplementation reduced the percentage of days ill by 9%, while zinc plus vitamin A further reduced by 9%. Mean URTI duration per episode was not different among groups.

CONCLUSIONS: Vitamin A supplementation reduced URTI incidence and percentage of days ill. Concurrent zinc and vitamin A supplementation further reduced URTI incidence and percentage of days ill.

DP28-03

VITAMIN D STATUS AND ACUTE LOWER RESPIRATORY INFECTION IN NORTHEASTERN BANGLADESH

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RATIONALE AND OBJECTIVES: Acute lower respiratory infection (ALRI) causes a large proportion of early childhood mortality in South Asia. We aimed to assess the association between vitamin D status and ALRI in Sylhet, Bangladesh.

MATERIALS AND METHODS: In a case-control study, children aged 1–24 months admitted to a rural hospital with ALRI were age- and sex-matched to community-sampled controls (N=25 pairs). The primary outcome was the mean case-control difference in the serum 25-hydroxyvitamin D concentration ([25(OH)D]).

RESULTS AND FINDINGS: The mean [25(OH)D] was significantly lower among ALRI cases than controls (29.1 vs. 39.1 nmol/L; P=0.015). In conditional logistic regression, the unadjusted odds of ALRI was halved for each 10 nmol/L increase in [25(OH)D] (OR 0.53, 95% CI 0.30 – 0.96). Adjustment for confounders increased the magnitude of the ALRI-vitamin D association (OR 0.23, 95% CI 0.06 – 0.81).

CONCLUSION: Vitamin D status was associated with early childhood ALRI. Randomized trials are needed to establish whether improvements in vitamin D status would reduce the risk of ALRI in this population.

DP28-04

HIGH HIGH-DENSITY LIPOPROTEIN-CHOLESTEROL IS ASSOCIATED WITH DECREASED RISK OF CORONARY ARTERY DISEASE IN PATIENTS WITH RHEUMATOID ARTHRITIS

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The cause of increased risk of coronary artery disease (CAD) in patients with RA is still highly controversial, and also unclear. The purpose of this study was to investigate which factor might be a significant indicator for developing CAD in patients with RA. This study had a case-control design. Twenty-nine RA patients with normal endothelial function and 33 patients with CAD were recruited. Risk factors of CAD were measured. Patients with RA had significantly higher high-density lipoprotein-cholesterol (HDL-C) and lower systolic blood pressure (SBP), triglycerides (TG) and serum folate values than patients with CAD. The association of SBP, TG and folate level with the risk of CAD disappeared after HDL-C (OR, 0.83, 95% CI, 0.74 – 0.93) was additionally adjusted into the model. Increased HDL-C was significantly associated with decreased risk of CAD in patients with RA. Patients with RA should try to increase their HDL-C level in order to reduce the risk of CAD.

DP28-05

LACTO-WOLFBERRY, A NATURAL NUTRITIONAL INGREDIENT WITH ANTI-INFLAMMATORY AND ANTI-OXIDANT PROPERTIES

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RATIONALE AND OBJECTIVES: Wolfberry, a validated Chinese functional ingredient, was processed with milk to improve bioavailability of its anti-oxidant components. Here, the improved so-called lacto-wolfberry (LWB) was assessed for its anti-inflammatory and anti-oxidant activities.

MATERIALS AND METHODS: Anti-inflammatory and anti-oxidant properties of LWB were assessed in vitro using NF- κ B and Nrf2 reporter gene assays, respectively. Efficacy of LWB was demonstrated in vivo using a preclinical model of intestinal inflammation.

RESULTS AND FINDINGS: TNF α -mediated NF- κ B activation was significantly reduced in a dose dependent manner by incubation with LWB, demonstrating its anti-inflammatory effect. Nrf2 activation was induced by LWB, suggesting its anti-oxidant properties. As proof of concept, oral supplementation with LWB resulted in a reduction of macroscopic (p<0.05) and histological (p<0.02) scores in mice developing colitis. These effects were associated with a significant decrease in expression of inflammatory proteins (e.g. COX-2, p<0.01; MPO, p<0.02). In parallel, a strong increase in both expression of genes encoding for anti-oxidants in the colon (e.g. GPX1, p<0.0001; CAT, p<0.0001) and plasmatic anti-oxidant capacity (p<0.008) were observed in LWB-supplemented animals.

CONCLUSION: Lacto-Wolfberry, displaying anti-inflammatory properties associated with anti-oxidant capabilities, could be considered as promising nutritional strategy to help manage inflammatory conditions in humans.

DP28-06

THE ASSOCIATION BETWEEN VITAMIN A STATUS AND HEPATITIS B ANTIBODY LEVEL AMONG YOUNG CHILDREN IN RURAL CHINA

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RATIONALE & OBJECTIVES: Studies have shown that vitamin A-deficient (VAD) children have impaired immunity. This study was to observe the relationship between VAD and immune response to Hepatitis B (HB) vaccination in rural Chinese children.

SUBJECTS & METHODS: A cross-sectional study was conducted in rural Linyi, China and 322 children, aged 7-36 months, were recruited into the survey. Two milliliter venous blood was drawn from each child to measure anti-Hepatitis B antibody (anti-HB), serum retinol, hsCRP level, as well as zinc, copper, selenium, magnesium, iron, ferritin concentrations.

RESULTS & FINDINGS: Of 286 children (118 girls and 168 boys) with serum samples, 39.5% and 22.7% of them were VAD (serum retinol <0.35 μ mol/L) and marginal VAD (serum retinol <0.70 μ mol/L), respectively. The logarithm of serum anti-HB had no correlation with serum retinol, as well as zinc, copper, iron, ferritin and hsCRP (all p>0.05), but was correlated with age (r=-0.17 p=0.001), serum selenium level (r=-0.11, p=0.04), and marginally with magnesium concentrations (r=0.09 p=0.08). However, after controlling for the time since the last Hepatitis B immunization and for serum selenium and magnesium concentrations, the association between serum retinol, and logarithm of anti-HB was significant (β =0.64,

p=0.04, n=225).

CONCLUSION: The results show that response to hepatitis B immunization could be independently associated with vitamin A status of infants and young children after controlling those potential confounders.

DP28-07

EFFECTS OF DIETARY FISH OIL ON HEPATIC MITOCHONDRIAL MORPHOLOGY AND ENZYME ACTIVITIES IN MICE WITH GUT-DERIVED SEPSIS

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RATIONALE AND OBJECTIVES: Sepsis is the most common complication seen in clinical practice. Oxidative stress to tissues and mitochondrial dysfunction are thought to play important roles in the pathogenesis of septic-induced multiple organ failure. This study investigated the effects of dietary fish oil supplementation on liver mitochondrial morphology and mitochondrial enzyme activities in cecal ligation and puncture (CLP)-induced septic mice.

MATERIALS AND METHODS: Male ICR mice were assigned to a control group and 2 experimental groups. The control group(C) were fed with a semi-purified diet with 10% soybean oil; the experimental groups were fed with a low-dose fish oil diet (2.5% fish oil+ 7.5% soybean oil; w/w)(L) or a high-dose fish oil diet (7.5% fish oil+ 2.5% soybean oil; w/w)(H). Three weeks later, peritoneal lavage fluid (PLF) and liver were harvested from mice at 0, 6 and 24 h after CLP respectively.

RESULTS AND FINDINGS: The H group showed a lower prostaglandin (PG) E2 than those in the L group in PLF at 6 h and those in the C group at 24 h. Also, the concentrations of tumor necrosis factor (TNF) - α in the H group were lower than those in the C and L groups at 24 h after CLP. Mitochondrial enzyme activities in liver were suppressed during early stage of sepsis. Compared with 0 h, the rotenone-sensitive NADH cytochrome c reductase activities were significantly decreased at 6 h and succinate cytochrome c reductase activities at 6 h and 24 h in the C and L groups after CLP. The cytochrome c oxidase activities were lower in the L and H groups at 6 h after CLP than 0 h. There were no differences in mitochondrial enzyme activities between the control and the fish oil groups. The morphology showed enlargement of hepatic mitochondria during early stage of sepsis.

CONCLUSION: These results suggest that CLP resulted in mitochondrial damage and downregulate enzyme activities. Mice fed with high-dose fish oil diet reduced PGE2 and TNF - α , however, the influence of fish oil on hepatic mitochondrial aspects and enzyme activities were not obvious in mice with gut-derived sepsis.

DP29: Obesity II

DP29-01

BIATRIC SURGERY AFFECTS ZINC AND IRON ABSORPTION AND NUTRITIONAL STATUS IN MORBIDLY OBESE PATIENTS

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OBJECTIVE: To evaluate zinc and iron absorption and nutritional status in morbidly obese patients before and 12 months after bariatric surgery.

METHODS: Fifty-five women were enrolled in the study (age

36.7 \pm 9.1 y, BMI 44.2 \pm 5.5 kg/m²). Twenty-eight underwent gastric bypass plus resection of the distal excluded gastric segment, 24 to gastric bypass with no removal of such segment, and 3 to sleeve gastrectomy.

RESULTS: Zinc absorption decreased from 31.6% to 16.7%, and iron absorption from 10.3% to 3.5% after 12 months of surgery (p<0.01). Plasma zinc and the size of the rapidly exchangeable zinc pool, hemoglobin, and serum ferritin were also decreased (p< 0.001). No differences were observed regarding removal of the excluded gastric segment.

CONCLUSION: Gastric bypass impaired intestinal absorption and nutritional status of zinc and iron. Removal of excluded gastric segment had no effects on these parameters.

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DP29-02

EXPLORING THE IMPACT OF WESTERN ADVERTISING AND MEDIA ON THE NUTRITION TRANSITION IN FOUR COUNTRIES

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RATIONALE AND OBJECTIVES: To describe the relationship between western media and the stage of the nutrition transition in four countries that are at different stages of the transition (US, Jordan, Japan, China); and to evaluate the impact of media on eating styles and body image.

MATERIALS AND METHODS: A cross-sectional survey that includes a variety of culturally appropriate Likert-type scales and body size images. In addition BMI was calculated based on self-reported height and weight. College females (n=1655) from universities across the four countries participated in the study.

RESULTS AND FINDINGS: Initial results confirm that the countries were at different stages of the nutrition transition with the US as most advanced, followed by Jordan, then Japan, and finally China. In addition, western advertising and media was significantly correlated with body image, desired change, and eating styles.

CONCLUSION: There is a need to develop public health interventions that account for cultural preferences regarding body size ideals and eating styles while minimizing the negative psychological and physical consequences of Western media, especially for young college women. Further implications and suggestions for future research are discussed.

DP29-03

PHYSICAL ACTIVITY, INACTIVITY, AND OBESITY AMONG URBAN AFFLUENT ADOLESCENTS IN INDIA

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RATIONALE: Adolescence represents a period of great decline in habitual physical activity and a sensitive period for the development of obesity.

OBJECTIVE: To examine the relationship between physical activity, inactivity, and adiposity among adolescents (9-16 yrs). **METHODS:** Body Mass Index (BMI), body fat (%) and blood pressure were measured on adolescent schoolchildren (n=901) in a cross-sectional study. Physical activity and inactivity were assessed using activity questionnaire.

RESULTS: Prevalence of overweight (IOTF cutoff) was high both in boys (24.8%) and in girls (19%). For pooled sample, time spent in outdoor games showed significant inverse association with adiposity and high risk (OR 8.08: CI 4.8-13.6) for overweight in children spending less (< 60 min/d) time. In contrast, total inactive time, and particularly TV viewing, showed significant positive association with adiposity. TV viewing (>120 min/d) showed the highest risks (OR 8.81: CI 1.9-38.9) for adiposity and marginally (p=0.07) significant risk

(OR 3.53; CI 0.8-14.3) for high systolic blood pressure.

CONCLUSION: Efforts to reduce obesity through increased physical activity appears to be an encouraging avenue. The increasing prevalence of childhood obesity and its concomitant health risks justify wide spread efforts towards its prevention.

DP29-04

THE RELATIONSHIP BETWEEN SNACKING AND OVERWEIGHT IN CHILDREN

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RATIONALE AND OBJECTIVES: Snacking may have an impact on overweight, however, data are limited on snack nutrient composition. The aim of the study was to assess the relationship between frequency and nutrient composition of snacks and childhood overweight.

MATERIALS AND METHODS: Three 24-hour recalls for 214 children, aged 8-10 years old and at high risk of overweight (QUALITY cohort), were analyzed. Body mass index (BMI) >85th percentile (Centers for Disease Control and Prevention) vs. normal weight children were compared for snacking behaviors.

RESULTS AND FINDINGS: All children had three main meals. Snacking frequency was not different between overweight and normal weight children (2.2 ± 0.8 vs. 2.1 ± 0.8). Total energy intake was not different by BMI group. Percent consuming morning, afternoon, and evening snacks were similar between overweight and normal weight children (79.4% vs. 83.0%, 81.4% vs. 80.3%, and 58.8% vs. 61.5%). For evening snack, % carbohydrate was higher in overweight children (72.0% vs. 60.2%, $p < 0.01$), and % fat was lower in overweight children than normal weight children (23.0% vs. 32.5%, $p < 0.01$). For other snacks, macronutrient distribution did not vary by BMI group.

CONCLUSION: Reported dietary intake patterns vary little by child weight status. The observed lower fat/higher carbohydrate evening snacks deserves further attention.

DP29-05

GENDER DIFFERENCES IN ADOLESCENT'S OVERWEIGHT AND OBESITY IN XI'AN, CHINA

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RATIONALE AND OBJECTIVES: To assess the prevalence of overweight and obesity by gender among adolescents in Xi'an city and associated socio-economic risk factors.

MATERIALS AND METHODS: 1800 adolescents aged 10-18 yrs were selected using multi-stage sampling from 30 junior high-schools in 2007. Their weight and height were measured. Socio-demographic factors were collected from parents using structured self-administrated questionnaires. IOTF BMI cutoffs were used to define overweight and obesity.

RESULTS AND FINDINGS: 11.9% of males and 10.5% of females were overweight and 4.3% of males and 1.0% of female were obese. Multiple logistic regression revealed that male adolescents from richest families, studying in schools from more developed districts, with one or both parents overweight, had higher odds of being overweight/obese. Females studying in schools from more developed districts and with one or both parents overweight had higher odds of being overweight/obese.

CONCLUSION: Males were more likely to be overweight or obese than female adolescents in Xi'an in 2007. Future interventions will be needed to take account of these gender differences.

DP29-06

A SURVEY OF OBESOGENIC ENVIRONMENTS IN PRIMARY SCHOOLS IN THE URBAN AREAS OF THAILAND

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RATIONALE AND OBJECTIVES: To examine obesogenic environments in primary schools in the urban areas of Thailand.

MATERIALS AND METHODS: A nation-wide survey was conducted in the largest schools from all constituencies in 2005. Information on availability of obesogenic food and beverages were obtained by interview and direct observation. Weights and heights of grade 6 students were retrieved from school records.

RESULTS AND FINDINGS: 342 schools provided information on school environments, while 47,389 grade 6 students from 268 schools provided anthropometric data. Using the 1995 Thai Growth Reference, the prevalence of obesity was 11.7%. Soft drinks were available in 33.7% of schools while energy-dense snacks were available in 62.9%. Vending machines for snacks and soft drinks were not found. Acceptance of financial support from industry, organization of extra physical activities, and having nutrition-trained food service managers were significantly associated with higher obesity prevalence. Availability of energy-dense snacks was significantly associated with lower prevalence. The multiple regression model predicted an increase in obesity prevalence of grade 6 students associated with being in the schools that accepted financial support from snack and beverage industry.

CONCLUSION: Our finding suggests a need to issue a measure to ban the acceptance of support from the industry.

DP29-07

CONSEQUENCES OF INCREASED FAT INTAKE DURING THE NUTRITION TRANSITION IN SOUTH AFRICA

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RATIONALE AND OBJECTIVES: Urbanisation in developing countries is associated with increased total fat intake. The objective was to assess the consequences of total fat intake on diet quality and risk of non-communicable diseases (NCDs).

MATERIALS AND METHODS: Dietary intakes and NCD risk factors of 800 rural and 820 urban Africans, 35 years and older were compared.

RESULTS AND FINDINGS: Urban subjects consumed on average 30 grams more fat daily than rural subjects. Twenty percent (20%) of men and 14% of women had fat intakes of $\leq 15\%$ of energy while 12 and 17% had $\geq 35\%$ fat energy. Very low fat diets were characterized by high alcohol intakes. Total fat intakes (together with energy, age and gender) were predictors of body mass index (BMI). Increased fat intakes were associated with increased intakes of fat-soluble vitamins and also of calcium, ascorbic acid, and vitamins B6 and B12. No significant differences were seen in NCD risk factors at 7 levels of fat intake.

CONCLUSION: Except for increases in BMI of women, at this stage of the nutrition transition in South Africa, increased fat intake is associated with improvement of micronutrient quality of the diet without marked effects on NCD risk factors.

DP29-08

THE EFFECT OF EXPERIENCE IN BORN CHILD ON THE BODY MASS INDEX AND OBESE PREVALENCE IN WOMEN

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OBJECTIVE: To analyze the relation of body mass index and obese prevalence in different aged women and study the ways to prevent obese in adult women in China using the data from 2002 National Nutrition and Health Survey.

METHOD: The method of multi-steps cluster sampling was adopted. Total subjects including unmarried women (n=2474), married women but without the experience born child (n=10816), married and born-child women (n=4103), were 17393.

RESULTS: The body weights of unmarried, married and but without the experience born child, married and born-child women in urban areas were 53.7 ± 9.0 kg, 57.6 ± 9.4 kg and 54.5 ± 8.5 kg respectively, however, the body weights of unmarried, married and but without the experience born child women were significantly higher than that of the married and born-child women ($t=12.25$, $P < 0.0001$; $t=8.32$, $P < 0.001$). The BMIs of unmarried, married and but without the experience born child, married and born-child women in urban areas were 21.1 ± 3.3 kg / m², 22.8 ± 3.4 kg / m² and 22.0 ± 2.9 kg / m², but the BMIs of married and but without the experience born child and married and born-child women were significantly higher than that of unmarried women ($t=14.88$, $P < 0.001$; $t=5.76$, $P < 0.001$). There was significant difference in the height, weight and BMI of women among three groups ($P < 0.05$). The weight and BMI of married and born-child women was decreasing as extending the time of postpartum. The rate of low body weight in unmarried women was higher than married women (comparing with urban $\chi^2=28.257$, $p < 0.0001$; with rural $\chi^2=50.040$, $p < 0.0001$), however, the prevalence of overweight and obesity of married women was higher than unmarried women (comparing with urban $\chi^2=28.257$, $p < 0.0001$; with rural $\chi^2=69.119$, $p < 0.0001$). The prevalence of overweight and obesity of married and born-child women was decreasing with extending the of postpartum. **CONCLUSION:** Weight retention of married and born-child women was one of the most important causes led to the obesity in the adulthood.

DP29-09

THE RELATION BETWEEN SERUM LIPID AND MINERAL IN HEALTHY YOUNG MEN

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RATIONALE AND OBJECTIVES: There are conflicting data on the associations between serum lipid and mineral. The purpose of this study was to investigate whether the levels of minerals (selenium [Se], copper [Cu], zinc [Zn], iron [Fe], calcium [Ca] and magnesium [Mg]) in serum were associated with serum lipid parameters (total cholesterol [TC], triglycerides [TG], high-density lipoprotein cholesterol [HDL-C] and low-density lipoprotein cholesterol [LDL-C]) in healthy young men.

MATERIALS AND METHODS: 174 healthy male volunteers with the same work intensity and dietary supply, aged 18 to 29 years, were recruited from different regions of China. Blood samples were collected after an overnight fast and the serum TC, TG, HDL-C, LDL-C levels were measured by enzymic method, serum Se, Cu, Zn, Fe, Ca, Mg concentrations were measured by atomic absorption spectrometry. Correlation analysis and stepwise multiple regression analysis were applied to reveal the interrelationship between serum lipids and mineral levels.

RESULTS AND FINDINGS: The prevalence of hypercholesterolemia, hypertriglyceridemia, elevated LDL-C, and low HDL-C levels were 10.34, 4.6, 5.75, and 5.17%,

respectively. TC correlated with Cu ($p < 0.001$), and Ca ($p = 0.034$) correlated negatively with Fe ($p = 0.004$). TG correlated with Se ($p < 0.001$) and Zn ($p = 0.006$), correlated negatively with Cu ($p = 0.073$). HDL-C correlated negatively with Se ($p < 0.001$) and LDL-C correlated negatively with Fe ($p = 0.016$).

CONCLUSION: Serum minerals may be one of the possible associated factors that influence the levels of serum lipid. Further studies are needed to clarify the cause-and-effect relationship of nutritional mineral status and lipid profile.

DP29-10

THE RISK OF BEING OBESE AND OVERWEIGHT TO HYPERTENSION AND DIABETES MELLITUS

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BACKGROUND: In recent years, the incidence of obesity in Indonesia tends to increase. Many studies showed that the more obese people are, the higher the risk they have diseases such as hypertension and diabetes.

OBJECTIVES: To identify the risks of being overweight and obese to hypertension and diabetes mellitus.

MATERIALS AND METHODS: Samples in this study were males and females, aged 15-65 years old with body mass index higher than 18.5. The samples were not taking antihypertensive or antidiabetes medicine. The analysis of the risk of being overweight and obesity to hypertension and diabetes mellitus was done using multinomial linear regression.

RESULTS AND FINDINGS: This study showed that overweight samples had a risk of pre-hypertension 1.63 times and hypertension 2.9 times greater compared to normal weight samples. These risks were more prominent in obese samples with risk 2.7 for pre-hypertension and 7.49 for hypertension.

Overweight samples had risk of pre-diabetes 1.51 times and diabetes 1.45 times greater compared to normal weight samples. In addition, the risk of pre-diabetes and diabetes was increased in obese samples with risk of 2.04 and 2.22 respectively. Female obese samples aged more than 45 years old, who lack physical activity, had a risk of pre-diabetes 9.34 times and diabetes 14.29 times greater compared to male with normal weight, under 35 years old and had moderate physical activity.

CONCLUSION: The risk of having hypertension or diabetes is increased with the increase on body mass index and the advance age of samples. Gender and physical activity are other factors that influence diabetes risk.

DP29-11

GENETIC OF OBESITY- BBS GENES AND THE ADIPOCYTES

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RATIONALE AND OBJECTIVES: Bardet-Biedl syndrome (BBS; MIM 209900) is an autosomal recessive multi-systemic disorder of genetic and clinical complexity. BBS is associated with marked obesity. The syndrome can be caused by mutations in any of 12 BBS genes. Moreover, BBS gene polymorphisms have been associated with common non-syndromic morbid obesity, suggesting a role of BBS genes also in obesity in wider populations. The mechanism by which BBS genes are associated with obesity is not fully known. Furthermore, the role of BBS genes in adipocyte differentiation and function is not known. The object of the current study was to analyze BBS genes role in adipocytes differentiation and function.

MATERIALS AND METHODS: We analyzed BBS genes role in adipocytes, using genetically manipulated (silencing

and overexpression) in-vitro preadipocyte culture system (3T3F442A and 3T3L1).

RESULTS AND FINDINGS: We demonstrate, through morphological, metabolic and molecular analysis, that BBS genes have a unique and an important role in adipogenesis and function, mainly, fat accumulation in adipocytes.

CONCLUSION: Our data suggest that the BBS genes have a role in adipogenesis and adipocyte function and that BBS mutations is likely to be partly mediated through a direct effect on adipocytes.

DP29-12

PREVALENCE OF OVERWEIGHT AND THE QUALITY OF LIFE IN CHILDREN OF TEHRAN, 2008

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RATIONALE & OBJECTIVES: Sedentary behavior and inappropriate dietary habits in early life have been considered as risk factors of non-communicable diseases in adulthood. This study was conducted to identify BMI status and lifestyle circumstances in elementary schoolchildren of Tehran in 2008.

MATERIALS & METHODS: This was a descriptive, cross-sectional study, wherein samples were all 7 year-old pupils of 46 elementary schools that were randomly selected from 5 areas of Tehran (n=3149). Weight and height were measured, BMI was calculated at-risk-of-overweight (85-95th) and overweight (>=95th) status was determined based on CDC2000. Then, for each overweight subject (n=675), a questionnaire on demographic characteristics, physical activity, and nutritional behaviors, was completed by interviewing their mothers. Data were analyzed using SPSS and Epi Info.

RESULTS & FINDINGS: Mean BMI was 16.1±2.5. Respectively, 11.2 and 10.2% of subjects were at-risk-of overweight and overweight. Logistic Regression analysis showed that the odds ratio of sex with overweight and at-risk-of-overweight was 1.86 (CI 95%: 1.301-2.90). There was positive correlation between family size, parity, weight of birth and overweight (P<0.05). Mean hours of watching television and using computer were 1.45±1.1 and 2.74±1.3, respectively. Fifty percent (50%) of subjects had moderate physical activity, 67% were eating breakfast and only 18% of pupils were in appetent. The most common food groups consumed as snack were: fruits (39%), milk and dairy products (20.5%), biscuits and waffles (14%). Junk food consumption was 11.3%.

CONCLUSION: In comparison to nutritional aspects, sedentary behavior showed a greater impact on overweight in this group. Therefore, implementing appropriate intervention programs to improve and support healthy lifestyle is highly recommended.

DP30: Nutrition-Related Chronic Diseases II

DP30-01

EFFECT OF WINE ON ENERGY METABOLISM AND UTILISATION

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RATIONALE & OBJECTIVES: The present study aims to investigate the contribution of alcohol toxicity to the development of disease by assessing the effect of consuming a moderate amount of wine immediately following a high-carbohydrate meal on plasma glucose, serum insulin, and serum IgA.

MATERIALS & METHODS: Twenty non-alcoholic males, aged between 19-22 years, participated in the current investigation. The experimental procedure required participants

to eat food for 45-min before ingesting either 4 standard units (40g alcohol) of white wine (n=10) or red wine (n=10) over a 135-min period. The level of blood alcohol, serum insulin, plasma glucose, and serum IgA were assessed upon arrival (0-min), immediately following the meal (45-min), and then, at regular 45-min intervals (90-min, 135-min, 180-min) during the study.

RESULTS & FINDINGS: The data revealed that the consumption of <15g alcohol in the form of: white wine can significantly decrease the level of post-meal serum insulin and significantly increase serum IgA concentration; red wine does not promote any alteration in post-meal serum insulin or serum IgA despite plasma glucose being significantly lowered.

CONCLUSION: Consuming a small-moderate amount of red or white wine alone, after a meal, by dysregulating energy metabolism and/or utilization, may encourage the development of a pseudo-diabetic condition.

DP30-02

PREVENTION OF TYPE2 DIABETES ASSOCIATED WITH METABOLIC SYNDROME USING SOME PLANT-BASED FOOD FACTORS

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OBJECTIVES: Type 2 diabetes is one of the serious problems and the number of patients is rapidly increasing in the world. Food factors are expected to have beneficial preventive effects against diabetes. The present study was designed to examine how plant-based food factors can prevent type 2 diabetes. Specifically, we will focus on anthocyanins, which are the typical plant pigments and ginger-derived components.

METHODS: KK-Ay mice and 3T3-L1 adipocytes were used in the experiments.

RESULTS AND CONCLUSION: Cyanidin-3-glucoside (C3G), which is a typical anthocyanin, ameliorates hyperglycemia and insulin sensitivity in type 2 diabetic mice. Dietary C3G can not upregulate adiponectin expression but elevates glucose transporter 4 expression in the white adipose tissue. This elevation contributes to the suppression of retinol-binding protein 4 in the diabetic state. This causes a decrease in the glucose output into the blood and an increase in insulin sensitivity. Ginger has various types of pungent-tasting components. The main ginger-derived components are 6-gingerol and 6-shogaol. These compounds significantly inhibit the TNF-alpha-mediated downregulation of adiponectin expression in adipocytes via different mechanism. These findings provide a biochemical basis for the use of food factors in the prevention of diabetes via the improvement of adipocyte dysfunction.

DP30-03

DOES MATERNAL UNDERNUTRITION EFFECT HUMAN FETAL PANCREAS MORPHOLOGY IN SECOND TRIMESTER OF PREGNANCY? AN EXPLORATORY STUDY

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Maternal undernutrition and hyperglycemia during pregnancy, as well as fetal undernutrition in long term affecting the development of fetal endocrine pancreas structure & function (particularly of β -cells) is well known. Human studies done earlier in growth retarded fetuses showed varying observations regarding the same. We studied changes in pancreatic islets morphology of aborted normal human fetuses (16-20 weeks old), collected over a 28 month period from medically terminated pregnancies of 6 undernourished mothers [BMI < 18.5] and 8 adequately nourished mothers [BMI > 18.5]. Masson trichrome stained paraffin sections for morphometric estimates (islet

count, area, volume etc) and immunohistochemistry study of β -cells for insulin content, were done.

The results of the study showed no significant differences in the various parameters studied in the pancreas belonging to both groups. Thus, it appears that nutritional status of the mother may not have profound influence on the morphology or functional aspect of islet cells in second trimester and other factors are responsible.

DP30-04

ANTI-TUMOR ACTIVITY AND ANTI-HYPERGLYCEMIC EFFECTS OF KUROZU ON BALB/C OR KK-A^y MICE

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OBJECTIVES: Kurozu is brewed rice vinegar prepared by a traditional method in Kagoshima, Japan, and is regarded as a healthful food. In the study, we reported the antitumor activity and hypoglycemic effect of Kurozu, and revealed the mechanism of the function.

METHODS: 1) The suppressing effect of crude Kurozu on the growth of implanted-sarcoma 180 tumor cells in mice was monitored. The natural killer (NK) activity in the spleen cells was monitored. 2) KK-Ay mice were fed with Kurozu and the blood sugar and HbA1c contents were monitored. The insulin signal pathway in the muscle was examined.

FINDINGS: 1) Kurozu and polysaccharides in Kurozu-feedings suppressed the growth of the implanted-tumor. The NK activity in the spleen increased in mice-fed Kurozu. 2) The KK-Ay mice-fed Kurozu suppressed blood sugar and HbA1c contents. Glut 4 was detected in the muscle membranes. The amount of insulin receptor substrate-1 raised in mice administered with Kurozu.

DP30-05

CONSUMPTION OF ANTIOXIDATIVE PROBIOTIC LACTOBACILLUS FERMENTUM ME-3 HAS IMPACT ON POST-PRANDIAL OXIDATIVE STRESS IN HUMAN VOLUNTEERS

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Probiotics are defined as live microbial food ingredients beneficial to health. Both oxidative stress (OxS) and blood lipoprotein status (BLPS) have an impact concerning the development of several diseases. The *Lactobacillus fermentum* ME-3 (LfME-3; DSM1421, patented in USA, Russia, Estonia), human origin, is proven as a safety probiotic, exhibiting both antimicrobial and antioxidative benefits in a number of experiments. Regarding this knowledge, we aimed to carry out next study to evaluate the effects of the kefir enriched with LfME-3 on both post-prandial OxS and BLPS status.

The asymptomatic persons (n=50), 40-65 yrs, were recruited into this study. Blood was analyzed for post-prandial lipid profile (triglycerides, high-density lipoprotein-cholesterol, low-density lipoprotein-cholesterol) and OxS markers (baseline of conjugated dienes, oxidized low-density lipoprotein, paraoxonase), and urine was analyzed for 8-isoprostanen and 8-hydroxy-2'-deoxyguanosine. There were statistically significant differences in OxS and BLPS compared with same kefir without LfME-3. Thus, consumption of the kefir enriched with antioxidative probiotic LfME-3 may have beneficial effects on both post-prandial OxS and plasma lipid profile in asymptomatic persons.

DP30-06

NUTRITION AND HELICOBACTER PYLORI INTERACTION: THEIR ROLE IN GASTRIC CARCINOGENESIS

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RATIONALE AND OBJECTIVES: Scientific evidence indicates that gastric cancer (GC) is the result of a long multifactorial carcinogenic process involving the interaction of *Helicobacter pylori* (HP) infection, genetic susceptibility, and environmental exposure, mainly foods and smoking. However, results on interaction between HP and nutrition are very sparse.

MATERIALS AND METHODS: In the European Prospective Investigation into Cancer and Nutrition (EPIC) study, developed in ten European countries involving 521,457 subjects, after 6.5 years of follow-up, 330 validated gastric adenocarcinomas were used for the analysis. HP and dietary micronutrients were measured in GC cases and a sub-sample of controls. Diet was collected at baseline.

RESULTS AND FINDINGS: It was found that a significant increase in the risk of distal GC was associated with the consumption of red and processed meat in those infected by HP. It was also observed that an increased risk of GC was associated with endogenous formation of nitrosamines and the effect seems to be stronger in subjects infected by HP. It was observed that there was a significant negative association between plasma levels of vitamin C, carotenoids, retinol and vitamin E and the risk of distal GC. This apparent protective effect of antioxidants was found only in those infected by HP.

CONCLUSION: These results suggest that HP modified the effect of dietary factors. Further studies are needed to reach a definitive conclusion.

DP30-07

PLASMA MICRONUTRIENT AND MINERAL PROFILE (I.E. PLASMA NUTRIOME) OF PROSTATE CANCER CASES IS ALTERED RELATIVE TO HEALTHY CONTROLS

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RATIONALE AND OBJECTIVES: Emerging evidence suggests the possible role of various micronutrients in cancer prevention. The present study was designed to test the hypothesis that the plasma levels of different micronutrients and trace elements profile in prostate cancer patients is different from that of healthy controls.

MATERIALS AND METHODS: Plasma samples from 116 Caucasian men affected with late onset of prostate cancer and 132 matched controls from South Australian population were collected and analyzed for their concentration of micronutrients and trace elements.

RESULTS AND FINDINGS: Plasma concentrations of lutein, lycopene and carotenoids (α and β) were found to be significantly lower in prostate cancer patients (p = 0.02, 0.008, 0.002 and 0.002, respectively). Plasma levels of trace elements such as iron, copper, calcium and sulphur were significantly higher (p < 0.0001, < 0.0001, < 0.0001 and p = 0.0003 respectively) while that of selenium was significantly lower (p = 0.02) in prostate cancer patients. Prostate cancer risk is significantly associated with low plasma levels of lycopene (OR: 2.0; 95% CI: 1.15-3.47) and β -carotenoid (OR: 1.89; 95% CI: 1.09-3.26) and high levels of iron (OR: 1.94; 95% CI: 1.1-3.44), calcium (OR: 3.65; 95% CI: 1.9-7.02) and sulphur (OR: 1.96; 95% CI: 1.11-3.46).

CONCLUSION: The results of this study suggest that the micronutrient and mineral profile in plasma (i.e. plasma nutriome) could be a useful diagnostic of prostate cancer risk.

DP30-08

THE MECHANISM OF COLON CANCER PREVENTION BY CITRUS LIMONOIDS

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Consumption of citrus and other fruits have shown reduce incidences of colon cancer based on in-vitro and in-vivo investigations. To know the mechanism of action of individual compounds, we have purified six limonoids (limonin, nomilin, obacunone and respective glucosides) using chromatographic techniques. Expression levels of cancer inhibition-related genes, proteins, and enzyme levels were studied in cells treated with compounds to understand the mechanism. All the compounds were found to inhibit cancer cells in the range of 40-70% with respect to control. Further, these compounds were found to activate beta-cells of lymphocytes mediated apoptosis pathway, evident from elevated level of caspase-3 in cells treated with compounds. The involvement was confirmed by depletion in the expression ratio of anti-apoptotic (bcl2) to apoptotic (Bax) genes and proteins. The activity was in the order of obacunone>nomilin>limonin. In addition, obacunone and obacunone glucosides were found to inhibit inflammatory pathway to prevent colon cancer. Our studies have clearly shown that, citrus limonoids have the potential in preventing colon cancer.

DP30-09

N-3 FATTY ACID-RICH OIL CONTENT ACCOUNTS FOR DIFFERENCES IN THE BREAST TUMOR-REDUCING EFFECT OF LIGNAN-RICH FOODS FLAXSEED AND SESAME SEED

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OBJECTIVES: Flaxseed (FS), an oilseed rich in lignan (secoisolariciresinol diglucoside, SDG) and oil (FO) rich in n-3 fatty acid reduced the tumor growth in athymic mice and in breast cancer patients. Sesame seed (SS), an oilseed also rich in lignans (sesamin, SES) but low in n-3 fatty acids, did not exert a similar effect. To explain the difference in their effect, we determined the effect of SDG, FO and SES on human breast tumors (MCF-7).

METHODS: Athymic mice with established MCF-7 tumors were fed for 8 weeks the basal diet (BD, control) or BD with 0.1% SDG, 0.1% SES, or 4.0% FO. Tumor size, cell proliferation, apoptosis and cell signaling biomarkers were analyzed.

RESULTS AND FINDINGS: SES and FO reduced the tumor area by 23% (P<0.05) and 33% (P<0.01), respectively, while SDG had no effect. SDG, SES and FO all reduced cell proliferation by 38% (P<0.05), but only FO and SES increased the apoptosis (P<0.05). Only FO reduced Akt expression by 54% (P<0.001) but had no effect on pAkt. SES and FO reduced MAPK and pMAPK (p<0.05).

CONCLUSION: The oil component accounts for the protective effect of flaxseed compared to SS. SES is not responsible for tumor-promoting effect of SS.

DP30-10

POLYPHENOL-ENRICHED EXTRACT OF OIL PALM FRONDS (*Elaeis guineensis*) PROMOTES ANTICANCER EFFECTS ON MAMMARY GLAND TUMOR IN RAT

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RATIONALE AND OBJECTIVES: Chemopreventive effect of Oil Palm Fronds (*Elaeis guineensis*) extract (OPFME) on breast cancers induced by LA7, a rat mammary tumor cell lines,

and the underlying mechanisms.

MATERIALS AND METHODS: LA7 was injected into the breast of S.D female rats to develop breast cancer. Forty rats were divided into five groups. The incidence rate and volume of breast cancer were monitored.

RESULTS AND FINDINGS: The OPFME led to proliferation of the MCF-7 cells at 17.5 µg/ml and an anti-proliferation effect at 150 µg/ml and 1200 µg/ml with an IC 50 value of 678.5 µg/ml. The total tumor volume and incidence rate of tumor were statistically lower in treatment group than control group.

CONCLUSION: This study found that OPFME had some anti-breast cancer activity via estrogenic properties, and antioxidant activity.

DP30-11

DO FATTY ACIDS ALTER BREAST CANCER TUMORIGENESIS BY TARGETING STEM CELLS?

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Currently, it is believed that stem cells in breast tumors may be responsible for mammary tumorigenesis. Since dietary conjugated linoleic acid (CLA) has been shown to reduce terminal end buds, a major site of stem cells, we hypothesized that CLA may target those stem cells. We have isolated stem cells from normal, premalignant, and malignant mammary glands by FACS and identified novel surface markers by the use of small molecule combinatorial libraries. Formation of tumor spheres from single stem cell was significantly reduced by two CLA isomers but not control fatty acids. Similar results were obtained when n-3 fatty acids were added. Since CLA and n-3 fatty acids can modify eicosanoid metabolite pathways, we assessed their role in altering tumor sphere formation. Although our previous work demonstrated a 5-lipoxygenase metabolite altered proliferation of a mature tumor cell, it did not alter tumor sphere formation. The effect of n-3 fatty acids on tumor spheres may be due to inhibition of prostaglandin E2, adding that metabolite with n-3 fatty acids increased tumor sphere formation above the inhibited levels. Thus, fatty acids known to reduce tumorigenesis in vivo and inhibit tumor cell growth in vitro were toxic to tumor-initiating cells. One potential target may be the cancer stem cell.

DP31: Nutrition Throughout Life Course II

DP31-01

EARLY PATERNAL ABSENCE AND ITS ASSOCIATION WITH LONG-TERM STUNTING AMONG PERUVIAN CHILDREN

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RATIONALE AND OBJECTIVES: Undernutrition is a leading cause of child morbidity and mortality. This study used bivariate and multivariate analyses to assess: whether paternal absence during infancy was associated with chronic undernutrition when children were 5; if suboptimal caregiving behaviors and undernutrition were linked; and how paternal absence compromised mothers' caregiving ability.

MATERIALS AND METHODS: Data came from Young Lives, a 15-year cohort study that follows 12,000 children in four countries. This study focused on Peruvian children.

RESULTS AND FINDINGS: Malnutrition was highest among children with high levels of paternal absence but the relationship between paternal absence and nutrition was not always clear. Even after adjusting for socioeconomic status, children whose fathers were always present had poorer nutritional status than

those who saw fathers less than daily. It may be that some "always present" fathers are unengaged in raising their children. In addition, poorer caregiving behaviors and lower educational aspirations for children were associated with greater levels of chronic malnutrition. Wealth, access to services, and maternal education were all associated with good nutritional status ($p < .0001$ for all comparisons).

CONCLUSION: Efforts to reduce malnutrition must be based on a fuller understanding of how paternal absence puts children at risk.

DP31-02 DAIRY CONSUMPTION AND IODINE STATUS AMONG REPRODUCTIVE AGE WOMEN IN THE UNITED STATES

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RATIONALE AND OBJECTIVES: Adequate iodine nutrition during pregnancy is critical for fetal neurologic development. In the U.S., dairy is thought to be an important source of iodine; however, few studies have examined differences in iodine status between dairy consumers and non-consumers.

MATERIALS AND METHODS: We analyzed 2001–2006 National Health and Nutrition Examination Survey (NHANES) data from UI spot tests for pregnant ($n=326$) and nonpregnant ($n=1,437$) women aged 15–44 years.

RESULTS AND FINDINGS: 13% of pregnant and 20% of nonpregnant women had not consumed dairy in the previous 24 hrs (non-consumers). Among pregnant women, median UI was 163.2 $\mu\text{g/L}$ (95% confidence interval = 103.3–219.5) among dairy consumers and 99.9 $\mu\text{g/L}$ (56.7–170.8) among non-consumers. Among nonpregnant women, UI was 135.8 $\mu\text{g/L}$ (120.1–147.9) among dairy consumers and 106.2 $\mu\text{g/L}$ (89.9–123.5) among non-consumers. In regression models adjusted for sociodemographic and other dietary factors, recent dairy consumption was positively associated with UI among both pregnant and nonpregnant women.

CONCLUSION: Dairy intake is an important contributor to iodine status among reproductive age women in the U.S., and those consuming dairy products are less likely to be iodine deficient.

DP31-03 CAN CHRONIC CONSUMPTION OF IRON THROUGH GROUNDWATER PREVENT IRON DEFICIENCY IN WOMEN OF REPRODUCTIVE AGE IN RURAL BANGLADESH?

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RATIONALE AND OBJECTIVES: In a field trial ($n=1198$) in rural Bangladesh from 2001–2007, we found very low rates of iron deficiency (ID, plasma ferritin $< 12 \mu\text{g/L}$) and ID anemia (IDA, ID plus low Hb) at 1st trimester (TM) ($< 1\%$ for both) and 3 months post partum (PP) (3% and 2%, respectively). Supplement use during pregnancy was infrequent ($\leq 16\%$ of women) and heme intake was low (median (IQR) 7 day frequency: 5 (3–8) at 1st TM and 3mo PP) suggesting non-dietary factors were influencing chronic iron status.

MATERIALS AND METHODS: In 2008 we revisited 400 randomly selected women to collect seasonal data to explore the strength of association between chronic consumption of iron through groundwater and chronic iron status.

RESULTS AND FINDINGS: Participants reported drinking 71% of water (median L/day: 1.7 of 2.4), directly from their home source (median (IQR) iron concentration ($n=323$

tubewells): 15.2 (6.4–27.5) mg/L) resulting in a daily iron intake of > 17.7 (2.7–41.6) mg/day.

CONCLUSION: These and other findings may help establish the dietary value of groundwater as a source of iron in preventing ID and IDA in women of reproductive age. Funded by The Bill and Melinda Gates Foundation, Procter and Gamble, Inc. and USAID.

DP31-04 SHORT- AND LONG-TERM EFFECTS OF LOW OR HIGH PROTEIN INTAKE DURING SOW GESTATION ON GASTROINTESTINAL TRACT DEVELOPMENT OF THE OFFSPRING PRELIMINARY RESULTS

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A nutritional disequilibrium applied to offspring during the prenatal period can result in a predisposition to visceral adiposity and complications linked to adiposity. Many publications report the effects observed at the metabolic level but information concerning the gastrointestinal tract (GIT) is very limited. This study investigated the effects of low and high protein levels in the maternal diet during gestation on the development of offspring's GIT organs and brush border enzyme activities. The sows ($n=30$) were fed with isoenergetic diets either with high (HP, 30%), low (LP, 6%) or control (C, 12%) protein levels throughout gestation. Subsets of offspring ($n=149$) were killed successively at day 1, 28 or 186. After d1, the remaining piglets were relocated to suckle foster sows fed with C-diet. At slaughter, GIT organs were weighed and measured, and samples were collected from small intestine for enzyme analysis. At birth, the proportion of low (≤ 1.15 kg, LBW) body weight (BW) increased with LP (+19%) and mainly HP (+39%) diets and that of high (≥ 1.4 kg, HBW) BW decreased. During the whole study, the maternal diet did not change the relative weights (% BW) of stomach, pancreas and small intestine; on the contrary, the birth BW affected their development [4.57 in normal BW (NBW) vs 4.63 and 5.02 g/kg BW in HBW and LBW, respectively, for stomach at d186, $P < 0.05$]. Globally for the 3 stages of age, compared to C-diet, the relative weight of liver decreased by 12% with HP and LP diets ($P < 0.05$) and the relative length of the small intestine tended to be lower with LP diet ($P < 0.10$). The ratio mucosa/mucosa+muscularis increased by 12% in HP and LP diets and decreased ($P < 0.05$) in piglets having a low or high BW as compared to normal BW at birth. The relative activities (International Units(UI)/kg BW) of lactase, aminopeptidase N and saccharase were not modified by the maternal diet, but that of maltase tended to decrease with LP diet (-73%, $P < 0.10$). But for all enzymes studied, these activities were increased in low BW piglets as compared to normal BW (2.9- and 1.9-fold, respectively, for lactase and maltase, $P < 0.05$) and this effect was mainly due to results obtained in jejunum (included also relative content of jejunum mucosa proteins (1.6-fold increase, $P < 0.05$). The relative intestinal protein content as well as relative enzyme activities decreased with age ($P < 0.05$). In conclusion, maternal protein disequilibrium during gestation results in modifications of the birth weight, GIT organ weight, and intestinal brush border enzyme activities of the offspring pigs. The mother diet during pregnancy could act on offspring GIT development, directly and indirectly, by the production of higher proportion of LBW piglets. Swine could be suggested as model of human species.

DP31-05

RELATIONSHIP BETWEEN EARLY GROWTH AND OBESITY IN PRE-PUBERTAL CHILDREN

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RATIONALE & OBJECTIVES: Early growth patterns have been described as associated to further development of obesity. We analyzed the relationship between obesity and body composition with early linear and weight growth.

MATERIALS & METHODS: From a school based sample, 188 children (1st-5th grades) were assessed. Data included birthweight, weight and height at 1 year of age, and child's and family related conditions. Body weight and height were measured; body composition was estimated by electric bioimpedance. Substantial weight and height gain was defined as increments ≥ 0.66 z-score in weight/height and height/age between 1 year and school age.

RESULTS & FINDINGS: Prevalence of obesity was and 7.3%. The proportion of children with substantial weight and height gain was 38.8% and 30.9%, respectively. Prevalence of obesity was 13.6% and 10.6% among those with substantial weight and height gain, respectively. The odds of being obese for children who experienced increments in standardized height was 3.7 (95%CI 1.1; 12.8), independent of height or weight at one year, birthweight, family history of obesity, and gender.

CONCLUSIONS: Early growth rate is an important factor associated to overweight in childhood.

DP31-06

BIRTH WEIGHT PREDICTORS AMONG LOW INCOME BRAZILIAN WOMEN

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RATIONALE AND OBJECTIVES: To investigate social, economic and biomedical predictors of birth weight (BW) among Brazilian women.

MATERIALS AND METHODS: This was a cohort study enrolling 1,229 pregnant women attending public health centers in Campinas, Brazil, between 2004-2006. Data were analyzed using structural equation modeling.

RESULTS AND FINDINGS: Food insecurity during pregnancy was positively associated ($p < 0.05$) with domestic violence during pregnancy ($b = 0.259$), which in turn was associated with more maternal mental health problems ($b = 0.174$). The latter were associated with lower birth weights ($b = -0.065$). As expected, maternal smoking ($b = -0.246$), a shorter duration of gestation ($b = 0.359$), and a prior history of a low birth weight baby ($b = -0.393$) were strongly associated with lower birth weights.

CONCLUSION: Food insecurity during pregnancy has a negative indirect effect on lower birth weights. This relationship is mediated by domestic violence during pregnancy and maternal mental health problems.

DP31-08

PREVALENCE OF VITAMIN D AND CALCIUM DEFICIENCIES AMONG LOW INCOME MINORITY CHILDREN IN A MAJOR CITY IN THE UNITED STATES

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RATIONALE & OBJECTIVES: There are concerns of resurgence of vitamin D deficiency and rickets among children

in the United States, especially among dark skin children. Objective: to determine the prevalence of vitamin D deficiency in minority children in a major US city and to examine whether 25-hydroxyvitamin D [25(OH)D] levels vary between non-Hispanic African-American and Hispanic children.

MATERIALS & METHODS: Two hundred ninety-two minority preschool children (age range 12-60 months) were recruited during their well-child visits to 2 clinics in Atlanta. Blood was collected for serum 25(OH)D and calcium measurements, and families instructed to complete a 3-day food diary. The 25(OH)D was determined by liquid chromatography-tandem mass spectrophotometer.

RESULTS & FINDINGS: Mean (SD) total 25OHD was 26.2 (7.6) ng/ml. Overall, 22.3% ($n = 59$) had low serum 25OHD levels (≤ 20 ng/ml), 73.6% ($n = 195$) had less than optimal serum 25OHD levels (≤ 30 ng/ml) and 1.4% ($n = 4$) had low serum calcium (≤ 9 mg/dl) detected. There was a significantly higher proportion of Non-Hispanic (African-American) children with vitamin D deficiency (25OHD3 < 20 ng/mL) compared to Hispanic children (26% vs. 18%; $p < 0.05$). There was no difference in the mean (SD) 25OHD [26.5 (8.9) vs. 25.9 (5.9) ng/mL, $p = 0.489$] and calcium concentrations [9.8 (0.4) vs. 9.9 (0.4) mg/dL, $p = 0.135$] by ethnicity. In multivariate models, age of child and season of recruitment were significant predictors of vitamin D deficiency but not of calcium deficiency.

CONCLUSION: Suboptimal vitamin D status is common among otherwise healthy young children. Age of child and season of enrollment into the study significantly predicted vitamin D deficiency.

DP31-09

PREVALENCE OF ZINC DEFICIENCY AND SUB-CLINICAL INFECTION IN PAKISTANI PRESCHOOL CHILDREN

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RATIONALE AND OBJECTIVES: A community-based study was carried out on pre-school children to assess the prevalence of zinc deficiency and sub-clinical infection in children.

MATERIALS AND METHODS: A two-stage cluster sampling procedure was followed to select 6 to 60 month-old children from the North West Frontier Province (NWFP), Pakistan. Plasma zinc and markers of sub-clinical infection, $\alpha 1$ -acid glycoprotein (AGP) and $\alpha 1$ -antichymotrypsin (ACT) were determined in 2606 children. Plasma zinc was determined on atomic absorption while acute phase proteins, AGP and ACT, were determined on a Cobas Fara by immunoturbidimetric method. The recommended cut-off values were used to assess the prevalence of zinc deficiency and sub-clinical infection in children.

RESULTS AND FINDINGS: Mean plasma zinc, AGP, and ACT of the children were 9.26 ± 4.25 $\mu\text{mol/L}$, 1.31 ± 0.64 g/L and 0.42 ± 0.17 g/L, respectively. The boys had significantly ($p < 0.05$) higher mean plasma zinc but lower AGP than those of the girls. There were no significant differences in the mean plasma zinc, AGP, and ACT either between the two age groups (age < 36 months and age ≥ 36 months) or between the urban and rural communities. Using the recommended cut-off values for assessing zinc deficiency and sub-clinical infection in children, 54.2% of the children were zinc deficient, 45.7% had raised AGP levels and 11.1% had raised ACT levels. An inverse and significant correlation between plasma zinc and markers of sub-clinical infection was observed suggesting that sub-clinical infection adversely affects plasma zinc level.

CONCLUSION: The study concludes that prevalence of zinc deficiency and sub-clinical infection in Pakistani preschool children is alarmingly high and requires proper intervention to reduce zinc deficiency and sub-clinical infection in the vulnerable group of population.

DP31-10

RICKETS IS AN EMERGING PUBLIC HEALTH NUTRITION PROBLEM IN BANGLADESH

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RATIONALE AND OBJECTIVES: Rickets has been recognized as an important health problem in Bangladesh in 1991 by SARPV. Prevalence of rickets among 1-15 years children and their nutritional status were studied.

MATERIALS AND METHODS: Data were randomly collected from 20,000 children from 6 divisions of Bangladesh on rickets. Anthropometric measurement (weight, height and MUAC) and radiological examination were done for identifying radiological signs of active rickets.

RESULTS AND FINDINGS: Rickets was found in almost every division of Bangladesh. One hundred ninety-seven rachitic cases were found and the prevalence rate was 0.99%. Radiologically, 24% were active rickets, 34% were in growing phase of rickets, 42% were not active. The prevalence of severe stunting, underweight, and wasting were 53%, 40% and 1.4% (<-3 SD), respectively.

CONCLUSION: The first ever national rickets survey showed that about 550,000 children of 1 – 15 years are suffering from rickets and needs urgent attention.

DP32: Nutrition / Food Policy & Program II

DP32-01

IRON STATUS IN ADOLESCENTS FROM 10 EUROPEAN CITIES AND INFLUENCE OF PUBERTAL MATURATION ON IRON STORE (HELENA STUDY)

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In order to assess the prevalence of iron deficiency in adolescents and to study the influence of pubertal maturation on iron store, a cross-sectional study was performed in 10 European cities, involving adolescents aged 12.5 to 17.5 years.

Biochemical assessment included measurements of hemoglobin, serum ferritin (SF), serum transferrin receptor, and c-reactive protein (to correct the SF values). Biochemical indicators were measured in 952 adolescents. Pubertal maturation was assessed in 859 adolescents who were classified in Tanner stages I to V. The prevalence of iron depletion was 21.9%, significantly higher in females (25.4%) compared to males (18.0%). The prevalence of iron deficiency and iron-deficiency anemia was 4.4% and 1.2%, respectively, with no differences between males and females. Iron stores increased significantly in females from stage III [SF mean; 26.0±16.1 (sd) µg/L] and IV [27.1±19.9 µg/L] to V [31.7±24.2 µg/L] and in males from stage

II [32.2±16.2 g/L] and III [31.3±17.6 µg/L] to IV [39.9±27.9 µg/L] and V [40.0±27.5 µg/L]. The results indicate that the critical period in both sexes is the middle adolescence and that specific attention should be given to females to ensure that their dietary intake of iron is adequate.

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DP32-02

TRENDS OF NUTRITION STATUS & ITS ASSOCIATED FACTORS AMONG AGING VIETNAMESE

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The aging population in Vietnam is increasing due to advances in socioeconomic development and health care. As people age, changes in physiology and nutrition status are thought to affect overall health. This study is designed to provide policy makers with information on the health effects of nutrition status for the growing cohort of older Vietnamese individuals.

OBJECTIVE: To explore the trends and factors associated with nutrition status among aging Vietnamese.

DESIGN: This study was based on three national surveys of socioeconomic factors and health conducted over a 10 year period. The surveys were: the Vietnamese Living Standard Survey 1992-93; the Vietnamese Living Standard Survey 1997-98; and the Vietnamese National Health Survey 2001-02.

SUBJECTS: Subjects older than 45 years were stratified by gender, age group, area of residence, household expenditures, and comorbidities. Chronic energy deficiency (CED), overweight, and obesity were defined using body mass index (BMI) cutoffs of <18.5, and 23 kg/m², respectively.

RESULT: In older Vietnamese, between 1992 and 2002, the prevalence of CED decreased from 45.9% to 30.0%, while overweight and obesity prevalence increased from 7.4% to 18.4%. Gender, area of residents, household expenditure, and comorbidities were found to be strongly associated with these changes. In the adjusted models, women and urban residents were 10% and 40% (respectively) less likely to suffer from CED and about twice as likely to be overweight and obese. CED sufferers were found to be inversely correlated with household expenditure and reported a high prevalence of feeling weak. Overweight people were more than twice more likely than CED sufferers to have hypertension.

CONCLUSION: There is a double burden of disease observed in the aging Vietnamese population, in that both CED and overweight exist, along their related comorbidities. This double burden of disease is a common characteristic of countries in this phase of the nutrition transition.

The decline in lean body mass among older people is thought to cause these changes and should be addressed by public health policy.

DP32-03

PRESCRIBING IRON SUPPLEMENTS: IS IT EFFECTIVE?

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RATIONALE AND OBJECTIVES: In spite of a national program on pre-natal iron supplementation, gestational anemia in the country remains a persistent public health problem (FNRI, 2005). In the present setup, where delivery of public health programs was devolved to the local government units (LGUs), this study aimed to examine how iron supplementation is actually delivered at the grassroots.

MATERIALS AND METHODS: A prospective case series, 32 midwives in selected LGUs and 150 women attending pre-

natal care in government-run health facilities were interviewed. The women were also tested for anemia at baseline and endline.

RESULTS AND FINDINGS: Because of the unavailability and inadequacy of supply, only 18.8% of midwives disclosed dispensing iron supplements to visiting mothers, 46.9-56.0% answered “no” and 25.0-34.4% “sometimes”. Knowing their importance, 80.0-87.5% gave prescription. But because of mothers’ poor condition, unavailability and inaccessibility of source, and transportation cost, mothers’ access to supplementation is further limited. This resulted to increase in anemia prevalence, from 29.0 to 40.1%, 3-4 months.

CONCLUSION: Prescribing iron supplementation to mothers attending free pre-natal care is not a practical and effective approach to reduce gestational anemia.

DP32-04

INVESTIGATING THE EUROPEAN PUBLIC HEALTH NUTRITION WORKFORCE, THE JOBNUT PROJECT

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RATIONALE AND OBJECTIVES: The JOBNUT project investigated current training programs and future needs for public health nutritionists in Europe. The objectives of this particular work package were to investigate the employers’ expectations of public health nutritionists’ competencies and training needs, as well as the organisational location of this workforce across Europe.

MATERIALS AND METHODS: A qualitative study design was used, including semi-structured interviews among selected stakeholders in 8 countries. The 58 interviewees were representatives of government (national, regional and local), the private sector, academia, NGO’s and IGO’s. Additionally, 10 recent graduates in public health nutrition were also interviewed.

RESULTS AND FINDINGS: Most of the public health nutrition work was described as taking place at local level by authorities, health centres and NGO’s. More specifically, school teachers, nurses and general practitioners were doing a lot of the hands-on work. A complex picture emerged of different professional groups doing work in public health nutrition, leaving little room for well-trained public health nutritionists. In the UK and Sweden, the respondents raised serious doubt whether General Medical Practitioners had the right competencies to perform a lot of the tasks. There was confusion among employers as to the roles and responsibilities for public health nutritionists, and graduates confirmed that employers were unfamiliar with the skills and competencies needed. All respondents expressed a need for developing a public health nutrition workforce structure.

CONCLUSION: Public health nutritionists, as a workforce, were largely found missing in the reviewed organizations and structures. Some countries showed to be more developed in this regard and employers in those countries saw the value of employing public health nutritionists. There is a need to further market the knowledge and skills of public health nutritionists, and to show the specific competencies required by the nurses, General Medical Practitioners, and school teachers when they are actively working in the area.

This study was supported by the Leonardo Programme within the Directorate for Education and Culture, European Commission.

DP32-05

PUBLIC HEALTH NUTRITION WORKFORCE DEVELOPMENT MISSING IN EUROPEAN NUTRITION POLICIES: THE JOBNUT PROJECT

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RATIONALE AND OBJECTIVES: It was assumed that there is a need of a competent workforce for the implementation of policies and action plans. In the JOBNUT project, we aimed at auditing European action plans and policies in the nutrition area in order to assess governmental mandates for public health nutrition workforce development.

MATERIALS AND METHODS: English language versions only of national and international policy documents within public health nutrition were identified in the WHO European nutrition policy database. The documents were reviewed and relevant sections were analyzed against an audit framework. A total of 17 European national action plans were included in the analysis.

RESULTS AND FINDINGS: Most national action plans gave very limited reference to workforce development as a strategy, if at all. In some cases, focus was on training health care professionals and school staff. It was barely made clear who would take the responsibility for continuing education and training of first line staff, such as health care professionals or teachers, nor how quality assurance of the performance of this workforce would be taking place. The policy documents from the UK, France, Ireland, Iceland, Spain, and Denmark clearly articulated the implementation responsibilities of the health workforce in public health nutrition areas. Only France and the UK had policy statements pointing out the need for additional resource investment in workforce growth and the Dutch document identified insufficient direction and coordination in implementation of public health nutrition policies.

CONCLUSION: Workforce development is a forgotten strategy in European national action plans relevant to public health nutrition. Societal capacity to implement strategies in policy documents is likely to be limited.

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DP33: Food & Nutrition Interventions for Health II

DP33-01

ENVIRONMENTAL, BIOLOGICAL, AND BEHAVIORAL IMPACT OF A SCHOOL-BASED INTERVENTION TO PREVENT OVERWEIGHT AND OBESITY IN SCHOOL-AGE MEXICAN CHILDREN

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OBJECTIVES: To describe the impact of a school-based environmental intervention (EI) to prevent childhood obesity in public elementary schools (PES) of Mexico City.

METHODS: An EI was implemented and evaluated with an experimental design in 27 PES, 16 intervention schools, and 11 comparison schools (CS). Environmental changes designed to impact children’s eating and PA patterns included: enhanced availability of healthy food & water (FWA), moderate to

vigorous physical activity (MVPA) at recess and Physical Education classes (PEC), and an education and communication strategy (ECS). The intervention lasted 8 months and had two intensities: basic (B; 8 schools) and plus (P; 8 schools). Pre and post evaluations were conducted in schools and a subsample of 832 children.

RESULTS AND FINDINGS: a) Environmental: There was a significant reduction in the availability of unhealthy (red) items in B (42 to 26.6%, $p=0.002$) and P (40.9 to 30.2%, $p=0.01$). Per capita availability of fruits increased significantly in the P group, from 14.1 g to 25.4 g $p=0.03$. There were no changes in FWA in the (CS) ($p>0.5$). b) Biological: MVPA instruction time showed an increasing trend for both intervention groups, but only during PEC. There was no change in PA instruction time in the (CS) ($p>0.5$). There were no changes in BMI in B and P schools ($p>0.5$). c) Behavioral: Children in B and P schools reported significant improvements in general eating behaviors (B $p<0.05$, P $p<0.01$), eating behaviors at school (B&P $p<0.01$), plain water consumption (B $p<0.05$, P $p<0.01$), self-efficacy (B&P $p<0.01$), and attitudes (B&P $p<0.01$). P schools showed improved behavioral intent ($p<0.01$).

CONCLUSION: A modest impact was documented, suggesting the feasibility of EI to enhance the availability of healthy opportunities at school towards the prevention of obesity.

DP33-02

NUTRITIONAL BEHAVIOR, NOT PHYSICAL ACTIVITY, IS THE MAJOR FACTOR IN THE POLISH YOUNG PEOPLE NUTRITIONAL STATUS. NUPHACT-POLYS STUDY

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OBJECTIVES: To recognize the relationship between dietary habits, physical activity, physical development and social-economical group status of young people aged 11-16 years.

METHODS: The research examined 686 children aged 10-16 years (390 boys, 296 girls), who attended sports' classes ($n=340$) or classes with only normal gymn hours ($n=346$). The study was conducted after obtaining parents' written consent and the children's affirmative acceptance. Children were examined once, twice or three times in the period 2004-2007. Altogether 1604 person/examination were executed. From 107 variables according to the research background, four groups were stated: I – social-economical variables; II – sport activity – yes or no; III – physical development of children -a) subgroup – anthropometrical factors, b) disorder factors of body mass; IV – eating habits. To find the relationship between variables, the models of two groups of variables were defined. The canonical model was used to explained relationships between groups of the variables. The dietary habits were examined using food frequency questionnaire.

CONCLUSION: 1) The statistical analysis confirmed relationship between physical activity, physical development, and dietary habits of young people at pubescence status. 2) The canonical analysis confirmed that the treat of the physical activity by the young people during pubescence phase is not a main factor having the influence on the nutritional status of the young people (the occurrence of the undernutrition, overweight and obesity). 3) The proper nutritional behaviors are the major factor having the influence on the nutritional status of the young people.

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DP33-03

PHYSICAL ACTIVITY QUESTIONNAIRE DEVELOPMENT AND NORMS SETTING FOR THAI CHILDREN

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RATIONALE AND OBJECTIVES: Physical activity questionnaire (PAQ) has not yet been established and used. It is therefore the objective of this study to develop a validity and reliability PAQ and set the norms for Thai children.

MATERIALS AND METHODS: Thai schoolchildren, aged 10-18 yrs were included. First data set obtained from mail questionnaire was 2,134 samples for the item selection analysis, and second data set from survey sample using the multistage sampling technique were 2,655 samples, in order to set norms for PAQ by percentiles. These included both primary school PAQ and secondary school PAQ. The reliability and validity were tested using Cronbach's alpha coefficient and Factor analysis.

RESULTS AND FINDINGS: The final PAQ for primary and secondary schoolchildren consisted of 68 and 27 items. The Cronbach's alpha coefficient either with Metabolic equivalent (METs) or without METs were 0.92 and 0.94 compared to 0.71 and 0.74 respectively. The reliability was better in the primary school PAQ. Results of factor analysis showed the predictive value 49.6-54.9 percent, which was not considered high, but the validity in an acceptable level. Norms of PAQ was established.

CONCLUSION: The developed PAQ for Thai children could be applicable for physical activity survey.

DP33-04

FEASIBILITY OF AN INTERVENTION MODEL FOR PROMOTING HEALTHY DIET AND PHYSICAL ACTIVITY IN GUATEMALAN SCHOOL-AGE CHILDREN

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BACKGROUND: The double burden of micronutrient deficiencies and increased adiposity are becoming a common finding in developing countries as the nutrition transition progress. The objective of this study was to develop and test feasibility of a multilevel, low-cost intervention model for promoting healthy diet and physical activity in school-age children, which might prevent and control the double burden of malnutrition.

METHODS: Phase 1: Adaptation, development, and validation of tools and educational material for target audiences (children grades 1-3, teachers, principals, parents, and community leaders). This phase included literature review, elaboration of manuals, and content and design validity of all material. Phase 2: An 8-week pilot intervention to assess feasibility, acceptability, and short-term effectiveness of the model. The intervention was performed in 4 schools from two municipalities around Guatemala City, and consisted in weekly activities for children and monthly activities for parents. Feasibility and acceptability were assessed in all teachers ($n=23$) and in a stratified (by classroom), randomized sample of children ($n=720$). Knowledge, attitudes, and practices (KAPs), pre- and post-intervention, were compared (χ^2) in a stratified (by classroom and sex), randomized sample of children ($n=227$).

RESULTS: Six manuals were developed and validated (assessment of school environment, learning skills, and activities for grade 1, 2, and 3, and for parents). The intervention resulted feasible (schedule, materials, space, skills) and acceptable (teachers, students) for activities with children, but not with parents. KAPs in children improved, being changes in knowledge the greatest, and in practices the least ($p<0.05$). Changes were greater in KAPs on physical activity in those children who performed activities where physical activity was

included; likewise, KAPs on healthy diet changed more in those children who performed activities related to healthy diet.

CONCLUSION: The intervention model resulted feasible, acceptable, and effective in changing KAPs related to healthy diet and physical activity in children. The parent component was not feasible. Recommendations were given to disentangle barriers found.

DP33-05

IMPACT OF EXERCISE ON DNA STABILITY: RELEVANCE OF TRAININGS STATUS AND EXERCISE DURATION

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It is commonly accepted that regular moderate intensity physical activity reduces the risk of developing many diseases. However, evidence also exists for acute and strenuous exercise resulting in oxidative stress. Enhanced formation of reactive oxygen and nitrogen species may lead to oxidatively modified lipids, proteins and nucleic acids, and possibly diseases. Currently, only a few studies have investigated the influence of exercise on DNA stability and damage with conflicting results.

The findings suggest that competitive ultra-endurance exercise (>4 hours) does not induce persistent DNA damage. However, when considering the effects of endurance exercise (< 4 hours), no clear conclusions could be drawn. Laboratory studies have shown equivocal results (increased or no oxidative stress) after endurance or exhaustive exercise.

Explanations for the unchanged or sometimes decreasing levels of DNA damage are adaptive effects of exercise on antioxidant defense, the nutritional status, the upregulation of endogenous antioxidant enzymes, altered expression of genes and the upregulation of stress proteins. There is also growing evidence that free radical-related adaptive mechanisms are linked to the upregulation of DNA repair enzyme activity.

It is shown that the trainings status, principally, is of major importance regarding the influence of physical exercise on clinical parameters, particularly describing the extent of oxidative stress and scattered of inflammation. Much less data are available to significantly link the trainings status to DNA damage.

DP33-06

IMPACT OF A NUTRITION-EDUCATION INTERVENTION PROGRAM FOR OLDER PEOPLE ON NUTRITION KNOWLEDGE, ATTITUDE & PRACTICE, ANTHROPOMETRIC MEASUREMENTS AND SERUM LIPIDS

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Development of the nutrition-education intervention program is essential to increase knowledge towards good eating behavior and healthy lifestyle and to prevent nutrition problems among elderly people. Therefore, this study was carried out to develop and evaluate the intervention program for promotion of healthy ageing among rural elderly Malays.

The study was conducted in three phases starting from identification of information needs among elderly Malays, caregivers, and health professional staffs. Based on the information, a nutritional education package (flipchart, booklet and placemat) had been developed in phase 2. A formative evaluation on the acceptance of the nutritional education package was also carried out. In phase 3, an evaluation on the

impact of nutrition education intervention program was carried out. Elderly Malays with metabolic syndrome, aged 60-75 years with no critical illness were recruited as control (n=20) and intervention (n=22) group and matched for age and socio-economic status. The nutrition education was delivered via group discussions and demonstrations using the nutrition-education package. Nutrition KAP, body weight, waist circumference, and fasting serum lipids were ascertained at baseline, 3 months and 6 months in both groups.

There were significant increment ($p<0.05$) in nutrition knowledge and attitude score, significant reduction ($p<0.05$) in body weight and waist circumference among female subjects and significant intervention effect ($p<0.05$) for total cholesterol among male subjects in the intervention group.

The six months nutrition-education intervention program had successfully improved several important health related parameters in this cohort of elderly people.

DP33-07

IDENTIFYING CRITICAL ISSUES AND SUITABLE APPROACHES FOR FOOD SAFETY COMMUNICATION IN INDIA - INFERENCES FROM A NATION-WIDE STUDY

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RATIONALE AND OBJECTIVES: Although food safety is a global public health concern, it often gets low priority in many national health agendas. India is no different. The WHO Global Strategy for Food Safety (2002) identifies communication and advocacy as important tools in promoting food safety at all levels. Such communication should be culture-specific and targeted. A nation-wide KABP study was carried out in India to identify the critical issues and suitable approaches for food safety communication.

MATERIALS AND METHODS: Both qualitative and quantitative research methods were employed. The quantitative data was collected from 20,719 households in 28 states. This data was triangulated with 325 focus group discussions (FGDs) with women and 1850 in-depth interviews with different stakeholders like Anganwadi Workers (grassroots-level health functionaries), adolescent girls, doctors, food inspectors and schoolteachers.

RESULTS AND FINDINGS: Critical issues identified were lack of food safety enabling environment (access to potable water, safe cooking fuel and sanitation), washing hands without using soap, limited knowledge of food labels, quality symbols and steps to redress adulteration cases. Anganwadi Workers (AWWs) and TV are preferred sources of information for women. The regulatory staff and AWWs lack orientation on newer food safety issues. Adolescent girls consider schoolteachers as sources of information, who in turn suggested that school syllabi lack emphasis on food safety.

CONCLUSION: Advocacy can be a suitable approach to influence the policy makers for improving enabling environment. Refresher programmes involving scientists and academia are needed for capacity building among AWWs and regulators. Appropriate modifications in school syllabi are needed to promote food safety education in schools.

DP33-08

EFFECT OF EATING BEHAVIOR MODIFICATION PROGRAM

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RATIONALE AND OBJECTIVES: Unhealthy eating is an important risk factor for several chronic diseases, namely diabetes mellitus, hypertension, hyperlipidemia and obesity.

The objective of this research was to determine the effect of the eating behavior model on lipid status in hyperlipidemic women. **MATERIALS AND METHODS:** Quasi-experimental research, one group pretest and posttest design, was done in 30 hyperlipidemic women, living in municipal area of Chiang Mai district. The subjects participated in the eating behavior modification model based on empowerment for 6 months. Data were analyzed using descriptive statistics and dependent t-test. **RESULTS AND FINDINGS:** The results of the study revealed that after 6 months of active participation in activities related to promote eating behavior toward nutritive value and safety, HDL-cholesterol were significant higher than those at the baseline ($p < 0.05$). Total cholesterol and LDL-cholesterol were significantly lower than those at the baseline ($p < 0.05$). There were no significant differences of body weight, body mass index, body fat, triglyceride level, and blood glucose level among women before and after participation. **CONCLUSION:** The result of this study provides the model, based on application of the empowerment concept and process, to promote eating behavior for controlling of serum lipid in hyperlipidemic women.

DP33-09
MAINSTREAMING NUTRITION INITIATIVE (MNI) INTO MATERNAL AND CHILD HEALTH PROGRAMME: BRAC'S EXPERIENCE IN RURAL BANGLADESH

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RATIONALE AND OBJECTIVES: Bangladesh is facing huge burden of malnutrition among women and under-five children. To achieve the national targets for MDGs, BRAC, the largest NGO in Bangladesh, has integrated MNI into a comprehensive maternal, neonatal and child health program in one rural district. The priority nutrition actions include initiation of breastfeeding within 1st hour of birth, exclusive breastfeeding, complementary feeding, and maternal nutrition. The strategies used for improving practices are: enhancing counseling skills of community health workers; building community awareness; developing partnerships with public-private health sectors; and advocate different Stakeholders. The objective is to improve nutritional practices regarding maternal and infant and young child feeding (IYCF) by demonstrating a model for integration of nutrition in MNCH program.

MATERIALS AND METHODS: Data was abstracted from the Management Information System of the project from January-December 2008.

RESULTS AND FINDINGS: A positive trend is observed in mother's knowledge on maternal nutrition and IYCF. Consumption of food, iron supplementation, and postpartum Vit-A have improved. Early initiation of breastfeeding increased from 50% to 65%, exclusive breastfeeding 48% to 65% and complementary food introduction at 6 months 30% to 46% in project areas.

CONCLUSION: A remarkable improvement is observed within one year. It is thus crucial to strengthen and maintain nutrition-related activities for women and children through integrated approach.

DP33-10
EFFECT OF FOOD AND MICRONUTRIENTS ON FETAL SIZE IN BANGLADESH

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RATIONALE AND OBJECTIVES: To estimate the effect of food and micronutrient supplementation on fetus size.

MATERIALS AND METHODS: Pregnant women in rural Bangladesh (MINIMAT study) were randomly assigned to be encouraged (or not) to participate early (from 1st trimester) in a national feeding program. Within each group they were also randomly assigned to 1 of 3 micronutrient supplements (30mg iron/folate, Fe30F; Fe60F; multiple micronutrients, MM). Ultrasound was used to measure fetal size at baseline and at 30 wks gestation, and z-scores of measures were used in intent-to-treat analysis.

RESULTS AND FINDINGS: There was no effect of food group on fetal size. At 30 wks, abdominal circumference (Fe30F: -0.04; Fe60F: -0.16; MM: -0.18), biparietal diameter (Fe30F: -0.20; Fe60F: -0.29; MM: -0.35) and femur length (Fe30F: 0.43; Fe60F: 0.33; MM: 0.29) were significantly larger in the Fe30F than other groups.

CONCLUSION: Supplementation with a higher dose of Fe or MM is associated with smaller fetal size at 30 wks gestation. The biological significance of this difference has yet to be established.

DP33-11
THE EFFECT OF SHORT-TERM VITAMIN K1 SUPPLEMENTATION ON INDICES OF VITAMIN K STATUS AND BONE TURNOVER IN ADULT CROHN'S DISEASE (CD) PATIENTS

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The circulating concentration of under- γ -carboxylated osteocalcin (ucOC), a sensitive marker of vitamin K status, reflects hip fracture risk and bone mineral density (BMD). Adult CD patients have been shown to have higher circulating ucOC concentrations with negative implications on bone metabolism. Thirty adult CD patients, were randomized to one of three treatment groups (placebo, 1000 μ g or 2000 μ g vitamin K1/d, for 2 weeks) to establish which treatment was sufficient to maximize γ -carboxylation of serum osteocalcin and the effects on markers of bone turnover and vitamin K status.

There were no significant differences in any of the biochemical indices of bone turnover or vitamin K status among the three treatment groups at baseline. Serum %ucOC was significantly reduced in patients who received daily 1000 μ g or 2000 μ g vitamin K1 compared to placebo; with no significant effect seen on markers of bone turnover or any benefit seen at the higher dose.

There is a need for a long-term, interventional trial to establish the effects of vitamin K status on bone metabolism.

DP33-12

GARNERING COMMUNITY STRENGTH, THEIR COLLECTIVE WISDOM AND LEADERSHIP FOR ADDRESSING INFANT UNDERNUTRITION: A POSITIVE DEVIANCE TRIAL IN RURAL AGRA, INDIA

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RATIONALE & OBJECTIVES: Positive deviant families succeed nutritionally despite poverty. We collected influencers of positive behaviors within these families to address undernutrition in early infancy utilizing collectively devised strategies.

MATERIALS & METHODS: Three of seven matched villages were randomly selected as intervention area and four as comparison area. In intervention area, positive behavior influencers were grandmothers and those keen were collected as voluntary groups, trained to implement a 3-year intervention and bimonthly supervision. Strategies included– i) context-responsive nutrition education, ii) collective problem solving, iii) community-service provider linkage and iv) institutionalizing groups as village-level organizations. Intervention was prospectively evaluated on a birth cohort from each area.

RESULTS & FINDINGS: Intervention had 98% coverage. There was 16.9% effect-size increase in exclusive breastfeeding. At 6 months, fewer intervention infants compared to comparison infants were underweight (37.1% vs. 50.7%) and stunted (40% vs. 47%).

CONCLUSION: Today, these groups confidently bridge demand-supply gap and ensure access and coverage of nutrition services. They have generated collective community consciousness for addressing infant undernutrition.

DP33-13

EFFECT OF FREQUENCY AND DOSAGE OF IRON-FOLIC ACID SUPPLEMENTATION ON BLOOD HEMOGLOBIN OF ANEMIC ADOLESCENT GIRLS

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Iron-deficiency anemia is highly prevalent in developing countries, particularly among adolescent girls. Oral supplements are used to supply iron to replenish hemoglobin deficits. The present study determined the effect of frequency and dosage of iron-folic acid supplementation on blood hemoglobin levels of anemic adolescent girls. The subjects were drawn from an NDMC school in Delhi. Adolescent girls (13-15 years) with hemoglobin less than 12g/dl i.e. anemic (N=89) were divided by random sampling into 2 groups. Group I received the supplement thrice a week, while group II received it once every week for twelve weeks. Hemoglobin levels were assessed by the cyanmethemoglobin method. Data indicated a significant impact of iron-folic acid supplementation on blood hemoglobin levels in both the groups. However, the mean increase in hemoglobin levels was not significantly different (1.42g in Group I and 1.33g in Group II). A significant improvement in hemoglobin levels was achieved even with a lower frequency/dosage of once a week. Further, weekly administration of the supplement caused lesser intestinal discomfort as compared to thrice a week supplementation. Thus, a lower frequency of supplementation for improving hemoglobin status must be considered for benefits of lesser cost and side effects, as well as easier monitoring.

DP34: Frontiers in Nutrition Research II

DP34-01

TRANSGENERATIONAL NUTRIGENOMICS

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RATIONALE AND OBJECTIVES: An association of longevity with ancestors' food supply in their early life has been found. Selection, learning and social inheritance could be ruled out. Genomic imprinting of the egg and sperm developments, first erased before implantation and later, then reset at differentiation, could be a mechanism.

The objectives are to study the ancestors' childhood exposure to food crises and the effects on the health and imprints of children, grandchildren and grand-grandchildren.

MATERIALS AND METHODS: In Överkalix, Sweden, 100 individuals were followed three generations back. The ancestors' exposure to poor or good supply of food in the environment was established through historical harvest statistics and food price statistics. Global analysis of uniparental disomy was used to detect proband's imprinting.

RESULTS AND FINDINGS: Early growth and development can be divided into five phases. One is the slow growth phase (SGP), before the prepubertal peak growth.

We found poor availability of food in the environment, during the SGP, protective to the descendants from premature death and cardiovascular disease. Uniparental disomies were possible mechanisms.

CONCLUSION: The current health of the population partly depends on ancestors' childhood food availability.

DP34-02

S-ALLYLCYSTEINE MODULATES THE EXPRESSION OF E-CADHERIN AND INHIBITS THE MALIGNANT PROGRESSION OF HUMAN ORAL CANCER

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Oral cancer is a prevalent type of cancer in the Asian countries. Several studies indicated that garlic extracts such as diallyl disulfide (DADS) and diallyl trisulfide (DATS) have anti-cancer effects. However, the inhibitory effects of water-soluble garlic extracts, S-allylcysteine (SAC), on the malignant progression of oral cancer have not been studied well yet.

RATIONALE & OBJECTIVES: Thus, the purpose of this study was to investigate the inhibitory effects of SAC on the proliferation and progression of human oral squamous cancer CAL-27 cells.

RESULTS & FINDINGS: In the present study, we demonstrated that SAC dose dependently inhibited the growth of human oral squamous cancer cells. Our results showed that SAC induced the expression of E-cadherin adhesion molecule. Immunocytochemical staining result also revealed that SAC could restore the distribution of E-cadherin molecule on cell membrane. We further demonstrated that SAC stabilized the adherent junction complex of E-cadherin/b-catenin in oral cancer cells. Treatment of MAPK/MEK specific inhibitor, PD098059, could upregulate the expression of E-cadherin molecule. Furthermore, SAC significantly inhibited the activation of MAPK/ERK signaling pathway. These findings were associated with the downregulation of Slug repressor protein.

CONCLUSION: In conclusion, our results indicated that SAC effectively inhibited the proliferation, upregulated the expression of E-cadherin molecule, and stabilized the E-cadherin/b-catenin adherent junction complex in human oral squamous cancer cells. The mechanism of action was in part through the suppression of MAPK/ERK signaling pathway and downregulation of Slug repressor protein.

DP34-03

COFFEE AND CAFFEINE DECREASE MARKERS OF OXIDATIVE STRESS IN G93A MICE: COFFEE IMPROVES ANTIOXIDANT ENZYME CAPACITY IN MALES

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RATIONALE & OBJECTIVES: Coffee (COFF) consumption reduces oxidative stress and increases antioxidant status. G93A mice (an animal model of ALS) exhibit elevated markers of oxidative stress and an upregulation of antioxidant enzyme activity. Does coffee confer its effects through one or several of its constituents? We aimed to study the effect of COFF, caffeine (CAFN) and chlorogenic acid (CHLA) on markers of oxidative stress (4-HNE, 3-NY) and antioxidant enzyme protein content (MnSOD, CAT, GR) in the brain of G93A mice.

MATERIALS & METHODS: Starting at age 40 d, 30 female and 21 male G93A mice were randomly divided into four groups: control (CNTL: 8 F/6 M), COFF (7 F/5 M), CAFN (8 F/5 M) and CHLA (7 F/5 M). Compounds were added to the food, equivalent to amounts found in 5-10 cups of coffee/day (mg/g body weight). At age 108 d, mice were euthanized and the brains harvested for analysis.

RESULTS & FINDINGS: In females, COFF and CAFN decreased 4-HNE vs. CNTL ($P \leq 0.001$), whereas CHLA increased 3-NY vs. all other groups ($P < 0.001$). COFF and CAFN decreased GR vs. CNTL ($P = 0.048$, main effect). In males, COFF, CAFN and CHLA decreased 4-HNE vs. CNTL ($P \leq 0.005$), whereas COFF and CAFN decreased 3-NY vs. CNTL ($P = 0.043$, main effect). COFF increased CAT vs. all other groups ($P \leq 0.039$). COFF and CAFN decreased GR vs. CNTL ($P \leq 0.044$).

CONCLUSION: We conclude that in the G93A mouse, COFF and CAFN supplementation decrease markers of oxidative stress in both sexes, whereas CHLA may increase oxidative stress in females only. COFF improves antioxidant enzyme capacity in males only.

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DP34-04

EPIGENETIC EPIDEMIOLOGY: EVIDENCE FOR THE ROLE OF EPIGENETIC VARIATION IN COMPLEX DISEASE

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Despite recent advances in genetic epidemiology, a significant proportion of the heritability of common complex diseases remains unresolved. This phenomenon of ‘missing heritability’ may be explained in part by epigenetic factors as they are postulated to (a) influence phenotype, (b) be heritable and (c) be influenced by environmental factors through the lifecourse. Evidence from human studies is presented to support these claims, with a particular focus on obesity.

Genome-wide and gene specific DNA methylation analyses were undertaken on human samples using Illumina GoldenGate arrays, Pyrosequencing and Sequenom MassArray. Study populations include the Avon Longitudinal Study of Parents and Children, the North Cumbria Community Genetics Project and the Newcastle Thousand Families Study.

Early life exposures are associated with DNA methylation patterns at birth and these, in turn, influence disease-related phenotypes in childhood. Cross-sectional analysis in later life demonstrates an association between DNA methylation status and phenotype. These observations support a role for epigenetic mechanisms in the pathogenesis of common complex diseases.

DP34-05

AN ADVANCED, PORTABLE FIELD DARK ADAPTOMETER FOR ASSESSING FUNCTIONAL VITAMIN A DEFICIENCY

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BACKGROUND: Current methods to detect impaired dark adaptation remain cumbersome and inefficient under field conditions. A consistent negative relationship between serum retinol and the light intensity required to elicit a pupillary response has previously been established (Congdon et al, 1995). We first reported on a portable device for assessing dark adaptation, based on the principle that a dark-adapted pupil constricts when the contralateral eye is exposed to a certain intensity of light, at the 2004 IVACG meeting. This novel device has undergone substantial improvements and is now ready for field validation and calibration.

METHODS: The device consists of a pair of opaque, face-conforming eye-goggles which expose one eye to a calibrated Ganzfeld light source while monitoring the contralateral eye with a non-stimulating infrared “night vision” miniature camera embedded in the goggle. The use of “night-vision” infrared technology has a further advantage of inverting the contrast of the iris (like a photograph negative image), permitting ready assessment of subjects with dark irises, heretofore a severe limitation of existing methods. A controlled series of short (1s) light stimuli are applied at 10s intervals with increasing intensity until a pupillary contraction is documented. The initial device has been re-engineered into a lightweight, printed circuit board (PCB), laptop-driven system. Component parts are either commercially available or can be mass-manufactured at low cost. Customizable software permits a minimally-trained field worker to place a pair of USB-powered opaque goggles over a subject’s eyes, and run an automated program that digitally records the video feed of the eye, including telemetry of light intensity, time of test, and subject identifier data. This digital record can be stored for research or QC purposes and for later, expert review.

CONCLUSIONS: The Dark Adaptometer is undergoing field testing and validation against serum biomarkers of vitamin A status in a population of pregnant women in rural Bangladesh.