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# ABSTRACTS



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# Paper Presentations

## Nutrition Congress Abstracts

### Clinical Nutrition

#### 1 Disappearance of long chain omega-3 fatty acids from human red blood cells in vivo after supplementation with salmon oil

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**Background:** Long chain Omega-3 fatty acids are essential dietary components indispensable for growth, development and general health. Little is however known about the kinetics of Omega-3 fatty acid metabolism. This probably explains the lack of a scientific basis for a universally accepted daily intake of long-chain Omega-3 fatty acids.

**Objective:** To study the metabolism of long chain fatty acids in humans by following the disappearance of Omega-3 fatty acids from red blood cells in vivo after supplementation with salmon oil for six weeks.

**Methods:** Eight healthy volunteers with normal blood lipid values were supplemented with capsules containing 1000 mg salmon oil (180 mg Eicosapentaenoic (EPA) and 120 mg Docosahexaenoic (DHA) acid) for six weeks. Average intake was 1000mg EPA and DHA per day. Blood samples were collected before supplementation, after six weeks of supplementation and during six weeks after cessation of supplementation. Lipids were extracted from washed RBC with chloroform-methanol and separated by thin layer chromatography. Methyl esters of fatty acids from the different lipid fractions were analyzed by gas liquid chromatography (GLC) and expressed as percentage of fatty acids.

**Results:** The EPA and DHA content of Phosphatidyl Choline (PC) and Phosphatidyl Ethanol Amine (PEA) of red cells increased significantly during supplementation. After cessation of fish oil supplementation, the rate of disappearance of EPA from RBC-PC was about 12 X faster than that measured for DHA. However similar rates of disappearance were observed for EPA and DHA in PEA.

**Conclusion:** Significant differences were observed between the rate of metabolism of EPA and DHA in red blood cells.

#### 2 EPA and DHA: evidence based health claims, recommended dosages and implementation thereof

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**Introduction:** Research regarding omega-3 fatty acids (EPA/DHA) in prevention/treatment of disease is ongoing. The aim of this research was to: review evidence on health benefits of omega-3 fatty acids

(FA); investigate recommended dosages for cited benefits; and determine feasibility of consuming recommended dosages through diet/supplements.

**Methodology:** A Pubmed search was conducted to identify the most recent evidence supporting use of omega-3 fatty acids for medical conditions as well as recommended dosages. Best food sources were identified using the MRC fatty acid composition supplement. All omega-3 fatty acid containing supplements available through a national retail pharmacy were assessed for EPA/DHA content and cost/tablet.

**Results:** Evidence supports use of omega-3 fatty acids for cardiovascular disease, depression, visual acuity and neural development, especially in pregnancy, lactation and infancy. Dosages recommended for these purposes range from 200 to 4000mg. Evidence for use in ADHD is inconclusive. Medium-to-high fat fish, providing 1000mg-2250mg EPA/DHA per 100g cooked fish, are best food sources. The investigated pharmacy stocked 38 supplements containing omega-3 FA, with the content of EPA/DHA ranging from 176-367mg per 1000mg fish oil tablet, at a price range of R0,65 to R3.20 per tablet. Combinations of omega-3 with omega-6 and/or omega-9 fatty acids is available at a cost of R0,75 - R2.80 per tablet and contain half the concentration of DHA/EPA when compared to omega-3 FA only supplements. Specialized formulations for babies, pregnancy, ADHD and cardiovascular disease are more expensive, with varying EPA/DHA content.

**Conclusion:** Increasing consumer awareness regarding evidence based and effective increases in omega-3 fatty acid intake through food sources/supplements is recommended.

#### 3 Nutrition knowledge, attitudes and practices of professional health workers at Morogoro urban district

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**Background:** Nutritional knowledge plays an important role in public health. However, there has been general concern about the state of nutritional knowledge of nurses and clinicians in many parts of the world.

**Objective:** To examine the nutrition knowledge, attitude and practice of health workers at different health facilities in Morogoro, an urban district in Tanzania.

**Design:** Descriptive cross sectional survey.

**Methods:** A self-administered questionnaire was administered to 155 health workers, among them 100 nurses and 55 clinicians working in various health facilities and departments in Morogoro. In addition, an in-depth interview was conducted among 40 health workers and a



focus group discussion was conducted on a group of clinicians and a group of nurses separately.

**Results:** The overall nutrition knowledge score was rated as poor with a mean score of 42% for clinicians and 41% for nurses. Nutrition knowledge of 53% and 38% of the clinicians was rated poor and mediocre, respectively and that of 56% and 40% of nurses was rated mediocre and poor respectively. Health workers rated their nutrition knowledge as moderate. Although health workers regarded nutritional care as an important component of their health delivery responsibility, only 17% always provide nutrition counseling to patients. Barriers to nutrition counseling included lack of time, equipment, human resource and inadequate nutrition knowledge and skills because basic health worker training does not provide sufficient exposure of the trainees to nutrition knowledge and skills.

#### 4 Association between serum hs-CRP levels with nutritional factors in depressed and healthy nurses

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**Objective:** Depression has been related to a higher risk of developing coronary heart disease. A recent history of depression is strongly associated with elevated CRP (C-reactive protein), a strong risk factor for atherosclerotic heart disease. The objective of present study was to investigate the association between several nutritional factors and serum high sensitive CRP (hs-CRP) concentrations in depressed and healthy female nurses.

**Method of data collection and analysis:** This was a cross-sectional comparative study involving 45 depressed and 53 healthy subjects with age range of 23-52 years. Depression was measured using the Beck Depression Inventory (BDI). Daily dietary intake was assessed using a 3 day 24-hour food recall. We measured 25-hydroxy vitamin D, erythrocyte glutathione reductase activity coefficient (EGR-AC) for assessing riboflavin status and serum hs-CRP concentrations.

**Results:** There was no significant association between EGR-AC, 25(OH) D3 serum levels and dietary intake of riboflavin and cholecalciferol with hs-CRP serum levels in both groups. Dietary intake of 1 mg/day more of both iron and magnesium was associated with a 35% elevated and 19% lowered serum hs-CRP levels, respectively ( $p < 0.05$ ). Dietary intake of vitamin B6, vitamin A and calcium were higher in the first quartile of hs-CRP levels than the second in healthy subjects ( $P < 0.05$ ). There was no difference between quartiles of vitamin D status in both groups.

#### 5 Knowledge, beliefs and practices of dietitians and doctors in South Africa on the use of the internet in healthcare

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**Background:** Regulation of internet use by health professionals as part of patient treatment is lacking in South Africa (SA). This study aimed to assess internet use by dietitians and medical doctors (MDs) practicing in SA.

**Methods:** A cross-sectional analytical e-mail based survey was conducted amongst dietitians and a sample of MDs using a self-administered electronic questionnaire. Variables included demographics, internet influence on quality of care, quality control when using web sources and information technology (IT) training needs of health science students.

**Results:** N=106 dietitians [mean±SD age: 32.6± 8.0] and n=70 MDs [mean±SD age 50.5± 8.9] participated. The majority of respondents were White (82%) and female (67%). Mean± years in practice for the total group was 9.1(±8.0) years. Dietitians (58%) and MDs (68%) had access to the internet at their practice/workplace and home. Significantly ( $p=0.000$ ) more dietitians (65%) than MDs (41%) used e-mail and/or internet for patient treatment. MDs did not utilize the internet for research purposes, whilst 21% of dietitians did. More dietitians (82%) than MDs (69%) reported that the internet had improved quality of care of their patients. Majority (60%) of dietitians and 53% of MDs were unclear on how to source and determine reliability of information from the internet.

**Conclusion:** More dietitians than MDs incorporated the internet in patient treatment and perceived it to improve quality of treatment. More than half of the respondents seemed unable to source and assess the accuracy of internet sources. To facilitate regulation of internet use in health practices in SA, a policy on use of IT in health-care was drafted.

#### 6 Immune measures in treatment-naïve 13 to 15-year-old adolescents with alcohol use disorders

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**Background:** Alarming proportions of adolescents internationally and in the Western Cape, South Africa have chronic exposure to hazardous levels of alcohol. This is likely to be a significant predictor of health outcomes, including those related to immunity.

**Methods:** Substance use and biochemical immunological parameters were assessed in heavy drinking adolescents (n=18; meeting DSM-IV criteria for alcohol dependence (AD)) and light/non-drinking control adolescents (n=19; lifetime dose <100 standard units alcohol/never consumed alcohol) in Cape Town.

**Results:** Adolescents in the AD group were lymphopenic compared to controls, with significantly lower mean numbers of absolute circulating CD3+ ( $p=0.01$ ), CD4+ ( $p=0.03$ ) and CD8+ ( $p=0.02$ ) T-lymphocytes. As expected, mean lifetime alcohol dose, measured in standard units of alcohol) was significantly higher ( $p<0.01$ ) in the AD group (1296.22 ±1577.85) than in the control group (2.11 ±2.92). Mean alcohol dose per month in the AD group was 55.78 ±50.73. All adolescents in the AD group had a 'weekends-only' style of alcohol consumption. The AD group was chosen to represent relatively 'pure' AD, with minimal other drug use or externalizing diagnoses, and was comparable in age to and gender distribution to controls.

**Conclusions:** Adolescents with excessive alcohol intake in a weekend binge-drinking style, but without comorbid drug or externalizing disorders may be at increased risk of compromised immunity.

This alcohol misuse may increase infectious disease susceptibility, including TB and HIV. Complex interactions of alcohol with other documented high-risk activities may further compound health risks.

## 7 Analysis of omega-3 fatty acid content of South African fish oil supplements

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**Introduction:** Substantial evidence describes the protective effects of marine derived omega-3 (n-3) polyunsaturated fatty acids (PUFA) on cardiovascular diseases as well as many other conditions. Numerous fatty acid preparations are marketed for supplementing the western diet which is low in n-3 fats. Since these preparations may vary in their n-3 PUFA content, we tested 45 commercially available products on the South African market for their fatty acid composition.

**Method:** Fourty five (45) commercially available n-3 fatty acid supplements were analyzed using gas liquid chromatography to determine fatty acid contents.

**Results:** More than half of the n-3 supplements available on the South African market contained less than 89% of the claimed content of EPA and/or DHA as stated on the product labels. To meet ISSFAL's recommendation of 500 mg EPA+DHA/day can cost consumers between R2 and R5 p/p/day (R60-R150 p/p/month). Regarding rancidity, the majority of capsules contained conjugated diene (CD) levels higher than vegetable oil obtained from opened containers (3 months) used for domestic cooking purposes, despite the addition of vitamin E as antioxidant.

**Conclusion:** Since no formal regulatory structure for dietary supplements currently exist in South Africa consumers depend on self-regulation within the nutraceutical industry for assurance of product quality, consistency, potency and purity. Our results indicate that more than half of the n-3 fatty acid supplements on the South African market do not contain the claimed EPA and/or DHA contents as stated on product labels and contained CD levels higher than unused vegetable oils obtained from opened containers used for domestic cooking purposes.

## 8 Washout kinetics of eicosapentanoic and docosahexanoic acid from plasma lipids after supplementation with salmon oil

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**Background:** Recent research reported that eicosapentanoic acid (EPA) and docosahexanoic acid (DHA) demonstrate diverse effects in the human body implicating different metabolic rates of EPA and DHA.

**Method:** Eight (n=8) randomly selected normolipidaemic subjects were loaded with fish oil capsules supplying 1 000 mg EPA+DHA/day over a 6 week period. After 6 weeks participants discontinued taking the fish oil capsules and were followed up for another 6 weeks. EPA and DHA were measured in plasma cholesterol esters (CE), plasma

triacylglycerols (TAG) and total plasma phospholipids (TPL). Dietary intake remained unchanged during the study period.

**Results:** The disappearance rates of EPA from TAG, CE and TPL all differed with TAG (half-life = 3 days) demonstrating the fastest disappearance rate with TPL (half-life = 5½ days) the slowest. In the TAG and TPL components, DHA levels were almost 2 to 3 times higher throughout the loading as well as washout period, when compared to the EPA levels. DHA disappeared from all plasma components at a slower rate than EPA and remained elevated for a longer period compared to EPA. No significant differences were observed in measurements for lipid oxidation such as conjugated diene (CD) and thiobarbituric acid reactive substances (TBARS) levels with (loading phase) or without (washout phase) omega-3 fatty acid supplementation.

**Conclusion:** Disappearance rates of EPA and DHA from plasma TAG, CE and TPL implicate different metabolic rates of these components. These finding may have important implications for human health especially in individuals with special dietary needs such as diabetes, cardiovascular disease and HIV.

## 9 Future South African health care professionals: do they practice what they ought to preach?

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Studies show that health care professionals with prudent eating habits and lifestyles are more likely to council patients on these preventative factors for chronic diseases of lifestyle. This study investigated eating habits and lifestyle factors among undergraduate students in the Faculty of Health Sciences at the University of the Free State.

The sample consisted of 161 randomly selected full time students. Dietary intake was determined by 24-h recall and short food frequency questionnaire, and smoking, alcohol consumption and physical activity levels by questionnaire. Body mass index (BMI) and fat distribution were determined from weight, height, waist- and hip circumferences.

Compared with the USDA Food Guide Pyramid, 44% of students failed to consume the recommended daily minimum of 6 servings of starchy foods; while 98% ate less than 3 vegetable servings; 58% less than 2 fruit servings; and 83% less than 2 dairy servings, per day. High intakes of fat, oil and sweets were reported by 43% of students. Overweight (BMI>25kg/m<sup>2</sup>) was recorded in 22% of female, and 13% of male students. Four students had waist circumferences and 6 students had waist-hip-ratios indicative of high risk fat distribution. Almost all students were physically active due to busy daily schedules, but only 22% took part in gym or sporting activities. Eleven percent of students smoked (3.5 cigarettes/day) and 62% consumed alcohol (3.5 units /day; classified as heavy drinking) mostly over weekends.

The results of this study emphasises the need to promote prudent living practices among students preparing for health care professions.

## Food Safety, Functional Foods and Food Composition

### 1 The antioxidant potential of oleic acid in FB1-induced hepatocarcinogenesis

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Fumonisin B1 (FB1), a mycotoxin produced by the fungus *Fusarium verticillioides* and classified as a 2B carcinogen, is a natural contaminant of maize and other cereal grains. FB1 induced carcinogenesis is related to altered fatty acid biosynthesis (FA) and lower oxidative status due to decreased long chain PUFAs and an increase in oleic acid (C18:1n9, OA), suggested to possess antioxidant properties.

The antioxidant property of OA was compared to known antioxidants; vitamin E, reduced glutathione (GSH) and the polyphenols quercetin, ECGC and catechin, in an in vitro microsomal system by determining the inhibitory effect on the formation of iron-induced lipid peroxidation products, malondialdehyde and conjugated dienes. The antioxidant property of OA was also compared to vitamin E in rat primary hepatocyte cultures treated with FB1. In the microsomes, OA protected against lipid peroxidation exhibiting an IC50 of 760µM, half as effective as vitamin E with an IC50 of 320µM, while GSH was less potent (IC50 10mM). The polyphenols showed strong inhibitory effects at low concentrations (EGCG, IC50 42µM; catechin, IC50 90µM; quercetin, IC50 17µM). In the primary hepatocytes, both OA (100µM) and vitamin E (10µM) attenuated the FB1-induced lipid peroxidation and depletion of PUFA. The present data suggest that OA plays an important role in the control of the oxidative status of a cell by protecting against the cytotoxic effects of toxins/carcinogens. The implications of OA and oxidative status with respect to carcinogenesis will be discussed.

### 2 Comparison of the nutrient content of dishes determined by recipe calculation and by chemical analysis

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Calculation of the nutrient content of recipes remains a challenge as moisture and nutrient losses occur during processing. Theoretical models are available for recipe calculations, but the accuracy thereof remains questionable. The aim of this project was to compare calculated nutrient values of multi-ingredient dishes by using a theoretical model, with values generated by chemical analysis.

**Methods:** Two multi-ingredient dishes, lasagne and vanilla cake, were prepared from a standard recipe. The EuroFir model where yield and retention factors are applied at ingredient level was used. Samples of the dishes were sent to a food analysis laboratory for chemical analysis of moisture, fat, protein, thiamin, riboflavin and niacin content for comparison.

**Results:** The values for moisture were lower in the analysed sample than when calculated: lasagne (22%) and cake (33%). Total fat

in analysed lasagne was 20% less than the calculated value. In contrast, total fat in the analysed cake, was 44% higher than the calculated value. For protein, the differences between the analysed and calculated values were smaller: lasagne 11% and cake 7%. In both dishes the value for thiamin was 92.3% higher in the analysed than in the calculated value. Riboflavin and niacin were both lower when analysed compared to the calculated value, lasagne, 12.3% and 40.3% and cake 8.3% and 40.3%, respectively.

**Conclusion:** Recipe calculations produce estimates of nutrient content of multi-ingredient dishes and should be interpreted as approximations. Chemical analysis of multi-ingredient dishes remains the preferred method of determining nutrient content, but has a high cost factor.

### 3 Rooibos as an antioxidant supplement: a cellular perspective

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The popularity of flavonoids as dietary supplements has increased dramatically. However, studies indicate that they could induce many adverse effects due to diverse pharmacological properties. High flavanoid intake may potentiate processes such as mutagenesis, altering the activities of key metabolizing enzymes and cell signaling pathways. Although flavonoids are known for their beneficial health effects the interaction between antioxidants and reactive oxygen species (ROS) is not well understood. The disruption of the homeostatic redox balance may therefore result in the survival of genetically altered cells leading to carcinogenesis. Many flavonoids are known to exhibit genotoxic effects depending on the dosage level and specific structural determinants. Apart from being directly genotoxic, auto-oxidation of flavonoids results in the formation of ROS such as hydrogen peroxide, superoxide and hydroxyl radicals depending on the oxidative status of the cell. Cells exhibit many regulatory mechanisms to control the redox status which is a key regulator in determining cell survival. Differences exist in the regulation of the redox status between normal and cancer cells and antioxidants could play an important modulating role to maintain cellular homeostasis and cell survival. Flavonoids exhibit potent antioxidant properties when compared to normal cellular constituents such as glutathione and vitamin C. Aspalathin, a major flavonoid of rooibos, occurs as conjugated and unconjugated metabolites in the urine and blood of humans after ingestion of rooibos. The relevance of these metabolites and their role in modulating the cell's redox status by rooibos and/or rooibos supplements will be debated with respect to health and disease.

### 4 Indigenous plant foods consumption and nutrient intake in rural and urban communities

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In South Africa, malnutrition and poverty often co-exist with urbanisation, which is associated with significant dietary change, neglect of indigenous foods and loss of indigenous knowledge. The objectives of this study were to assess the availability, cultivation,

consumption and general knowledge about indigenous plant foods in rural and urban communities and to compare the nutritional status of consumers and non-consumers of traditional leafy vegetables (TLV).

A comparative study was conducted in rural and urban populations of the North West Province of South Africa. Data were collected using a questionnaire (n=396 households), key informant interviews (n=4), and focus group interviews (n=46). Existing data on dietary intake and nutrition status were extracted from the Prospective Urban Rural Epidemiological South African Study. There was a disparity in the food available and consumed in the urban and rural areas and fewer species were used as edible food material than expected. The rural area had more plant food available and consumed. Consumption in both areas was influenced by availability, accessibility, diversity in markets and price. The elderly were more knowledgeable regarding indigenous foods as compared to the younger age groups. There was no cultivation of indigenous crops in urban areas and cultivation in the rural areas was limited to a number of species and restricted to household consumption.

Rural inhabitants were more likely to consume TLV ( $X=137.2$ ,  $p<0.0005$ ,  $\phi=0.59$ ) than urban inhabitants. The significantly higher serum concentration and nutrient intake suggest that urban participants consumed more food rich in animal products and fresh fruit and vegetables (calcium intake:  $t=4.39$ ,  $p<0.0005$ ; vitamin C intake:  $t=5.71$ ,  $p<0.0005$ ) than rural participants. Considering the limited availability and accessibility of fresh fruit and vegetables in rural areas, the consumption of micronutrient-rich indigenous plant foods should be promoted as a feasible approach to improve rural consumers' nutritional status.

## Food Security

### 1 Barriers preventing people from accessing social grants in KwaZulu-Natal

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**Objective:** To determine barriers preventing people from accessing social grants in KwaZulu-Natal.

**Methods:** A questionnaire was administered to a convenience sample of black adults who represented 146 households in the France community, KwaZulu-Natal.

**Results:** Of those eligible for social grants, only 49% accessed them. Of these, 53% spent over 75% of this money on food and for most the grant was the only form of income. The most accessed was the old age grant and the least accessed the adult disability grant, care dependency and foster care grants for children. The most common barriers were a lack of the required documents (identity book) and being given inconsistent information by officials, the long process (queues, frequent trips) and the cost (ID photographs and travel). Other common barriers included doctor's letters, birth certificates, referral letters from other provinces and inadequate staff in the welfare offices. The quality of service from the Department of Social Development, Home Affairs and doctors were poor (long queues, rude staff). The quality of service from the South African Police Service, the Magistrate's Court and the Department of Labour was good (quick service, friendly staff).

**Conclusion:** Although social grants contributed significantly to food security, the uptake was poor. Many of the barriers experienced could be eliminated with better information being given to both the responsible government officials and the potential recipients reducing both the cost and the long process.

### 2 The Protein-Energy Malnutrition Programme (PEMP): a nutrition intervention or a food security program?

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The Protein-Energy-Malnutrition Program (PEMP) is implemented at public health facilities to treat and manage clients suffering from malnutrition or those that are at risk of becoming malnourished. Clients participating in the PEMP receive both nutrition education and food supplements. A cross-sectional descriptive study was conducted in 51 Primary Healthcare (PHC) facilities to evaluate the implementation of the PEMP. Retrospective data was collected through record reviewing and interviews with health professional and mothers / caretakers. Anthropometric data of children and their mothers/ caretakers was also accessed.

The results of the study generally indicated that the PEMP was not implemented effectively due to logistical challenges, lack of training and under-identification of clients. Most of the children participating in the PEMP (n = 46) had an inadequate food intake for the day. Food supplements were often shared with family members and the only food eaten at home. Twenty percent (20%) of the children (n = 399) were underweight-for-age, with 22% of them at risk of becoming severely malnourished. Half of the mothers / caretakers (n = 399) had a Body Mass Index (BMI)  $\leq 25$  kg/m<sup>2</sup> and 15% of them had a BMI  $< 18.5$  kg/m<sup>2</sup>. Eighty eight percent (88%) of the children had been breastfed for about 5 months.

This study indicated that the PEMP is generally regarded as a food security program and not as a nutrition intervention to support the prevention and treatment of malnutrition amongst identified clients by both health professionals and clients participating in the PEMP.

### 3 Practices of caregivers of children aged between 0 and 60 months, residing in an urban informal settlement

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**Introduction:** Poverty has been linked with poor childcare and child malnutrition and South African children, especially those living in informal settlements, are vulnerable to poverty. Appropriate care giving practices by caregivers have enabled them to raise well-nourished children in low-income communities.

**Objectives:** To examine the practices of caregivers regarding childcare and care giving behaviours with children aged 0-60 months in the study area.

**Study design:** An exploratory study conducted amongst 145 randomly selected caregivers of children aged 0-60 months, living in an informal settlement in the Vaal region was undertaken. Practices were determined by focus group discussions (FGD) and an observation checklist was used to determine the hygiene and feeding practices.

**Major findings and implications:** Poor health practices were apparent in the study sample. A number of inappropriate feeding practices were identified. This included that exclusive breastfeeding was rarely practiced, solids were introduced early, short period of breastfeeding and mixed feeding methods. According to FGD results the contributory factors were inaccessible primary health care, low household income and caregiver's work load. Hygiene practices were generally good. Poor care giving behaviours were also observed. A lack of childcare assistance and caregiver's work load were contributing to this poor behaviour.

**Conclusions:** An improvement in the practices of childcare and care giving is required. These results will be used to plan appropriate interventions for the children living in this informal settlement.

#### 4 Food consumption patterns in Lesotho: preliminary results

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**Background:** High stunting rates in Lesotho are linked to chronic food insecurity, coupled with insufficient knowledge on the association between diet, malnutrition and health as well as inadequate information for designing programmes and interventions.

**Objectives:** To assess food consumption patterns and determine nutrient intakes of mothers and children under the age of five.

**Design:** A cross-sectional study was undertaken.

**Methods:** 150 mother- child pairs with 40 repeats were randomly selected in the mountainous district of Thaba-Tseka. Dietary intake was assessed with interactive multiple pass 24- hour recall and a dietary diversity questionnaire. Nutrient levels were determined by use of the Lesotho Food Composition Tables. Other indicators included were anthropometry, food security, livelihoods, health and sanitation.

**Results:** Households consumed maize, vegetables, oil/fats and sugar 6 -7 days a week, whilst they consumed food of animal origin occasionally. The stunting rate was 48.4%. BMI ranges of caregivers (women 15-49 years of age) revealed that 48% had normal BMI, 28% were overweight, 18% obese and 5% underweight. 36% of households had safe sanitation. For the majority of households income was assessed through casual labour, brewing and own food production.

**Conclusion:** Dietary patterns were mostly monotonous and lacked diversity. The study revealed the need to update and revise the Lesotho Food Composition Tables (missing nutrient values and gaps on standard recipes). Furthermore, there is need for a nationally representative study which will allow the development of food fortification guidelines.

#### 5 Dietary diversity and adequacy of female caregivers in a peri-urban informal settlement in South Africa

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**Objectives:** The aim of this study was to assess the food security of black women in an informal settlement by exploring their food access capabilities through dietary diversity measures and the coping strategies they employ to cope with poverty and hunger.

**Research methods and procedures:** A randomly selected sample of black women living in an informal settlement completed a pre-tested socio-demographic questionnaire (socio-economic circumstances) and validated questionnaires (one-week quantified food frequency questionnaire; diversity measures; 24-hour recall: nutrient intake measure; Cornell Hunger Scale: coping strategy measure). Food variety scores (FVS) and food group diversity scores (FGDS) were calculated from frequency analyses for all foods and food groups. Nutrient adequacy ratios for various nutrients and the mean adequacy ratio for the diet were calculated. Relationships between dietary diversity and nutritional adequacy were investigated with Pearson correlations. Food variety score cut points were tested for sensitivity and specificity against nutritional adequacy.

**Results:** Intakes were deficient for all nutrients except carbohydrates. Individual mean±SD NARs ranging between 0.15±0.18 and 0.95±0.19 confirmed the poor dietary quality. Zero to 40 individual foods were consumed, but the mean±SD food variety score was only 3.17±1.21, indicating low food diversity, as did the low dietary diversity score (2.82±0.99) using zero to six food groups.

**Conclusions:** Limited food access and food variety in poor households resulted in inadequate nutrient intakes (low NAR), confirmed by poor dietary diversity (FVS and FGDS). Dietary diversity assessment can successfully replace traditional dietary assessment tools in poverty-stricken or low income communities where quick assessments are often required to assess the greatest need.

#### 6 Perceived hunger, food variety and dietary diversity among lactating women (0-6 months postpartum) in Nairobi

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Food variety and dietary diversity scores are measures of food consumption that reflect access to a variety of foods in the diet and are a proxy of the nutritional adequacy of the diet of individuals.

**Aim:** To assess domestic hunger, food variety (FV) and dietary diversity (DD) in the diets of lactating women.

**Design:** A descriptive cross - sectional survey was undertaken.

**Setting:** Mbagathi District Hospital, located at the edge of Kibera slum area (Nairobi).

Population and sample: Convenience sampling was used, selecting 120 women who volunteered and consented.

**Methodology:** The hunger scale (Radimer et al, 1990) was used for assessing domestic hunger and a 24 – hr recall (NFCS, 2005) were analysed for FV and DD.

**Findings:** The women had a mean FV of 6.6 (2.0) and DD of 4.3 (1.0). The mean adequacy ratio (excluding niacin) was 0.74. The lowest median nutrient adequacy ratio (NAR) was for calcium (0.41) and folic acid (0.59). The NAR for energy was 0.62. The highest frequency of consumption (100%) was from cereals, tubers/roots, other vegetables and oils/fats. Vitamin-A rich vegetables/fruits (6.6%) and dairy products (1.7%) had the lowest frequency of consumption. Overall, 35.8% of households were food secure while 64.2% were either hungry (5 or more positive responses) or at risk of hunger (1-4 positive responses) (36.7% and 27.5% respectively).

**Conclusion:** Perceived hunger corresponded with narrow food variety and dietary diversity. Nutrition interventions in low socio-economic areas should focus on measures for dietary adequacy among lactating women since optimal nutrition supports breastfeeding.

## 7 Food security dilemmas and challenges in South Africa

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The South African constitution enshrines food security as a human right. The Integrated Food Security Strategy (IFSS) provides a robust framework for action. Both government and private sector stakeholders have indicated readiness to participate in initiatives to find solutions. This paper reports on a research initiative of the Development Bank of Southern Africa which found that action for food security remains difficult, due to the multidimensional nature of the problem, the changing context, and institutional dilemmas.

Food insecurity and malnutrition remain widespread in both rural and urban communities. Urban food security is a growing political issue, with recent studies confirming widespread hunger in low-income areas in South African cities. The food security challenge is rooted in the structure of South African agriculture and exacerbated by challenges in the value chain linking the production, manufacturing, and retail of food. Players throughout the value chain recognize that better coordination and collaboration is necessary to shift the food supply system towards providing for long-term, environmentally sustainable food security in the country.

In the public sector, the IFSS provides a broad framework to facilitate coordination and collaboration and guide action. However, implementation of the strategy has been hampered by weak institutional arrangements, a lack of funds for multidisciplinary programmes and insufficient dialogue with civil society. Improving communication and collaboration for enhanced food security in South Africa requires personal and collective leadership at many levels. The paper introduces one response to this challenge, namely the Southern African Food Security Change Lab.

## 8 Factors that influenced mothers/caregivers to purchase specific brands of infant formulae in the Tshwane Metropole

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**Rationale:** Human breastmilk is regarded to be nutritionally and immunologically superior and a complete food that has adequate amounts and combinations of nutrients for the infant's optimal growth and development. However, the prevalence of the use of breastmilk substitutes such as infant formula is on the increase worldwide.

**Objective:** To identify and categorize factors that influenced the choice of specific brands of infant formula, and the reasons for the consumer's choice.

**Materials and methods:** A cross-sectional point-of-purchase survey was conducted on 200 mothers/caregivers at a pharmacy, and large retail stores at shopping malls of Centurion, Pretoria West, and Atteridgeville areas (Tshwane Metropolitan Area). Participants were purposively selected at these points after an infant formula was picked from the shelf with the intention of purchasing. Informed consent was obtained.

**Results:** Influencing factors were: advice from others (76.5% of which 32% was advice from paediatricians), a perceived claim for an infant formula to provide a specific health benefit (49.5%), brand loyalty (13.5%), an infant formula was seen used in hospital (10.5%), and infant's preference (9%). Nestlé infant formulas were purchased by half of the interviewed participants (51%) while Aspen infant formulas were purchased by 22% of participants.

**Conclusion:** The paediatricians' recommendation was considered a primary influencing factor among mothers/caregivers, as well as perceived health claims. Appropriate training should target paediatricians and other healthcare professionals to ensure that they become uncompromised advocates of breastfeeding, and that they advise mothers/caregivers on appropriate indications for an infant formula.

## 9 Sensory acceptability of alternative protein dishes for the aged in Sharpeville

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**Introduction:** Appetising meals that are easy to prepare and provide balanced nutrition are vital for the health and well-being of elderly people. A study in Sharpeville indicated that the socio-economic status of the elderly people were poor.

**Objectives:** The purpose of this study was to develop, implement and evaluate a new menu that would be cost effective, nutritionally adequate and acceptable to the elderly people. This paper focuses on the sensory acceptability of different recipes incorporating, soy, dried beans, legumes and fish.

**Methodology:** All the elderly (n=450) attending an elderly care centre in Sharpeville and the volunteer food service workers formed part of this study. Twelve affordable recipes were selected and prepared. A randomly selected sample of elderly people (n=200) rated the dishes in terms of taste, smell, color, texture, portion size and overall acceptability. Data was analysed on SPSS, version 17.0 for descriptive statistics.

**Results:** All the dishes rated very high in terms of taste (98%), smell (98.4%), color (98.2%), texture (97.22%), portion size (78 %) and receiving dish as part of menu (98%). The most popular dish was a fish dish (98%) and the least was a soy dish (96.1%).

**Conclusion and recommendations:** Although the centre management was of the opinion that only meat and chicken were acceptable protein sources, results indicated that alternative protein sources were highly acceptable to the elderly. These results will be used to develop and implement a cost effective nutritious balanced menu for the elderly.

## 10 Food insecure and HIV affected Indian families: a double burden for the HIV infected child

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**Introduction:** Growth failure is a common feature of children infected with human immunodeficiency virus (HIV). Food security plays a crucial role in maintaining quality of life and improving survival through nutrition for children infected with HIV.

**Aim:** This study explored associations between child nutritional status and household food security in HIV affected families living in Aurangabad, Maharashtra.

**Methods:** Households with children belonging to a network of people living with HIV/AIDS were confidentially invited by the network to participate. Anthropometric measurements were used to collect data on 55 HIV-infected and 80 non-infected children. A total of 135 households (85.6%) participated in this study. Caretakers consenting to participation were interviewed to assess household food security. Logistic analysis was used to test associations, controlling for socio-economic confounders.

**Results:** HIV-infected children had, compared to non-infected children, a significantly higher prevalence of stunting (respectively 64.2% and 36.7%.  $p=0.002$ ) and significantly higher prevalence of underweight (respectively 67.9% and 41.8%  $p=0.003$ ). The child's HIV-status was associated with stunting (OR=0.29; CI:0.13-0.65) and with household food insecurity (OR=3.96; CI:1.76-8.89).

**Conclusions:** Further research is needed to investigate causal relationships. These findings show a high level of food insecurity in HIV/AIDS affected households with children. The association between household level determinants, such as food insecurity, and child nutrition indicate the need for intervention at the household level to improve food security and thereby diminish the risk of undernutrition among children.

## 11 The lack of food intake data and the consequences thereof

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South African researchers working in the fields of nutrition and dietetics generally collect food intake data as a first step towards determining the nutritional status of various populations. However, on publication, the majority of the results obtained from these studies are expressed in terms of nutrient intake, whereas food intake data is either not included or presented in non-uniform formats. Other researchers who wish to determine what foods South Africans are eating, are not able to access food intake data from existing studies. For example, if the Food-Based Dietary Guidelines (FBDG), which are expressly based on food and not nutrient intakes, are to be revised regularly as stipulated by the WHO, very little additional food intake data from the decade following publication of the first FBDG in 2001 would be available for adult South Africans. It is probable that the consumption of certain foods may have increased due to urbanisation and westernisation of large sectors of the population. Conversely, economic factors, including the present recession, household food insecurity, and poor food choices will have reduced the intake of nutrient-dense foods in the past decade. The present paper describes the disparity in reporting food intake data, and deficiencies in making data that is available in electronic storage systems accessible to researchers working in the fields of food production and utilisation, community nutrition and education. The creation of a Working Committee to make food intake data more accessible is suggested.

## 12 Household food security in rural and urban communities in the Free State

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**Introduction and aim:** The Assuring Health for All in the Free State study was undertaken in rural (2007) and urban areas (2009) with the main objective of determining burden of disease and reasons therefore. This sub-study investigated household food security and prevalence of hunger.

**Methods:** Household food security was determined by Dietetics students during interviews with adults (25-64 years) in rural Trompsburg, Philippolis, and Springfontein and urban Mangaung, using a questionnaire adapted from the one developed for the PURE study.

**Results:** In both rural (n=493) and urban (n=379) households, pensions/grants were the main source of income (66.7% and 50.3% respectively). Significantly more rural households produced crops (rural=23.1%; urban=9.0%) [9.4%;18.8%], had fruit trees (rural=68.6%; urban=41.1%) [20.9%;33.7%] and owned livestock (rural=23.0%; urban=6.8%) [10.8%;19.7%]. More rural households that produced food preserved food (73.9%), mostly through sun drying. Most participants walked to buy food (rural=83.0%; urban=54.0%), but in urban areas 45.8% used public transport. Significantly more urban households reported running out of money to buy food (87.9%), relying on a limited number of foods to feed their children (66.8%), eating less due to a shortage of money for food (77.1%) and giving

children less food (62.1%). Of the households that reported food shortage (rural=46.5%; urban=80.8%), most relied on assistance from family and neighbours for food.

**Conclusion:** Food insecurity is common in both rural and urban communities, but the problem is worse in urban areas. Communities should be empowered to become involved in food production and income generating projects to improve household food security.

## Food-Based Strategies for Optimal Nutrition

### 1 $\beta$ -Carotene content and consumer acceptability for twelve different sweet potato varieties

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There is a global interest in the potential of orange-fleshed sweet potato as source of vitamin A, particularly for developing countries. A number of promising sweet potato varieties with varying flesh colour and taste are available for possible use in South Africa in crop-based programmes.  $\beta$ -Carotene and moisture content were determined for raw and boiled sweet potato of 12 varieties with distinct colour that were cultivated under controlled conditions and harvested five months after planting.

Beauregard, Khano, Resisto, W-119 and 2001-5-2 exceeded 7500  $\mu$ g  $\beta$ -carotene per 100g raw (upper target breeding level); Excel, Serolane, Impilo and 1999-1-7 exceeded 3700  $\mu$ g  $\beta$ -carotene per 100g raw (medium target breeding level); Blesbok, Monate and Ndou had extremely low  $\beta$ -carotene content.  $\beta$ -Carotene retention after cooking varied from 78 to 94%. For 100 g boiled sweet potato, six varieties provide at least 75% of the Recommended Dietary Allowance (RDA) for vitamin A of 19-30-year old women (700  $\mu$ g Retinol Activity Equivalents). Dry matter content of boiled sweet potato varied from 15.9% (Blesbok) to 24.6% (Ndou). Colour and taste acceptability of boiled sweet potato was evaluated by grade 1 – 7 learners (n=168) and adults (n=48) using a 5-point hedonic scale. Mean consumer acceptability scores differed significantly for taste, but not colour.

Khano, Beauregard and 1999-1-7 varieties provide significant amounts of vitamin A but their taste acceptability is low, probably because of low dry matter content. Resisto, 2001-5-2 and W-119 with acceptable taste have the biggest nutritional potential providing significant amounts of vitamin A.

### 2 Contribution of low-value fish products to nutrition security among low-income populations in Lake Victoria Region

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The dwindling of fish stocks in Lake Victoria coupled with increased demand of fish in the region and at international markets has created increased demand for low-value fish products (also called trash

fish) among riparian populations. By-products of Nile perch filleting operations (i.e. skeletons, skins, and roe) and less-desirable species such as *Rastreneobola Argentea* are increasingly being sought for direct human consumption; however, the poor handling and processing of these products often results in high nutrient losses. This study sought to investigate common methods used to process low-value fish products and to determine nutrient losses in products processed using different artisanal methods. Emphasis was placed on changes in content of iron, zinc, calcium, crude protein, total fat, and changes in the lipid profile.

Results indicate that despite the high nutrient losses, low-value fish products have potential to improve dietary intake of calcium, iron, total fat, and essential fatty acids among low-income populations that have limited access to other animal source foods. Prices of most products were very low when compared to other animal source foods. The nutritive value of low-value fish products can be improved by reducing exposure of these products to air to minimize oxidative processes, modifying preparation processes such as drip drying to reduce leaching of nutrients, and optimizing dehydration processes to reduce proteolysis. There is also a need to influence policy to improve the quality and increase access of these products to populations at high risk for malnutrition.

### 3 Knowledge and attitude of women in Ibadan, Nigeria towards adequate diets and its intake

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Many families in Nigeria are finding it difficult to provide an adequate quantity and quality of food with vital nutrients for themselves. One of the major reasons usually attributed to this is poverty. Little is being reported on the knowledge and attitude of women who are the household food planners towards intake of adequate diet. This paper reports the findings of an assessment of the knowledge and attitude of households in Ibadan, southwestern region of Nigeria on adequate diet and its intake. Focus group discussions, (FGD) were done in three locations; Foko, Mokola and Bodija, targeting women in the households. From the discussions, about 80% of the participants at Foko and Mokola believed that an adequate meal is a meal that has different types of foods eaten together, expensive, luxurious, taken three or four times weekly. All the women agreed that people did not eat adequate meals for personal, cultural, economic reasons and misplaced priority. Bodija women affirmatively said that eating adequate meals does not have to do with money but with time and knowledge of foods. In all the locations, the women agreed that in household food insufficiency, the women are the mostly deprived; irrespective of their reproductive state and that their husband's influence on household food choices. Women in Ibadan seem to have poor knowledge and very poor attitude towards adequate diet. Women need to be empowered to overcome sentiment in intra-household food choices/distribution. There is also the need to advocate for kitchen-friendly programs.



#### 4 The impact of home gardens on access to food and dietary diversity, nutrient intake and nutritional status of pre-school children in Eatonside, Vaal Triangle, South Africa

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**Introduction:** This study set out to determine the impact of home gardens on access to food, dietary diversity, nutrient intake and nutritional status of pre-school children in an informal settlement.

**Methods:** Children aged two to five years (n=40), 22 boys and 18 girls, were selected to participate in the study. The individual dietary diversity questionnaire was used to determine dietary diversity. Caregivers completed quantitative food frequency questionnaires on the children's food intakes. Anthropometric measurements were taken and recorded.

**Results:** At the start of the study, low consumption rates were observed for most food groups. At the end of the study, the number of children consuming vegetables increased. Intakes of all nutrients improved except for energy and calcium, which dropped marginally, but both remained at around 50% below requirements. Twenty-five percent of boys were underweight at the pre- and post-project stages. Twenty-five percent of girls were underweight.

**Conclusions:** The increase in dietary diversity was statistically significant. No significant changes in the consumption of macronutrients. Home gardens had no statistically significant impact on anthropometric measurements.

#### 5 Strategies to improve the application of a vitamin A food-based dietary guideline for use by crèche caregivers in Limpopo, South Africa: a case study

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**Aim:** To develop and implement nutrition strategies to improve the application of a food-based dietary guideline (FBDG) for use by crèche caregivers to enhance the consumption of vitamin A- rich fruits and vegetables by preschool children in the Thulamela municipality area in the Limpopo Province, South Africa.

**Methodology:** The study was based on the triple A cycle. A cross-sectional survey of 100 caregivers from 20 crèches was conducted to obtain baseline and follow-up data. The study was done in 3 phases. During the first phase (assessment and analyses part) baseline information on demographics, nutrition information, availability of and access to vitamin A- rich food, menu planning, food preparation, and storage and preservation techniques were collected and analysed. The second phase (the action part) focused on the development and implementation of nutrition strategies. Crèche caregivers were trained by means of lectures, discussions, demonstrations and a game to improve their knowledge on vitamin A. This included training on

how to start a vegetable garden to supply vitamin A-rich vegetables to crèches. In the third phase (re-assessment part) caregivers were assessed on how the strategies were implemented.

**Results:** The situation analysis revealed that these children had a low intake of fruit and vegetables rich in vitamin A. The caregivers had a poor knowledge on the sources, functions and role of vitamin A in the diets of children. Training resulted in improved knowledge and implementation of the FBDG, menu planning, the cultivation of vegetables, dietary diversification, preparation and preservation of fruit and vegetables to enhance dietary diversification as well as vitamin A consumption on a daily base.

**Conclusion:** Nutrition education on the FBDG improved the caregivers' nutritional knowledge on vitamin A and provided direct access to vitamin A rich foods from cultivated vegetables, traditional vegetables and locally available fruits to preschool children. Due to serious micronutrient deficiencies under preschool children in rural areas in South Africa these strategies should be implemented in all crèches.

## HIV, TB & Nutrition

### 1 Nutrition knowledge of child care workers of immune compromised children in children homes in Durban

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**Objective:** To determine the nutrition knowledge of child care workers of immune compromised children in children homes in order to develop reliable and valid nutrition education material.

**Materials and Method:** Child care workers (CCWs) who participated on a voluntary basis (n = 40) completed a self-administered nutrition knowledge questionnaire. The CCWs were directly involved in the care of children in children homes. The questionnaire was divided into two sections. Section A included awareness of Food Based Dietary Guidelines (FBDG) and HIV/Aids dietary guidelines, knowledge of food sources relating to these guidelines and food safety and hygiene practices. Section B included personal data. Data were captured and analysed for descriptive statistics on SPSS, version 15.0.

**Results and findings:** The majority of the respondents (72.5%) indicated that starches should form the basis of each meal and 97.5% were aware of "starchy" foods. However, 40% indicated that meals should consist mostly of vegetables and smaller amounts of meat for a healthy immune system. Sixty three percent of the respondents selected fruit and vegetables to be eaten most of every day, but only 17.5% were aware of the recommended number of portions. Eighty two percent considered fruit a good source of protein. The combined results of eight questions indicated that the majority of the respondents did not know the different food sources relating to the FBDG and HIV/Aids dietary guidelines.

**Conclusion and recommendations:** The results indicated a need exists for nutrition education. It should focus on dietary guidelines, immune building nutrition and reinforcing food safety and hygiene practices.

## 2 Dietary iron intake is significantly associated with haemoglobin concentration in HIV infected children

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A common complication of paediatric HIV infection is anaemia, which may affect cognitive performance, physical growth, resistance to infections and quality of life. Iron supplementation is not recommended in HIV infected patients. The aim of this study was to assess the longitudinal association between dietary iron intake and haemoglobin concentration. Dietary intakes were measured by repeated 24-hour recall, with a dietician interviewing the primary caregiver of each child. Food photo books were used to estimate portion sizes and nutrient intakes were calculated using Foodfinder® software. Anthropometric measurements were done and demographic information was collected using a structured questionnaire. Haemoglobin concentration, CD4 and viral load were measured using standard methods. Longitudinal data (baseline, 6, 12 and 18 months) of 60 HIV-infected children, 3-14 years old at baseline, were used to examine the association by generalized estimation equations, with adjustments for demographic information, socioeconomic status, dietary intakes, growth parameters, CD4% and mid upper-arm circumference. The results showed that dietary iron intake was strongly associated with haemoglobin concentration. After adjustments for various covariates, the effect remained highly significant (regression coefficient=0.15,  $p=0.01$ ). Additional analyses showed that particularly children with an iron intake above 7.5 mg/day, showed higher haemoglobin concentrations. Dietary iron intake is strongly associated with haemoglobin concentrations in HIV infected children. Blanket iron supplementation is contra indicated in HIV infected children, but more attention should be given to nutrition education to improve iron intake and bioavailability.

The study was funded by the National Research Foundation of SA and the North-West University (Potchefstroom)

## 3 Probiotics, lactobacilli and HIV

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Probiotic food provides a potentially important adjunct to the care of people with HIV. In a series of studies, we have shown that probiotic lactobacilli administered in capsule form and in yogurt can potentially reduce fatigue and diarrhea, and increase the CD4 count of HIV subjects in a poor community in Mwanza, Tanzania. In women in the developed world, orally administered probiotics can improve vaginal health. This is important as bacterial vaginosis (BV) is extremely prevalent and increases the risk of acquiring sexually transmitted infections. The rate of BV is even higher in some developing world countries like Tanzania, and in HIV subjects it is recalcitrant to antibiotic treatment. In order to better understand this problem, we developed a bar-coded Illumina pyrosequencing technique and analysed the vaginal microbiota of 40 subjects with BV who were treated with metronidazole and probiotics, and the microbiota of 20 controls. The findings were intriguing, with

relatively few species present, clusters of bacterial species correlating with health versus BV, and *Lactobacillus iners* proportions increasing post therapy. A whole genomic sequence analysis of *L. iners* showed it to be the smallest *Lactobacillus* identified to date, and possessing adhesins, a cytotoxin and other factors which may allow it to survive and populate the vagina even in the presence of pathogens, raised pH and antimicrobials. In summary, further studies are warranted to identify the microbiome of HIV infected subjects, and to consider the use of specific probiotics that can improve quality of life.

## 4 Nutritional status of pulmonary tuberculosis patients in comparison with tuberculosis free contacts in Delft

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**Background:** Malnutrition is a risk factor for the development of pulmonary tuberculosis (TB) and may be responsible for the premature deaths of patients with active disease. An adequate nutritional status may therefore be protective in delaying the onset from latent infection to active disease. In South Africa, very little data is available on the nutritional status of adults who present with tuberculosis. This study therefore aims to compare the nutritional status of newly diagnosed pulmonary tuberculosis patients in comparison with TB-free controls.

**Study population and Design:** This is a community based case-control study. Forty-three newly diagnosed pulmonary tuberculosis patients were recruited as cases and matched according to age, gender and race to 43 TB-free close contacts.

**Methods:** Each participant completed a structured questionnaire to obtain demographic information. Weight was measured to the nearest 0.1kg and height to the nearest 1mm. A 24-hr dietary recall method was used to obtain dietary information.

**Results:** The mean Body Mass Index (BMI) was statistically significantly lower for cases ( $19.30\text{kg/m}^2 \pm 4.77$ ) than TB-free contacts ( $22.34\text{kg/m}^2 \pm 3.09$ )  $p=0.001$  whilst there was no significant difference in dietary intake of energy ( $p=0.695$ ), protein ( $p=0.804$ ), CHO ( $p=0.801$ ) and fat ( $p=0.796$ ) between the groups.

**Conclusion:** The significant difference in BMI is the result of the wasting effect of the infection, rather than differences in nutrient intake.

## 5 Assessment of HIV lipodystrophy syndrome (HIV LDS): diagnostic accuracy of common methods and of a new tool

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**Background and aim:** and Assessment of HIV LDS is not standardised in South Africa. This study aimed to determine in HIV+ females on Highly Active Antiretroviral Therapy in an urban Immunology Outpatient Clinic the agreement between five commonly used methods (National Cholesterol Education Program [NCEP] criteria, subjective

self-reporting, anthropometry [Kotler, routine, Dong&Hendriks]) with an objective case definition (reference standard), and to develop and cross-validate a new classification tool.

**Methods:** Purposeful sampling with a screening protocol divided the study population (N=1421) into a case and a control group. From these two groups a random sample of 79 cases and 73 controls was selected (age: 38±8y). Standard techniques were followed during data collection. Diagnostic testing, logistic regression, receiver operating characteristics (ROC) curves and cross-validation were employed to determine agreement, and to develop and validate a new classification tool.

**Results:** Occurrence figures for HIV LDS in this sample ranged from 11% (Dong&Hendriks-anthropometry) to 55% (Kotler-anthropometry) versus 28% for the reference standard. The diagnostic properties (sensitivity, specificity) of the index tests were: NCEP criteria: (45%, 83%); subjective self-reporting (74%, 59%); Kotler-anthropometry (71%, 52%); routine-anthropometry (62%, 54%); and Dong&Hendriks-anthropometry: (10%, 88%). The new classification tool had sensitivity 81%, specificity 79%, and area under ROC curve 0.88.

**Conclusion:** The five index tests give differing results. In a resource limited setting the NCEP criteria appear to be the "best" among the methods tested for identifying HIV LDS. The new tool showed substantially better diagnostic properties.

## Micronutrients

### 1 Effect of iodine treatment on lipids and insulin levels of iodine deficient children

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Chronic iodine deficiency in children typically increases their thyrotropin (TSH) concentrations. In adults, subclinical hypothyroidism (ScH), with increased TSH, may increase blood lipids and insulin levels. The aim of this study was to determine the effect of iodine treatment in iodine deficient children with elevated TSH on their thyroid related hormones, blood lipid and insulin concentrations. Pooled data of urinary iodine concentration, serum total thyroxine (TT4), TSH, C-reactive protein (CRP), insulin and blood lipids of 262 children, aged 5 to 14 years with elevated baseline TSH  $\geq$  2.5mU/L, who participated in three controlled intervention trials, were used in this study. During the 5 to 6 month intervention period of the three trials the treated children received either 400 mg iodized oil capsules or iodized salt containing 25 mg iodine/kg salt while the controls received placebos. At baseline the median urinary iodine concentration of the combined group was 46  $\mu$ g/L, indicating moderate iodine deficiency. Compared to the control group, iodine treatment significantly increased urinary iodine and TT4 and decreased TSH, insulin, and total and LDL cholesterol; mean LDL/HDL cholesterol ratio fell from 3.4 to 2.6, and the treatment had no effect on CRP concentration. This data suggest that correction of iodine deficiency by iodized oil or iodized salt reduces ScH in iodine deficient children, improves their lipid and insulin profile, and thus may reduce the risk for cardiovascular disease.

### 2 Bone health of black South African women in transition

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Globally, and especially in developing countries, populations are migrating from rural to urban areas due to availability of work and better opportunities. The accompanying changes in dietary patterns and lifestyle in populations have major health consequences. These demographic and lifestyle changes may also affect bone health outcomes. As part of the PURE-SA study, we aimed to assess the risk for osteoporosis in a group of 1264 black women from rural and urban areas in the North West Province of South Africa. The participants were interviewed to complete several questionnaires on socioeconomic status, self-reported diseases and bone fractures, dietary intakes, and were blood sampled. Serum 25(OH) Vit D levels were significantly higher in the rural women (35-49.99 years=30.9 ng/mL; 50-64.99 years = 30.1ng/mL;  $\geq$ 65 years = 26 g/mL) than the urban women (35-49.99 years=31 ng/mL; 50-64.99 years = 26.5 ng/mL;  $\geq$ 65 years = 25.6 g/mL). However, bone resorption (serum CTX) was significantly higher in the rural women (35-49.99 years=0.5 ng/mL; 50-64.99 years = 0.59 ng/mL;  $\geq$ 65 years = 0.57 g/mL) than the urban women (35-49.99 years=0.38 ng/mL; 50-64.99 years = 0.42ng/mL;  $\geq$ 65 years = 0.46 g/mL). The specific lifestyle factors that were identified in this cross-sectional study comprised reduced physical activity, use of diuretics, smoking, a history of the use of depot medroxyprogesterone acetate, high alcohol consumption, and an increased state of inflammation. Dietary factors identified were very low calcium, vitamin C and D intakes (especially in the rural areas) and high animal protein, phosphorous and vitamin A intakes.

### 3 The relative validity of a short food frequency questionnaire for assessing dietary iron intake

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The valid measurement of habitual dietary intake of food in free-living individuals is one of the most challenging problems in nutritional epidemiology. The main aim of the study was to determine the relative validity of a short food frequency questionnaire (SFFQ) designed specifically to assess iron intake. This was a descriptive study done on a convenient sample of 140 pre-menopausal women, aged 18-45 years. To determine relative validity, total iron, haem iron and non-haem iron intake was assessed with the SFFQ and compared with results from three repeated 3-day estimated dietary records (DR). Mean and standard deviation (SD) dietary intake for total iron, haem iron and non-haem iron assessed with the DR was 10.5 (2.8) mg, 0.9 (0.3) mg and 9.6 (2.8) mg and with the SFFQ, 8.2 (2.6) mg, 1.0 (0.5) mg and 7.2 (2.5) mg, respectively. Results differed significantly between the two methods. Spearman correlation coefficients between the DR and SFFQ for all three iron intake variables were significant and varied between 0.23 and 0.29. The mean differences between the two methods for total iron, haem iron and non-haem iron were 2.3 (3.4) mg, -0.2 (0.5) mg and 2.5 (3.2) mg, respectively. The SFFQ classified 33% of the study sample into the same quartile for total iron, 29% for haem iron and 32% for non-haem iron. The SFFQ can be used to assess dietary iron intake in groups, but not in individuals. The assessment of dietary iron intake in individuals remains a challenge.

#### 4 The validity of a short food frequency questionnaire to assess dietary iron intake: a structural equation modelling approach

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When investigating diet-disease relationships in epidemiological studies, the challenge is to incorporate a valid assessment of dietary intake. Biomarkers which reflect the nutritional status of a nutrient in blood or urine can be considered as valid, independent markers of the dietary intake of the relevant nutrient. The aim of this study was to determine the validity of a short food frequency questionnaire (SFFQ) that was designed specifically to assess dietary iron intake. The SFFQ was compared with three repeated 3-day estimated dietary records (DR) and the biochemical markers of iron status i.e. haemoglobin (Hb), serum ferritin and serum transferrin receptors (TfR). Structural equation modelling (SEM) was used to model the validity of the SFFQ. The data was obtained from a convenient sample of 137 premenopausal women, aged 18-45 years. Dietary intake of total iron, haem iron and non-haem iron intake was estimated with the SFFQ and with the DR. Spearman correlation coefficients between the DR and SFFQ were significant and varied between 0.23 and 0.29. Serum ferritin and TfR showed respective significant correlations of 0.18 and -0.19 with haem iron as estimated with the DR. A validity coefficient (VC) of 0.52 was estimated for the SFFQ as measurement of dietary haem iron intake, using SEM. Menstruation patterns had a strong covariate effect on serum ferritin in the SEM. It is concluded that the SFFQ could be used to assess dietary haem iron intake. Serum ferritin shows potential as a biomarker for dietary haem iron intake in premenopausal women with normal menstruation patterns.

#### 5 Potential role of street foods as micronutrients source

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Although more than 40% of Nairobi's lower-income groups consume street foods, there is paucity of information available for urban policy makers and programmers on the potential contribution of street foods to micronutrient intake. A cross-sectional survey and a non-repetitive 24-hour dietary recall were employed to determine household intake of vitamin A, iron and zinc, and the proportion of the intakes from street foods in the selected Kangemi and Dandora estates in Nairobi, Kenya (low and middle-low income groups respectively). Results indicate that there was no significant statistical difference in the consumption pattern of street foods between the two sites. Absolute vitamin A, iron and zinc intake from street foods were comparatively lower among the low income groups as compared to middle-low income groups, these variations were not significant except for zinc. Street foods were less important vitamin A sources in Kangemi (4.4% of total intake and 2.64% of the RDA) than in Dandora (26% of total intake and 9.46% of the RDA). The proportion of those who obtained at least 50% of total vitamin A from street foods was also significantly higher in Dandora. Iron intake contributed by street foods significantly differed with Dandora being higher (30%) than Kangemi

(21%). Although not significantly different, those who obtained at least 50% iron from street foods was higher in Dandora than Kangemi. Iron intake from street foods in both sites (15mg/AE in Kangemi and 25mg/AE in Dandora) was sufficient to meet the RDA for iron for adults (5-28mg/AE). Zinc intake contributed by street foods was not significantly higher in Dandora (25.2%) than Kangemi (16.7%). The proportion of those who obtained at least 50% of their zinc intake from the street foods was also insignificantly higher in Dandora (12%) than Kangemi (7%). Overall, street foods are better contributors of iron (26% of total intake) and zinc (21%) than vitamin A (12%). Apparent factors that tend to potentially influence street foods' contribution to micronutrient nutrition are economic status, availability and proximity to street foods, consumption pattern and the type of street foods sold. Street food trade deserves recognition by urban policy makers in order to improve the opportunities of vendors to support their livelihood and to ensure the availability of affordable, safe and nutritious food for low income consumers.

#### 6 Magnesium status and bone quality in anaemic rats fed inulin-type fructans

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In a previous work we demonstrated that Fe deficiency decreases bone mass and strength in rats, and that effects are influenced by bone Mg levels. In this study, we reinforce these findings and showed that recovery from anaemia corrected some Mg parameters; these effects were affected by Fe source and inulin-type fructans (ITF), which improves Fe bioavailability. Weanling male Wistar rats (n = 55) were fed adequate or low (6 mg/kg) Fe diets for 15 days followed by two weeks of Fe repletion with diets providing 35 mg Fe/kg as ferrous sulfate (FS) or ferric pyrophosphate (FP) that was added with 7.5% ITF as yacon flour or Raftilose P95 (RAF), a purified source of ITF. Fe (blood Hb, HRE) and Mg (plasma, erythrocyte, 24h-urine, gastrocnemius muscle) status were evaluated at days 7 and 14 of the repletion period. Tibias were removed for mineral (AAS) and bone strength (3-point bending assay) analyses. Fe deficiency resulted in decreased Mg urinary excretion, tibia and muscle Mg and reduced bone strength parameters. At day 7 of the repletion period, HRE was higher in RAF comparatively to FP group. Tibia Mg was significantly decreased in FP rats whereas that ITF supplementation resulted in increased bone Mg retention. Furthermore, HRE was significant and positively related with tibia Mg levels ( $r = 0.60$ ;  $P < 0.01$ ). These results showed that Mg status is impaired by Fe deficiency and that food matrix (dietary Fe source, ITF) influences some Mg parameters in Fe deficiency recovery.

#### 7 Serum retinol in newborns and mothers in a Northern Cape area with a high liver consumption

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South Africa introduced a blanket vitamin A supplementation (VAS) programme as a strategy to control vitamin A deficiency (VAD). The target group for the VAS programme includes neonates and lactating

mothers and information on this group is therefore important. The aim of this study was to determine the vitamin A status of newborns and their mothers in an area with a high intake of liver and where previous studies showed a virtual absence of VAD among preschool children. For the study, 121 newborns and their mothers were recruited. Information included socio-demographic status, choices of infant feeding, pregnancy history, serum retinol (cord and mothers' blood), height and weight. The mothers' mean age was 24.4 years, < 80% completed matric and 49% was single. Ninety-eight percent mothers planned to breastfeed, of which 28% indicated 6-18 months and 72% indicated  $\geq 24$  months as the planned breastfeeding period. Ninety-five percent mothers consumed liver, organ meat or both, 85% consumed liver  $\geq 1$  per month, and 42% have consumed liver in the last two weeks prior to the survey. The mean serum retinol was  $29.7 \pm 12.1$  ug/dL for mothers and  $22.0 \pm 6.9$  ug/dL for infants and correlated significantly ( $r = 0.29$ ;  $p = 0.002$ ). However, when interpreting postpartum results the transient effect of haemodilution on serum retinol levels of mothers during pregnancy, as well as the tendency of vitamin A stores to be low at birth, which increase rapidly if breastfed by mothers with adequate vitamin A stores, need to be considered.

## 8 Selected nutrient content of six African leafy vegetables and its potential contribution to nutrient requirements

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**Introduction:** Under-exploited natural resources such as African leafy vegetables (ALVs) could potentially make an important contribution to combating micronutrient malnutrition as well as providing food security. This study determined the nutrient content of six ALV crops grown under adequate agricultural practices.

**Methodology:** Representative sample batches were harvested for six ALV crops, chinese cabbage, black nightshade, amaranth, jew's mallow, cowpeas and bitter watermelon. Nutrient analyses of the edible plant parts (mostly leaves) included proximate analysis, selected minerals and  $\beta$ -carotene (provitamin A).

**Results:** As compared to the Recommended Dietary Allowance (RDA) of 19-30-year-old women, 100 g raw ALVs (taking nutrient retention from raw to cook into account) provides the following nutrients: <5% of energy requirement; 10% or less for protein and zinc (except for black nightshade); 4 to 21% for phosphorous and copper; more than 10% for calcium and magnesium; at least 33% for iron (black nightshade and bitter watermelon); and 32 to 46% (chinese cabbage, jew's mallow, bitter watermelon) and more than 50% (black nightshade, amaranth, cowpea) of the RDA for vitamin A.

**Conclusions:** Regarding nutritional deficiencies in the South African population, the vitamin A, iron and zinc content are of specific interest. ALVs provide substantial amounts of vitamin A. With the exception of chinese cabbage and jew's mallow, all the ALVs provide  $\geq 25\%$  of the RDA for iron for 19-30-year-old females. ALVs are not a good source of zinc.

## 9 Serum retinol in preschool children from a low socioeconomic community with a high intake of preformed vitamin A

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Although high dose vitamin A supplementation (VAS) is known to reduce morbidity in young children, there are indications that VAS may actually increase morbidity in children that are not vitamin A deficient. The aim of this study was to determine the vitamin A status of children from a low socioeconomic Northern Cape community that has a high intake of liver. The study population comprised 314 children (12-75 months) attending the Calvinia clinic, who have not received VAS during the last 6 months, and their mothers. Measurements included serum retinol, CRP, height and weight. Information on liver intake, breastfeeding practices and socioeconomic indicators were obtained by questionnaire. Stunting, underweight and wasting was prevalent in 41%, 21.7% and 9.4% of the children. Only 5.8% had serum retinol concentrations  $< 20$   $\mu\text{g/dL}$ , which is in contrast to the national figure of 63.6%. None of the mothers were vitamin A deficient, and 92% of the children were being breastfed or had been breastfed in the past; breastfeeding was continued up to a median age of 18 months. Liver was eaten by 86.7% of children (at least once a month by 77.6%), and was introduced into their diets at the median age of 15 months. Fifty percent of mothers were single, and 38% were dependant on social grants or financial support from non-relatives. This study shows that the vitamin A status of a community can be adequate despite poor anthropometric and socioeconomic status, and suggests that a blanket approach in applying the national VAS programme may not be appropriate for all areas in the country.

## National Nutrition Programmes

### 1 Process for development of the Road-to-Health Booklet (RtHB)

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The Road-to-Health chart (RtHC) is a tool for recording growth monitoring, vitamin A supplementation and essential health services rendered to preschool children visiting health facilities. Before 1994, various versions of the RtHC were used. A national standardized RtHC was developed and has since has been revised several times to incorporate new information. It is currently in an A3 format and is printed on paper that is tear- and waterproof. The new World Health Organization (WHO) growth standards as well as changes in the immunization schedule necessitated revision of the current RtHC and provided the opportunity to add additional health information.

Consultation on the revision of the RtHC started at the end of 2007 and concluded at the end of 2009. During this time extensive input was received from national Maternal Child Health and Nutrition units at national and provincial level as well as academics. This resulted in the format of the RtHC being changed to that of a booklet to enable the detachment of pages on specific health information. This format was also pretested among caregivers and health workers in selected clinics in KwaZulu-Natal during September to October 2009.

The presentation will highlight the process that was followed to develop the RthB and will focus on the layout of the RthB, specifically the inclusion of the new WHO weight-for-age, length/height-for-age and weight-for-length/height growth charts. The development of an orientation and training package and rolling out of training in the 9 provinces during 2010 will also be discussed.

## 2 2009 National Child Health Week campaign: crossing the target

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**Introduction:** The National Child Health Week Campaign was conducted from 7th-20th September 2009 in 8 provinces. The coverage target for the campaign was set at 80% of the children aged 12-59 months. The 2008 Vitamin A supplementation campaign report recommended that training on data management should target programme managers, information officers and service providers.

**Methodology and Results:** General orientation, with emphasis on data management was conducted in participating provinces. Areas of low coverage were identified and visited during the intra-campaign evaluation. Districts were monitored daily on their progress in respect of coverage. Information Officers were encouraged to electronically capture the data into the District Health Information System, version 14. This enabled the National to immediately alert provinces to address areas that are not sufficiently covered. Data flow from facilities to sub-districts was closely monitored at national level. Through active participation of programme managers and information officers, national coverage increased from 78% to 81.2%. This coverage trend was also comparable to successes of other intervention strategies rendered. Deworming coverage was 83.7%. Fully immunized rate and measles second dose rate increased by 23% and 57% respectively when compared to the same period in 2008.

**Conclusion:** With still low routine coverage, campaigns remain the most viable option for reaching large targeted population. There is a need to determine the full cost of a campaign in South Africa. Close data monitoring and prompt feedback on progress is essential for the success of a National Child Health Campaign.

## 3 Landscape analysis of readiness to accelerate action to reduce maternal and child undernutrition in South Africa

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**Introduction:** The Landscape Analysis was developed as part of WHO-led inter-agency efforts in strengthening the contribution of nutrition to the achievement of the Millennium Development Goals after the launch of the Lancet series on maternal and child under nutrition, which identified a number of cost-effective nutrition interventions. The objective of this assessment was to identify the critical health system constraints and analyze the capacity gaps constraining the optimal scaling up of nutrition-related interventions.

**Methodology and Results:** The study was conducted in 239 facilities in RSA based on the WHO Landscape Analysis framework. The findings

indicate that there is willingness to scale up effective nutritional interventions to reduce maternal and child undernutrition. The strong political commitment to act is diluted by a poor perception of what nutrition problems are. Although policies and guidelines to address cost-effective nutrition interventions are available, implementation was inadequate, yet budgets allocated to nutrition have increased in real terms in the past five years. Barriers identified in scaling-up nutrition actions were shortage of human resources, lack of strategic guidance on prioritization and implementation of evidence-based nutritional interventions. Policies, guidelines, IEC materials, supplies and equipment were not available in all facilities. Knowledge of health workers on key child and maternal nutrition interventions was insufficient.

**Conclusion:** The findings provided National, provinces and districts with valuable opportunities to engage in rigorous discussions towards the reformulation of the national nutrition strategy and identification of priority activities. The findings will be used to advocate for more evidence-based nutrition actions throughout the country.

## Nutrigenetics and Nutrigenomics

### 1 Association of fibrinogen beta-gene polymorphisms with plasma fibrinogen levels in an African study

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Fibrinogen levels in Africans are commonly higher than in Caucasians. These increased fibrinogen levels might contribute to the increasing cardiovascular disease risk in South Africa as a result of urbanisation. We investigated the influence of genetic polymorphisms on plasma fibrinogen in a large prospective cohort study (PURE) in black Africans living in urban or rural areas in South Africa.

Cross-sectional data of 1915 participants were collected. Sequencing was performed of 2 kB of the promoter region of the  $\beta$ -fibrinogen gene for 28 randomly selected subjects. Based on this, haplotype-tagging SNPs were selected for determination in the total study population.

High plasma fibrinogen levels were observed (Mean  $\pm$ SD: 3.69  $\pm$ 1.82 g/L). In the sequenced sample 14 polymorphisms were detected of which 5 were not previously known. Four haplotype-tagging SNPs were determined in the overall study population. A significant difference in fibrinogen level was observed for the -854 G/A SNP with highest levels for the A/A genotype (geometric mean: 4.8 g/L versus 3.2 g/L for the G/G genotype), but the number of subjects with the A/A-genotype are too small (n=11) to explain the higher fibrinogen levels generally observed in the African population. No significant differences in fibrinogen levels were observed for the other three SNPs and no associations were observed between the haplotypes and fibrinogen levels.

Genetic variation in black Africans in the promoter region of the  $\beta$ -fibrinogen gene differs markedly from Caucasians. The difference in fibrinogen level that was observed for the -854 G/A SNP does however, not explain the high fibrinogen levels in this population.

## 2 The interaction between BMI, lifestyle factors and seven obesity related polymorphisms in Caucasian adults

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**Introduction:** The interactions between polymorphisms in several genes and lifestyle factors influence obesity development and management.

**Methods:** N=133 volunteers (BMI>27) participated in the study. SNPs investigated: FABP2 Ala54Thr, INSIG2 rs7566605, FTO rs1421085, FTO rs17817449, ADRB3 Trp64Arg, ADRB2 Arg16Gly, GNB3 C825T, PPAR $\gamma$ 2 Pro12Ala. Life-style assessments included diet, physical activity, general psychological health (GHQ), self-esteem, depression and eating behaviour (TFEQ). Statistical analysis involved t-tests, ANOVA and regression analysis.

**Results:** The mean BMI was 35.2kg/m<sup>2</sup>. Significant effects of genotype on interaction between BMI and lifestyle: Strong decreased BMI associated with increased leisure-time activity for GNB3 and INSIG2 wild-type genotypes. Strong decreased BMI associated with increased leisure-time and work activity for PPAR $\gamma$ 2 heterozygotes. Strong increased BMI associated with increased energy dense snack intake for GNB3 wild-type genotype and increased GHQ score for FTO rs1421085 wild-type genotype. Strong decreased BMI associated with increased self-regulation (TFEQ) for FTO rs1421085 wild-type genotype and increased flexible control (TFEQ) for ADRB2 wild-type genotype. Increase BMI associated with strong increased situational disinhibition (TFEQ) in mutant genotype of INSIG2.

**Conclusion:** It may be useful to screen select SNPs to personalize weight management guidelines. E.g. individuals with wild-type genotype of INSIG2, GNB3 or the Pro12Ala genotype of PPAR $\gamma$ 2 may benefit from increased physical activity. Subjects with wild-type genotype of GNB3 may benefit from increased physical activity and decreased intake of energy dense snacks; these strategies may not work in mutant allele carriers. Subjects with wild-type genotype of FTO rs1421085 may benefit from improved self-regulation of disinhibition and general psychological health.

## 3 Tumor necrosis factor- $\alpha$ Gene-308 G/A polymorphism modulates the relationship between dietary fat intake, serum lipids, and obesity risk in black South African women

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The prevalence of obesity and related disease risk is high in black South African (SA) women, possibly influenced by the dietary transition associated with urbanization. This study explored interactions between dietary fat intake and the tumor necrosis factor- $\alpha$ ; (TNFA) -308 G/A polymorphism on obesity, insulin resistance and serum lipid concentrations in urbanized black SA women. Normal-weight (105) and obese (118) women underwent measurements of body composition, fat distribution, fasting serum lipids, glucose and insulin

concentrations, and dietary intake. Participants were genotyped for the functional TNFA -308 G/A polymorphism. There were no significant differences in the genotype (P=0.345) or allele frequency (P=0.164) of the TNFA -308 G/A polymorphism between the weight groups. However, when dietary fat intake was 30% of total energy intake (%E), the odds of obesity in those with the TNFA GA+AA genotype was only 12% of those with GG, but increasing intake of dietary fat (%E) was associated with an increase in obesity risk in women with the TNFA GA+AA genotype compared to those with the GG genotype (P=0.036). Moreover, increasing intake of  $\alpha$ -linolenic acid (%E) and PUFA (%E) were associated with decreasing total cholesterol:HDL-cholesterol ratio (P=0.036) and increasing LDL cholesterol levels (P=0.026), respectively, but only in those with the TNFA -308 GA+AA genotype and not the GG genotype. The TNFA -308 G/A polymorphism modifies the relationship between dietary fat intake, obesity risk and serum lipid concentrations in black SA women.

## 4 What is the value of nutrigenetics testing in a South African context?

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The recent proliferation of DNA-based testing for the purpose of providing dietary guidance makes it timely to evaluate the scientific validity in offering these tests to an ethnically diverse population such as that of South Africa. Many of the tests make health related claims where dietary intervention is aimed at reducing susceptibility to medical conditions. The outcome is that some results may directly affect healthcare decision making and thus the clinical relevance and the predictive value of the tests need to be conveyed to the recipient. Through television, radio, magazines, newspapers and the internet, the public is exposed to nutrigenomics advertising that is compelling, but that often fails to present the essential facts for rational decision making. International concerns have led to genetic societies and healthcare organizations developing guidelines for molecular genetic testing in a healthcare scenario and for the marketing of direct to consumer genetic tests. The emphasis has been on the need for service providers to examine the scientific validity and clinical utility of their tests in their target populations. Some advocate the need for oversight, a regulatory framework and a means to ensure adherence to ethical principles. The evaluation of the scientific validity of nutrigenetic tests offered in South Africa provides a platform for further debate relating to the need for regulations or guidelines in the provision of DNA tests used for dietary intervention and the promise of improved health.

## 5 MTHFR C677T, age, gender and GGT are more important determinants of homocysteine concentrations than B vitamins

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**Background:** It is unknown whether the effect of alcohol consumption on total homocysteine (tHcy) concentrations is modulated by the methylenetetrahydrofolate reductase (MTHFR) C677T polymorphism.

**Objective:** The objective was to determine the interactions between alcohol consumption and the MTHFR 677 genotype on tHcy concentrations in a black South African population.

**Design:** This presentation outlines a cross-sectional epidemiological study of the baseline data of 1827 black individuals within the South African arm of the international Prospective Urban and Rural Epidemiology study.

**Results:** Subjects harbouring the 677 TT genotype had the highest mean tHcy concentration. Among subjects harbouring the 677 CC genotype, men had significantly ( $p = 0.04$ ) higher tHcy concentrations than women. Age and  $\gamma$ -glutamyl transferase (GGT) correlated best with tHcy concentrations ( $r = 0.26$  and  $r = 0.27$ ;  $p < 0.05$ ) while percentage carbohydrate deficient transferrin (%CDT) and the B vitamins only correlated weakly ( $r < 0.1$  for both;  $p < 0.05$ ). Age, GGT, gender, MTHFR and vitamin B<sub>6</sub> explained 16.8% of the variation in tHcy with the following  $\beta$ values 0.26, 0.23, 0.13, 0.10 and 0.09 ( $p < 0.01$ ). tHcy concentrations were positively associated with reported alcohol intake ( $p \leq 0.01$ ). There was no interaction between alcohol consumption and the MTHFR 677 CC or CT genotypes ( $p > 0.05$ ).

**Conclusions:** There is no significant interaction between alcohol intake and the MTHFR 677 CC or CT genotypes, however, MTHFR C677T genotype status, age, gender and GGT are more important determinants of tHcy concentration than Bvitamin intake in the black South African population investigated.

## 6 The effect of the 4G/5G polymorphism on PAI-1act in a black South African population

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Increased plasminogen activator inhibitor-1 (PAI-1) is considered to be a major risk factor for cardiovascular disease. PAI- levels in black Africans are, however, known to be lower than that of Caucasians. Plasma PAI-1 levels are regulated by various factors including genetic influences such as the 4G/5G polymorphism. Very little information is available regarding the 4G/5G polymorphism in black South Africans and if and how it is related to the lower PAI-1 levels observed.

PAI-1act was measured in 2000 black South Africans from the PURE study. Apparently healthy men and women were randomly selected from rural and urban areas in the North West Province. The 4G/5G polymorphism was determined by real-time PCR using allele specific primers and probes.

The allele frequencies were: 2.6%, 24.9% and 72.5% for the 4G homozygous, heterozygous and the 5G homozygous subjects, respectively. In Caucasians the distribution differs with the prevalence of the 4G/5G as the highest, the 4G/4G intermediate and the 5G/5G the lowest. The median PAI-1act for the total population was 4.26U/ml (1.27-7.91U/ml). The median PAI-1act for the different genotypes was: 6.39U/ml (1.04-7.64U/ml), 4.54U/ml (1.72-8.77U/ml) and 3.97U/ml (2.96-9.70U/ml) for the 4G homozygous, heterozygous and the 5G homozygous subjects, respectively.

The results indicate that the 4G/5G polymorphism has an influence on the PAI-1act. The 5G/5G polymorphism associated with low PAI-act has a prevalence of 72.5% in the studied population. The prevalence of this polymorphism is much higher than in Caucasians and this might explain why PAI-1 levels are lower in the black South African population.

## Nutrition Programming and Maternal & Child Health

### 1 The microbiological safety of powdered infant formulae prepared at public hospitals in South Africa

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This study evaluated the efficacy of preparation controls implemented in kitchens or other preparation areas related to reconstituted infant formula, at eighteen public hospitals in South Africa, with respect to *Enterobacter* (En.) *sakazakii* and other potential pathogens, including *E. coli*, *Salmonella*, *Bacillus* (B.) *cereus*, *Staphylococcus* (S.) *aureus*, *Klebsiella* and other potential opportunistic pathogens, such as *Pseudomonas* (P.) *aeruginosa*. Plate counts and pathogen incidence were determined using standard plating techniques. The premises where formula was prepared, the storage area of formula, personal hygiene of health care staff preparing formula and food hygiene practices were evaluated. In addition, vitamin content of 10 commercially available infant formulae prepared using water at either 40 or 70°C was evaluated using standard methods. Few samples of powdered infant formula from sealed tins tested positive for potential pathogens, while the majority of samples which tested positive occurred only after preparation, implicating inadequate hygiene in feed preparation. Pathogens detected included *B. cereus*, *S. aureus*, *Klebsiella*, other nosocomial Gram-negative pathogens, such as *Acinetobacter* (A.) *baumannii* and *P. aeruginosa*, and *En. sakazakii* on one occasion. *Salmonella* was absent from all samples. Addition of water to feed at a higher temperature, drying hands using paper towel after washing, preparation of feed and immediate use as needed within the wards, wearing face masks during preparation procedures and prompt disposal of left-over feeds, together with a general enhancement in hygiene practices, were all found to be important environmental parameters influencing the microbiological safety of reconstituted infant feeds in South African hospitals.

### 2 Perceptual obstacles to optimal infant and young children feeding during childhood diarrhoea

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**Introduction:** Beliefs and cultural practices influence people's health-seeking behavior. The study attempted to examine the impact of perception of caregivers on nutrition and feeding patterns during diarrhoeal episodes in young (under 3 year) children.

**Methodology:** Data were collected through focus group discussions and in-depth interviews of family caregivers and health professionals. Information was obtained from 104 caregivers (all female and mostly mothers of patients) and seven health professionals. The research took place at the ICDDR, B hospital, Dhaka, Bangladesh.

**Results:** It was found that patients were deprived of breast milk primarily because of disease-induced anorexia and reluctance of mothers to feed a fidgeting child and to a lesser extent, from the misconception that 'milk aggravates diarrhoea'. Caregivers had



adequate knowledge on basic nutrition. Yet, cultural practices and deep-rooted beliefs such as reliance on expensive foods (infant formula, meat, fish etc) and 'supernatural spirits' were strong in many caregivers. Mother and child were sometimes forced by their relatives to avoid certain 'forbidden' foods, pushing them to semi-starvation. Generally fish and other high-protein foods for the mother and milk and all complimentary foods for the child were considered to aggravate diarrhoea. Moreover, caregivers had mixed and confused idea about the ideal composition and importance of diet. However, some caregivers could overcome prejudices through hospital counseling.

**Conclusion:** Feeding practices do not necessarily conform to knowledge due to deep-rooted beliefs and cultural practices. Appropriate counseling would help improve caregivers' knowledge, attitude and practice.

### 3 Potential of nutrition education to improve growth among young children in rural settings

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Uganda is one of the Sub-Saharan African countries that has staggering levels of childhood undernutrition, indicated by the high prevalence of stunting among young children. Various interventions are being implemented to ensure adequate caloric and micronutrient intake but most programs have limited reach. In most cases, rural populations that are not in emergency situations are often excluded. This study was a controlled longitudinal study conducted to assess the effectiveness of nutrition education on improving growth patterns of young children (6-48 months) in a rural setting. Caregivers in the intervention group attended a 9-session nutrition education program that lasted 5 weeks and their children were measured each month for a period of one year to assess changes in growth patterns. A control group of caregivers concurrently participated in sewing classes and their children's growth was also monitored. At one year from baseline, children in the intervention group had significant changes in weight-for-age when compared to the controls (Mean:  $0.61 \pm 0.15$  versus  $-0.99 \pm 0.16$ ,  $p = 0.038$ ). Changes in height-for-age, weight-for-height, and MUAC-for-age showed positive trends for children in the intervention group but not statistically different from the controls. Changes in weight-for-height were statistically significant across age groups ( $p = 0.018$ ) and negatively related to caregivers age ( $p = 0.048$ ). This study indicates that nutrition education of caregivers has the potential to improve nutritional status and child growth; however, children's nutritional status could have been compromised by infections.

### 4 Predictors of stunting in Malawian preschool children: evidence from the 1996-2005 MICAH programme

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**Objective:** To determine predictors of linear growth retardation (stunting) among children under the age of 5 years from communities that participated in a 1996-2005 integrated community-based micronutrient and health (MICAH) programme in Malawi.

**Design:** Three prospective cross-sectional surveys (baseline [1996] and programme evaluation [2000 and 2004]) were conducted, and data for children from randomly-selected households that responded to a household questionnaire were used.

**Results:** At baseline, the probability of being stunted decreased with increasing household socio-economic status (odds ratio [OR] = 0.86, 95% confidence interval [CI] = 0.81-0.95,  $p=0.001$ ), an effect which was observed to the end of the programme in MICAH (OR=0.91, CI=0.88-0.95,  $p<0.001$ ) and Comparison areas (OR=0.90, CI=0.85-0.94,  $p<0.001$ ). In 1996, children who were exclusively breastfed for 6 months were less likely to be stunted (OR=0.46, CI=0.23-0.90,  $p=0.02$ ). Those aged  $\geq 24$  months were less likely to be stunted in 1996 (OR=0.57, CI=0.38-0.85,  $p=0.006$ ) and in 2004 in MICAH (OR=0.67, CI=0.55-0.81,  $p<0.001$ ) and Comparison areas (OR=0.63, CI=0.49-0.82,  $p=0.001$ ). In Comparison areas, children from households that had access to protected water sources were marginally less likely to be stunted in 2000 (OR=0.79, CI=0.61-1.01,  $p=0.06$ ). Raising livestock was also protective of stunting, but only among children from Comparison areas in 2004 (OR=0.74, CI=0.55-0.99,  $p=0.04$ ). Overall, improving the socio-economic status of rural residents, improving access to protected water, promoting exclusive breastfeeding for 6 months, and promoting the raising of livestock should be incorporated in public health nutrition programmes to reduce the high prevalence of stunting in Malawi.

**Conclusion:** Improving the social and economic status of rural people, improving access to protected water, promoting EBF for 6 months, and promoting the raising of livestock should be incorporated into public health nutrition programmes to reduce stunting among preschoolers.

### 5 Infant feeding messages in South African magazines

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**Background:** The print media is a strong influencer of infant feeding attitudes and decisions. They are often a trusted source of information, and can promote behaviours with their content and images. The extent to which breastfeeding is supported by the print media in South Africa is unknown.

**Objectives:** The objective of the study was to conduct a cross-sectional descriptive survey of infant feeding messages that were published in pregnancy and infant care magazines, readily available in mainstream retail outlets, Durban, in the February/March editions published from 2006 until 2009.

**Methods:** Content analysis of the sampled magazines was conducted with a standardised coding grid in order to manually record the category of infant feeding message published, the frequency with which these categories received coverage, as well as the section in the magazine where it was published.

**Results:** No trend was observed in the coverage of the various infant feeding messages over the four years of the survey. Breastfeeding related messages made up between 21% (2007) and 45% (2009) of the infant feeding messages published.

**Conclusion and recommendation:** Magazines in South Africa convey a lot of information on infant feeding, but it is difficult to

conclude that they support breastfeeding. It may not be the media's main responsibility to educate consumers, but the media can be a strong ally in the promotion of good infant feeding practices. It is recommended that the study expands to include other media (e.g. radio and TV), and the survey be extended to 12 months.

## 6 Training intervention on infant feeding in primary health care facilities in Ibadan

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In Nigeria, health workers at the primary level are well positioned to provide health information and counseling on infant feeding to mothers at antenatal visits. However, the existing antenatal counseling on breastfeeding and complementary feeding is often inadequate and needs to be strengthened. The study aimed to train health workers in primary health care (PHC) facilities and evaluate the effect on their knowledge, attitudes and provision of infant feeding information and counseling to antenatal clinic attendees. This clinic-based intervention study was carried out in PHC facilities in Ibadan Nigeria. A two-stage cluster sample was used to select health workers for training. Baseline, immediate and 4-week post-training surveys were conducted to obtain information on knowledge, attitudes and practices of health workers regarding infant feeding. 125 participants were trained to provide information that is consistent with current WHO recommendations for infant feeding, and to effectively deliver individualized infant feeding counseling to the mothers. The sample included community health extension workers (59.7%), nurses (27.4%), community health officers (11.3%), and pharmacy technicians (1.6%). The sample's mean age ( $\pm$ SD) was 41.8 $\pm$ 8.2 years, and the majority were female (95.2%). Knowledge and practices of health workers regarding infant feeding, particularly complementary feeding was low at baseline but improved following the training intervention ( $p < 0.0001$ ). Mean scores for attitudes to infant feeding increased between baseline and the 4-week post-test but was not statistically significant. Knowledge and practices regarding provision of infant feeding information improved with training. Health workers need regular retraining exercises to ensure optimal performance in their duties.

## 7 Risk factors of poor anthropometric status in children under 5 years living in rural districts of the Eastern Cape and KwaZulu-Natal provinces, South Africa

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**Objectives:** This study aimed to identify factors associated with childhood malnutrition as assessed anthropometrically.

**Methods:** Secondary data analysis of a cross-sectional questionnaire and anthropometric survey including 0 to 60-month-old children ( $n = 2485$ ) and their mothers in rural districts of the Eastern Cape and KwaZulu-Natal Provinces was done. Logistic regression taking

into account hierarchical relationships of risk factors was used to determine the odds of a child being stunted, underweight or overweight.

**Results:** Risk factors for child stunting were male gender (Odds ratio (OR)=1.233;  $p=0.019$ ) and maternal perception about her child's growth (OR=1.346;  $p=0.018$ ). Handouts as source of food (OR=0.719;  $p=0.005$ ) and mother making important household decisions (OR=0.760;  $p=0.009$ ), on the other hand, were protective of stunting. Risk factors for underweight were male gender (OR=1.432;  $p=0.021$ ), maternal education (minimum of 5 years of schooling: OR=1.720;  $p=0.002$ ), maternal perception about her child's growth (OR=2.526;  $p=0.000$ ), current breastfeeding (for children <24 months: OR=2.022;  $p=0.014$ ) and history of a gastrointestinal symptom (OR=1.527;  $p=0.013$ ). The household having a regular source of income was a risk factor for child overweight (OR=1.473;  $p=0.002$ ), while maternal education (OR=0.595;  $p=0.001$ ) and maternal perception about her child's growth (OR=0.361;  $p=0.000$ ) were protective of overweight.

**Conclusion:** Socio-economic, maternal and child factors were associated with child malnutrition.

## 8 Inappropriate breastfeeding pattern causes childhood malnutrition and increases risk of diarrhoea

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Child nutritional status is reasonably considered as critical to a country's comprehensive human development. Each year, approximately 10 million children die before they reach 5 years of age, half of which is attributable to malnutrition and more or less two million to diarrhoea. Child malnutrition is still a major problem in Bangladesh. The BDHS report from 2007 reveals that 46% of children younger than 5 are underweight caused mainly by inappropriate feeding practices. Children not exclusively breastfeeding during the first 6 months are most vulnerable to childhood morbidity. This cross sectional study was executed to determine the relationship between nutritional status and feeding pattern of diarrhoea-affected children. It was conducted among 190 conveniently sampled diarrhoea-affected children aged 6-36 months.

Results revealed that 50% of the diarrhoeal children were malnourished ( $< -2$ WAZ). 67.8% of those malnourished, were not exclusively breastfed ( $p < 0.001$ ). 56.9% of those malnourished had pre-lacteal food ( $p=0.041$ ). 58.6% of those well-nourished, had been introduced to breast milk within one hour of birth ( $p=0.058$ ). Non-exclusively breastfed children had more diarrhoeal attacks as compared to exclusively breastfed children ( $p < 0.001$ ). 25% of children deprived of colostrum, had more than five prior diarrhoeal attacks, whereas 14.5% of children who received colostrum had more than five prior diarrhoeal attacks ( $p=0.761$ ). 78.6% of those malnourished had more than five previous diarrhoeal attacks ( $p < 0.001$ ). It can be argued that mothers of well-nourished children had better breastfeeding practices resulting in fewer diarrhoeal attacks compared to malnourished children.

## Obesity, Chronic Disease of Lifestyle / Non-Communicable Diseases

### 1 The association between habitual alcohol consumption, PAI-1<sub>act</sub> and fibrinogen concentration in black South Africans

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The association between alcohol consumption, PAI-1<sub>act</sub> and fibrinogen concentration, as well as the influence of gender, urbanisation, waist circumference, BMI, triglyceride concentration and the 4G/5G polymorphism (latter two for PAI) in the South African PURE population was investigated.

Two thousand randomly selected rural and urban, apparently healthy, black men and women aged 35-60 years participated in this study. Habitual alcohol consumption (g/day) was determined using Quantitative Food Frequency Questionnaires.

PAI-1<sub>act</sub> increased with heavy alcohol consumption in the total population after adjustment for triglycerides and waist circumference. PAI-1<sub>act</sub> was significantly increased in abdominally obese and obese (BMI  $\geq$  30) participants who drank heavily. PAI-1<sub>act</sub> was decreased with moderate alcohol consumption in participants with normal triglycerides but not in those with increased triglycerides. In the total population fibrinogen was decreased in the moderate alcohol consumers, and reached a plateau with heavy alcohol consumption. In participants with normal waist circumference and BMI, as well as overweight participants, moderate drinking was associated with reduced fibrinogen concentrations. In abdominally obese participants, and those with a BMI of more than 30, consuming alcohol was, however, not associated with decreased fibrinogen concentrations. Neither gender, the 4G/5G polymorphism (PAI-1 only) nor urbanisation influenced the association between alcohol consumption, fibrinogen or PAI-1<sub>act</sub> significantly.

Heavy alcohol consumption was associated with increased PAI-1<sub>act</sub> while moderate alcohol consumption was associated with decreased fibrinogen concentration which was not further decreased in the heavy alcohol consumers. Normal triglyceride levels and waist circumference protected against the alcohol-related PAI-1<sub>act</sub> increase in this black African population.

### 2 The association between current weight status (BMI) and weight management practices, personal and parental weight history and taste sensitivity in obese and normal weight Caucasian women

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**Background:** Obesity and associated co-morbidities are significant health problems in South Africa, and development of appropriate

interventions is essential and should be based on formative assessment of target populations. The study aim was to investigate associations between weight status, personal and parental weight history, weight management practices and 6-n-propylthiouracil (PROP) taste sensitivity in Caucasian female adults.

**Methods:** A convenience sample of 89 obese Caucasian women and 102 normal weight controls completed the PROP taste tests and a self-administered questionnaire developed for this study. Group comparisons were conducted using Chi-square tests followed by multiple regression analyses to determine odds ratios, adjusting for age, language and education.

**Results:** Individuals were more likely to be obese as adults if they were overweight as children (OR 7), as adolescents (OR 13.3) and as young adults (OR 66); if their mother was overweight during their childhood (OR 3.3), if they weighed themselves frequently (OR 2.2) and if they exhibited dietary disinhibition (OR 19.9). Weight loss attempts were prevalent in both cases (98%) and controls (67%), although cases were more likely to have tried a number of different diets ( $p < 0.0001$ ), to have regained lost weight within a year (OR 5.9) and to have used unhealthy weight loss methods (OR 2.4). No association was found between taster status and BMI, even after controlling for eating behaviours.

**Conclusion:** It is clear that intervention strategies for South African Caucasian females firstly need to target young children (prevention) and secondly, the adult population to ensure successful weight loss and maintenance.

### 3 Prevalence of metabolic syndrome among urban overweight/obese Zulu women: comparative analysis of two sets of diagnostic criteria

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**Background:** The increase in overweight and obesity, especially among urban black women results in an increased metabolic syndrome (MS) prevalence. A number of sets of MS diagnostic criteria are available, which may render different MS estimations.

**Objectives:** To determine and compare the prevalence of MS among overweight/obese urban, Zulu women aged 23-40 years using the ATP III (2004) central adiposity with waist circumference WC > 102cm, high blood pressure, raised triglycerides and blood glucose & lowered HDL and IDF (2005) (central adiposity with WC > 94cm, high blood pressure, raised triglycerides and blood glucose & lowered HDL) criteria.

**Methods:** BMI; WC; blood pressure (BP); fasting blood glucose, triglycerides and HDL cholesterol levels were measured in a sample of 71 overweight/obese Zulu women for diagnosis of MS according to the abovementioned criteria.

**Results:** Mean values were as follows: BMI 38, 127kg/m<sup>2</sup>, WC 100, 1cm, systolic BP 122 mm Hg, diastolic BP 83 mm Hg, glucose 5,0mmol/L, HDL 1,30 mmol/L and triglycerides 1,0 mmol/L. Prevalence of MS was 19.7% according to the ATP III and 19.7% according to the IDF criteria. Although the two sets of criteria resulted in similar prevalence estimations, it is important to note that agreement between the two

methods was not 100%, this being due to different cut off criteria for WC.

**Conclusion:** The fact that different sets of diagnostic criteria may result in different prevalence estimation outcomes needs to be considered in the interpretation of this type of data.

#### 4 Diet related chronic diseases in rural and urban Dar-Es-Salaam: the case of Ilala Municipality

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Increased energy intake and low physical activity are the major contributors to rising levels of overweight/obesity and their comorbidities in many parts of the world. A Cross sectional survey was carried out on 270 adults aged above 25 years and residing in rural and urban areas of Ilala Municipality, Dar es Salaam. Food frequency questionnaire and 24-hour recall methods were used to assess energy intake. The Douglas bag technique assessed energy expenditure, nutrition status and body composition were assessed by body mass index, body fat content and waist hip ratio. Prevalence of overweight/obese was higher among urban (28%), female's (21%) and subjects aged above 45 years (34%). Females had higher body fat content (32%) than males (21%). 45% females and 4% males had waist hip ratio greater than 1 and 0.85 respectively. Mean fasting blood glucose level was 103.2 mg/dl. Females (46%) and subjects aged above 54 years (61%) had fasting blood glucose level between 140-200 mg/dl. Mean total cholesterol concentration was 5 mmol/l, that of low density lipoprotein was 6.0 mmol/l and high density lipoprotein was 1.1 mmol/l. More than 55% consumed refined maize flour, Irish potatoes, vegetable oil, and coconut milk for more than 4 days per week. Mean daily energy intake was 2134 kcal, and mean daily energy expenditure was 1705 kcal; close to 94% of the subjects had a positive energy balance. Subjects know very little about their nutritional status and health risks associated with poor nutritional status. Nutrition education should be emphasised at all levels so as to prevent and decrease prevalence of obesity and associated morbidities.

#### 5 Dietary patterns and risk markers for noncommunicable diseases in an Indian population in KwaZulu Natal

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Research into associations between diet and risk factors for noncommunicable diseases (NCDs) has shifted single nutrients to diet patterns, derived from data-driven methods using factor/cluster analyses. This study explored the association between dietary patterns derived from factor analysis with risk markers for NCDs in an adult Indian population in Kwa-Zulu Natal.

Dietary data were obtained from a random sample of 250 apparently healthy Indian adults using a culturally appropriate quantitative food frequency questionnaire. Principal component factor analysis with Varimax rotation was performed on the percentage total fat derived from 11 food groups. Relationships between factors and

NCD risk markers were tested using univariate Chi-squared tests and regression analyses. Two principal factors were identified. Factor 1 showed the highest loadings for the legume, cereal and vegetable groups and factor 2 for the sugars, fats and milk groups. The median values for the modified Indian risk score and blood glucose and cholesterol levels for factor 1 and waist circumference, body mass index and cholesterol levels for factor 2 differed significantly between quintiles ( $p < 0.02$ ). Weak but significant inverse correlations were found for blood glucose levels with factor 1 scores for males and factor 2 scores for the total sample and females ( $r = 0.17$ ).

Factor 1 described a pattern of high fat intake from fat added to legume, cereal and vegetable dishes while factor 2 described a pattern of fat consumption from sugar, fat and milk groups. Factor analysis identified that the major contributors to fat intake were added fat to prepared dishes.

#### 6 Prevalence of risk markers for noncommunicable diseases in an Indian community in KwaZulu Natal.

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Noncommunicable diseases (NCDs) represent the major health burden in industrialised countries and are increasing in developing countries. Indian migrants throughout the world have a high prevalence of diabetes, coronary heart disease and dyslipidaemia, but there is little data on risk markers of NCDs in the South African Indian population. The aim of this study was to determine the prevalence of risk markers for NCDs among the Indian population in KwaDukuza, KwaZulu Natal.

Two-hundred-and-fifty apparently healthy Indians, aged 35-55 years, living in KwaDukuza, were randomly selected. Physical activity level was determined by a questionnaire and pedometer. Blood pressure and fasting blood glucose, triglycerides and total cholesterol were measured under prescribed clinical conditions using Asian cut-off-points. The European SCORE and the modified doubled SCORE, were used to determine the ten-year risk of a first fatal atherosclerotic event.

Diastolic blood pressure was  $>85$  mmHG and triglyceride levels  $>1.69$  mmol/L for 92% of respondents. All women and 87.4% of men were classified as centrally obese. Raised fasting blood glucose was seen in 39% of respondents. 62.5% of respondents were classified as inactive ( $<600$  METS min). When, the risk markers were used in the algorithms, respondents showed a minimal risk for cardiovascular disease. Although HDL-C levels were not measured, it is clear from the results of the clinical and anthropometric measurements that the respondents had characteristics typical of the metabolic syndrome, which supports previous reports of Indians in South Africa and India.

#### 7 Diet and social determinants of obesity in Kenyan women

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**Background:** Little is known about the determinants of dietary intake and obesity in Kenyan women.

**Methods:** A national sample of women (N=1008) was randomly drawn by the Kenya Central Bureau of Statistics. Weight, height, waist and hip circumference were measured. A 24-hour dietary recall was conducted with each participant and a socio-economic questionnaire completed. Data was analyzed by age, education, location and socio-economic status. Odds ratios were calculated by age and location.

**Results:** Overweight and obesity (BMI $\geq$  25) were highly prevalent in Kenya (43.3%). Obesity was most prevalent in urban women, over 45 years, and those in the highest income group. Women in the high income group (7278kJ) and in urban areas (7049kJ) had the highest mean energy intakes. There were also significant urban-rural and income differences in the contribution of macronutrients to energy intake. Total fat intake was 34.5% of energy (E) in urban areas and 29.7% E in rural areas; while carbohydrates contributed 69.9% E in rural areas and 57.4% E in urban areas ( $p<0.0001$ ). Overweight was significantly more likely in the highest income group; among households where room density was low; had electricity or gas for cooking; and had own tap and/or own flush toilet.

**Conclusions:** The most significant differences in both diet and weight status were found between urban- rural areas, between economic status groups and in level of education. Health policymakers need to recognize that future westernization of diet will exacerbate the prevalence of obesity, at least among women.

## 8 How low can you go?

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**Background:** A weight loss and healthy lifestyle programme for personnel in the PEHC.

**Objective:** Designed in the form of a competition, the purpose was to educate personnel to make healthy lifestyle choices.

**Methodology:** Advertisements were posted 2 months before the start of the programme. Application forms were completed by personnel and 45 contestants were chosen using set criteria. The program was divided in 11 sessions plus a final weigh-in and announcement of the winner. "Before" and "after" photographs were taken. Anthropometrics were done weekly. Different topics were discussed. Participants received a booklet to monitor progress, weekly notes covering the topic discussed, meal plans and sample menus. A physiotherapist and psychologist advised on exercise and emotional eating. The winner of the competition was based on the overall percentage weight lost over the 12 weeks. An evaluation forms were completed by the participants at the end of the program and a certificate of completion was given.

**Results:** Of the 45 selected participants 18 completed the programme with an average weight loss of 5.8%. The overall winner lost 17.3%. Fifteen evaluation forms were completed. The overall content of the programme rated as Average=1; Good=5; Excellent=9. The quality of the notes rated Good=6; Excellent=9.

**Conclusion:** The programme was a success in creating an increased understanding of a healthy lifestyle among personnel working in the department of health hospital setting. This type of program, with full support from top management, should be part of all personnel wellness programs.

## 9 Weight gain, physical activity and dietary changes during the first year of university life

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**Background:** Overweight and obesity are on the increase in low-income countries, raising the risk of lifestyle-related diseases. The world over, university life is associated with adoption of lifestyles that are likely to be sustained into adulthood.

**Objective:** To assess weight gain, physical activity and dietary changes during the first year of university life in Malawi.

**Methods:** A prospective study of first-year students (mean age 19 $\pm$ 1.7 years) of the 2008/09 cohort at Bunda College of the University of Malawi was conducted. A self-administered questionnaire was used to collect data at the beginning (November 2008,  $n=67$ ) and end (June 2009,  $n=47$ ) of the academic year. Weight and height were also measured. Repeated measures analysis was done for the 47 participants who completed the study.

**Results:** There was a significant difference in weight gain between female (7.1 $\pm$ 3.2 kg,  $n=26$ ) and male students (9.6 $\pm$ 3.5 kg,  $n=21$ ) ( $P=0.013$ ). Overall, the students gained 8.5 $\pm$ 3.6 kg ( $P<0.001$ ), and a modest but significant height of 0.2 cm ( $P=0.04$ ), with body mass index (kg/m<sup>2</sup>) increasing from 20.7 $\pm$ 3.2 to 23.9 $\pm$ 3.2 ( $P<0.001$ ). The students largely lived sedentary lives, with 6.6 hours resting; 2.1 hours light activities; 1.3 hours moderate activities; and, 0.9 hours heavy activities, with no significant changes observed at the end of the study. The consumption of wheat products, meat, sugar, milk and margarine increased, while that of fish, fruits, and vegetables declined.

**Conclusion:** Transition into university life might be the genesis of detrimental dietary and lifestyle changes in Malawi, which if not managed, could elevate the risk of lifestyle diseases among well-educated people.

## Public Health

### 1 Comparison of nutrition knowledge between rural and urban primary school children

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**Objective:** To compare the nutrition knowledge of primary school children attending a purposively selected school in rural Qwa-Qwa and two purposively selected schools in the urban Vaal region.

**Respondents:** A convenience sample of 142 rural and 88 urban school pupils, six to thirteen years old.

**Methods:** The measuring instrument was a validated nutrition knowledge questionnaire to determine nutrition knowledge of the respondents. Data were analysed on the Statistical Package for Social Sciences (SPSS), version 17.0, for descriptive statistics (frequencies) and independent t-tests were done to measure statistically significant differences between the groups.

**Results:** The mean age of the respondents was 9.2 years. Both the urban and rural respondents showed poor nutrition knowledge in the majority of the questions. The urban group scored a mean of 48.7% correctly in 22 questions and the rural group 38.7%. Significant ( $p < 0.05$ ) differences in knowledge regarding the food items belonging to the vegetables and fruit group (76.% correct in the urban group compared to 42.3% in the rural groups) and the cereal/starchy group (40.8% urban and 23.7% for rural), were observed. The urban groups scored significantly higher than the rural group for questions relating to the importance of water in the diet (19.0% versus 3.1% respectively), the fact that different foods have different functions in the body (75.4% versus 56.8%) and that fruit is more beneficial as a snack than foods with a high sugar content (76.4% versus 48.3%).

**Conclusion:** Although the urban children scored higher in most of the questions asked, an average nutritional knowledge was observed in both the rural and urban children. Nutrition knowledge is needed for better dietary intake habits and nutrition education programmes should be implemented in schools to improve the nutrition knowledge and dietary practices of children to prevent health problems later on in life.

## 2 HealthyFood™ benefit: impact of financial incentives and rewards on health and purchasing behaviour of members of a private health insurance scheme in South Africa.

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**Introduction:** Poor food choices are implicated in the pathogenesis of chronic diseases of lifestyle. Financial incentives and social marketing are strategies for influencing health behaviour.

The Discovery Vitality HealthyFood™ Benefit is a health promotion initiative involving cash-back discounting up to 25% on purchases of pre-selected healthy food items (N=10 000) at a national grocery chain (Pick n Pay). Foods categorised as 'healthy' are evaluated against evidence-based criteria. Vitality members are rewarded Vitality points for HealthyFood™ purchases.

**Objectives:** To assess the impact of the HealthyFood™ benefit on health and purchasing behaviour.

**Methodology:** Formative research comprised a telephonic survey of 408 members. One year later 403 members who had activated the HealthyFood™ benefit were surveyed. Data was correlated with Pick n Pay sales and personal health review data.

**Results:** Of the formative research sample, 62% perceived healthy food as expensive, establishing cost as a potential barrier to healthy eating. One year on, 188 570 members have activated the HealthyFood™ benefit. In the follow-up survey, 20% of respondents reported that they joined Vitality due to the HealthyFood™ benefit; 48% had increased their shopping at Pick n Pay; 56% reported an increased awareness of healthy food when shopping; 56% reported that they purchased more healthy food since the HealthyFood™. There is further, a four-fold increase in the number of members completing health risk assessments.

**Conclusion:** The HealthyFood™ benefit has a positive influence on driving healthy behaviours and could provide valuable insight into the role of financial incentives in promoting health behaviour change.

## 3 A combination of supplements can improve nutrition supplementation in health facilities in Thabo Mofutsanyana

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In 2009, a single-blind experimental study was conducted amongst 295 clients (age 5-65 years) at two PHC facilities, a hospital and ARV site. The successful implementation of the Nutrition Supplementation Program (NSP) was hindered by complaints of taste fatigue from clients and limited budgets. For this study four standard complete feeds, providing 1 kcal / ml were used. An average of 91.5% of clients (n=295) preferred the enriched maize-based ready-to-use (RTU) sip feed. A recommendation was made that this sip feed (new product) be included in the NSP in combination with enriched maize meal (EMM). The second phase was to change the protocol to implement the recommendation and measure the impact of it on the nutritional status of the NSP clients.

Records at 10 PHC facilities and 4 ARV sites were reviewed to determine the impact of the changed protocol on NSP clients. Clients receiving a combination of supplements were diagnosed with undernutrition, chronic and debilitating conditions, with an average weight loss of 15% over 3 months, whilst receiving only EMM. Weight gain increased in general with 5% within 3 months amongst these clients (n=962). Chronically ill clients (n=15) regained their functionality within two weeks post combination-supplementation.

The RTU product was administered to pregnant women (n=100) pre- and post-delivery. This eliminated identified problems with supplement availability, storing, mixing and distribution of food supplements, regurgitation, nausea and vomiting.

In Thabo Mofutsanyana, a combination of food supplements improved the successful implementation of the NSP and the nutritional status of NSP clients.

## 4 The role of the food retail milieu and socioeconomic position on food purchasing patterns in Khayelitsha

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**Background:** An understanding of individual-level socioeconomic factors as well as upstream environmental predictors of food purchasing, and thus healthy eating, is imperative in order to develop appropriate nutrition and health interventions. Understanding the complex world of food choice requires a meticulous examination of multiple stimuli and deterrents of food choice such as, inter alia: micro-level compositional socioeconomic aspects as well as macro-level contextual influences of food cost, availability and accessibility.

**Aim:** This study sought to uncover some of the widely known environmental (contextual) and compositional (individual-level) socioeconomic factors that influence Health Club Members' (HCMs) ability to access and afford healthy foods within the community where they live.

**Study design:** The research employed both descriptive quantitative and qualitative study designs.

**Study population and sample:** The target population which was also the sample comprised 50 Health Club Members who were residing in Harare and the surrounding area within Khayelitsha at the time of the study.

**Data collection and analysis:** Data was collected by means of face to face quantitative interviews using a questionnaire, in-depth interviews, key informant interviews, as well as observations. Quantitative data was analyzed using SPSS version 16.0 and MS Excel 2007 for Windows. Qualitative analysis was executed using framework and content analysis techniques.

**Results and conclusion:** The study established that low socioeconomic status, poor access to healthy food choices, and lack of constant availability of such foods were primary challenges facing some of the HCMs in their quest to afford and access healthy food.

## 5 Dietary intake and nutritional status of children (0-19 years of age) residing in children's homes in Durban, South Africa.

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The main objective of this study was to determine the nutritional status and food consumption patterns of children (0-19 years old) residing in 3 Children's homes in Durban, to make recommendations to the management of the homes in addressing the nutritional needs of the children.

Cycle menus were analysed and plate waste studies conducted in the homes (n=3). All the children (n=119, aged 5-19 and n=50, aged 0-5) were weighed and measured and their ages recorded. Anthropometric indices included weight-for-age (0-5 and 5-10 year of age), BMI-for-age (0-5 and 5-19 years of age) and height-for-age (0-5 and 5-19 years of age) separately for boys and girls.

The results indicated that the food group most commonly consumed was carbohydrates. The mean energy intake was 10 374kJ (>100% of DRIs varying depending on the age and the gender) and the average vegetable portion consumed was 46g. The anthropometric indices indicated that in the age group 5-19 years of age, 24.1% of the boys and 22.2% of the girls were stunted (height-for-age <3rd percentile on the WHO growth charts) with 12.0% and 30.6% of boys and girls respectively at risk of overweight (BMI-for-age >85th and <97th percentile) and 13.9% of the girls were overweight (BMI-for-age >97th percentile). The 0-5 year age group indicated that 30.3% of the boys and 11.8% of the girls were severely stunted (below -2 z-score), with 12.1% boys overweight (above 2 z-score).

The portion sizes of the various food groups consumed by the children are not optimal for children in this age group. All these factors indicate a possible double burden of disease and incorrect food choices may contribute to malnutrition in this sample. Nutrition education, as part of an intervention, could be implemented to assist management and caregivers in making the correct food choices when planning menus for this group of children.

## 6 Impact of training on environmental conditions of food service outlets in urban Southwestern Nigeria

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**Introduction:** Most health misfortunes of man are food related, resulting from poor environmental conditions under which foods are prepared and served.

**Materials and Methods:** The study focused on the environmental condition of Food Service Outlets (FSO) in urban Southwestern, Nigeria. Structured questionnaire and "Spot Check Observation" (SCO) were used to assess the environmental condition of the FSO. Standardized environmental checklist on sources of water supply, methods of waste disposal and toilet facilities was used. Forty High Density Food Service Outlets (HDFS) and twenty Low Density Food Service Outlets (LDFS) were visited.

**Results:** Results showed that mean score of SCO for HDFS was (2.93±0.09) compared to LDFS (4.32±0.56). Tap water as source of drinking and cooking water was higher in LDFS (86.4%) than HDFS (28.5%). The most common method of solid waste disposal in HDFS was open refuse dump while LDFS was through approved contractors. Liquid waste disposal in HDFS was open drainage (82.4%), while covered drainage system was common in LDFS (76.5%). More of LDFS (93.7%) had good toilet facilities (water closets) while the majority (65.2%) of HDFS had no toilet facilities. A significant relationship existed between educational level of food service provider and environmental condition ( $r=0.789$ ,  $p<0.01$ ). Nutrition education on food safety consciousness was organized, three months later, SCO was conducted and environmental score improved greatly for the HDFS (4.13).

**Conclusions:** In conclusion, it is evident that constant training of food service providers is important in improving the environmental condition of the food service outlets in high-density urban areas.

## Public Health Nutrition Programmes in Schools

### 1 HealthKick: nutritional status and determinants of behaviour of grade 4 learners in the Western Cape

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**Background:** As part of the formative assessment, the nutritional status and determinants of behaviour of grade 4 learners (n=836) from 16 schools in disadvantaged settings were measured.

**Methods:** Learners from 8 self- and 8 co-implementation schools completed a questionnaire assessing their nutrition knowledge, attitudes and behaviour (KAB). Dietary intake was determined by means of an un-quantified 24-hour recall which was used to calculate a dietary diversity score (DDS). Anthropometric measurements included weight and height.

**Results:** The KAB questionnaire revealed poor nutrition knowledge, with only 14% knowing that starchy foods should form the basis of most meals and 26% knowing the correct number of portions of fruit and vegetables that should be consumed daily. The 24-hour recall showed that learners consumed less than one item of fruit and/or vegetables and lacked variety in their diet. The mean DDS was 4.6 (SD=1.25). The score ranged from one to nine food groups with 9 reflecting the most variety. 47% of learners reported eating 5 meals the previous day. 93% of learners ate breakfast and 70% brought a lunchbox to school the day before testing. Although overweight was not identified as a problem in this sample, z-scores for height-for-age ranged between -0.13 and -1.91 indicating that stunting was a nutritional health concern.

**Conclusions:** While overweight and obesity are not eminent concerns among learners from disadvantaged settings, dietary behaviour of these children was not optimal and warrants attention in terms of nutritional health promotion and specifically the food-based dietary guidelines.

## 2 Exploring perceptions concerning weight status, and barriers to changing behaviour of primary school educators

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**Background:** A survey of primary school educators conducted in the Western Cape found that more than 80% of educators in these schools were overweight (BMI  $\geq 25$ ) or obese (BMI  $\geq 30$ ). Furthermore, 56% of educators had a high waist circumference; indicative of increased cardiovascular disease risk (WC  $> 88$ cm) and hypertension (BP  $> 140/90$ ). In order to develop strategies to address the high prevalence of overweight and obesity in educators it was essential to firstly ascertain current perceptions regarding their weight status and also possible barriers to behavior change.

**Methods:** The HealthKick programme purposively selected 16 schools within the Western Cape which were then randomly assigned to self-implementation (control) and co-implementation (experimental) categories of a nutrition intervention programme to improve nutrition knowledge and behaviour. A qualitative approach was used to collect data on primary school educators and included focus group discussions and in-depth interviews. These were audio-taped and transcribed verbatim.

**Results:** Risk factors and behaviours for non-communicable diseases were prevalent in the educators' study. The majority showed a high interest in becoming leaner and more active. However, there were numerous barriers to this becoming a reality. The most commonly reported being lack of time, lack of knowledge about effective strategies, and lack of readiness to change.

**Conclusions:** Due to the high burden of obesity and other cardiovascular disease risk factors in educators it is essential that strategies are developed to address these, particularly weight loss. Effective strategies for weight loss in educators are only possible if the barriers to change can be addressed.

## 3 HealthKick: integrating the intervention in the Life Orientation curriculum

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**Background:** A survey of 800 grade 4 learners during the needs assessment phase of intervention development pointed to a lack of nutrition knowledge and poor dietary behaviours. Only 52% of children consumed fruit or vegetables the day before the survey. The selection of theory-based methods and practical strategies, pointed to a classroom-based strategy, in particular the life orientation (LO) learning area to attain identified behaviour outcomes. This is supported by best practices identified in the literature. Previously, principals (35%) had identified a lack of time or competing priorities as the main barriers to implementing health promotion programmes at schools. Therefore, there is a need to integrate the intervention into the existing LO curriculum, which forms part of the "Revised National Curriculum". Learning outcomes are health promotion, social development, personal development and physical development and movement.

**Methods:** A curriculum expert integrated the HealthKick goals into the curriculum by developing classroom and home-based activities and assessment possibilities based on the expected behaviour outcomes for each assessment standard contained in the four learning outcomes. Guidelines for parent and community involvement are also provided, e.g. poster competitions. A curriculum-related resource box was provided. Workshops were held with educators from participating schools explaining the relevance of the HealthKick intervention within the LO curriculum and indicating how the intervention could support the curriculum.

**Conclusion:** The implementation of the curriculum-based intervention is still being evaluated. However, preliminary results indicate the possibility to integrate a nutrition and physical activity intervention into the existing LO curriculum.

## 4 The Health Promoting Schools model as a service learning platform for undergraduate dietetic students

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World Health Organisation (WHO) launched its Global School Health Initiative in 2005 after twenty-seven country-areas indicated interest in collaborating in the development of Health Promoting Schools (HPS). The intent of this study was to explore the school setting, through the HPS concept as a platform for service-learning for undergraduate dietetic students. This descriptive cross-sectional study focused on interviewing teachers and headmaster of selected HPS, reflection journals completed by students and growth monitoring of all grade 1 learners in these schools.

Results showed that most of the students were positive about the HPS concept, but only fully understood the implementation when they entered the school setting. The students agreed that they have a role to play in increasing the efficacy of this concept and suggested that they become involved in educating learners, parents and teachers. They could assist in developing educational tools, growth monitoring, menu planning, meal budgeting and vegetable garden training.



The teachers were also positive about the HPS concept and felt that they have enough knowledge but were open to obtain more. Resources needed included first aid training, sport equipment, nutritious food and health resources. The teachers utilise life orientation classes and try to set an example to further the concept. Furthermore they offer workshops, soup kitchens and vegetable gardens for the poor and old. The teachers agreed that students have a role to play in the HPS by assisting with growth monitoring, alerting parents to nutritional problems, educating learners, teachers and parents as well as developing nutritional tools.

## 5 Process evaluation of HealthKick action planning in disadvantaged primary schools in the Western Cape

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**Background:** The HealthKick diabetes prevention programme is a holistic, primary school-based, multi-component programme in disadvantaged primary schools in the Western Cape. In order to assess whether the intervention was delivered and received as intended, the Healthkick programme requires the inclusion of a thorough process evaluation. This study evaluated the process of the action planning step of the HealthKick programme.

**Methodology:** A qualitative research design was adopted to best determine the experiences of the participants and the underlying factors involved. Data were collected by means of in-depth interviews and focus groups utilising semi structured interview schedules. Interviews and focus groups were audio taped and transcribed verbatim. The data were analysed utilizing content analysis with the assistance of Atlas ti computer software. Once open coding was done, the researcher then began grouping quotes under predetermined themes with summarising sentences, thus placing them into categories. Data of the different categories of participants were then compared and analysed.

**Results:** The findings indicated that the action planning process had an impact and small successes were documented, such as an awareness of a healthy lifestyle and small healthy gestures that instilled a sense of self-efficacy. Even teachers as role models felt motivated to live healthily. However, challenges, such as gaining teachers buy in and barriers, such as time constraints, competing priorities and socioeconomic circumstances have to be overcome.

**Conclusion:** The results of this study will be used to improve the action planning process of the HealthKick Diabetes Prevention Schools Programme.

## 6 HealthKick: a nutrition and physical activity intervention for primary schools in low-income settings for the prevention of diabetes in the Western Cape

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**Background:** In 2009, the WHO Summary Report on Interventions for Diet and Physical Activity determined that comprehensive, multi-component, school-based interventions, embedded in the curriculum, were best-practice for promoting healthy eating and exercise

behaviours in children. Van de Venter (SA J Educ 2009;29: 127-45) and others have highlighted the need for adequate training for teachers in the Life Orientation curriculum, to successfully achieve learning outcomes related to nutrition and physical activity. In this context, formative research was conducted in more than 100 schools to develop HealthKick, a school-based programme to promote healthy lifestyles in primary schools from low-income, urban and rural communities in the Western Cape.

**Methodological approach:** The primary aims of HealthKick are: 1) to promote healthful eating and regular participation in physical activity in children, parents and teachers, to reduce risk of chronic diseases; and 3) to promote a school environment that facilitates the adoption of healthy lifestyles. The components of HealthKick are: action planning, toolkit (resource guide, a resource box, physical activity resource bin), and an educators' manual, which includes a curriculum component.

**Logic Model:** The logic model for the HealthKick programme, process and evaluation will be presented and includes: inputs (funding, support and involvement from educational authorities, NGO's, teachers, parents, research team), activities (formative work, intervention mapping, action planning, goal setting, resource tool kit, educator's manual), outputs (situational analysis, barriers, teachers trained, learners and parents reached), and outcomes (changes in school health environment, learner and teachers' knowledge or practices).

## SAAFoST: Food Science and Technology Perspectives

### 1 The good, the bad and the auditors.

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With the recent announcement that the majority of retailers will recognize a single audit of suppliers' food safety systems, the focus will again be on the auditing companies performing these audits. The Salmonella peanuts scandal in the USA also highlighted the critical importance of auditor competence. This paper seeks to clarify the role of SAATCA (Southern African Auditor and Training Certification Association) in determining competence requirements for food safety auditors.

### 2 Ethical considerations in food safety

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Firstly, the presentation introduces a *basic ethics "toolkit"*, explaining what ethics is about and the meanings of ethics terminology, demonstrating the importance of ethics in our private and public lives, and explaining an ethical decision-making model. Second, the presentation sets out the *requirements for managing ethics in an organisation* – doing an ethics risk analysis, setting ethical standards, implementing those ethical standards, and monitoring and reporting on ethics management. Third, the presentation *focuses specifically on food safety* by analysing the relevant ethics concepts, exploring the ethical values and principles that should govern food safety among individuals and in organisations (strategically and operationally), and looking at some case studies of how an organisation ought to handle ethical challenges, specifically in respect of food safety.

### 3 Food science solutions for an evolving world

Maguire R

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The presentation will focus on highlights from the 15<sup>th</sup> World Congress of Food Science and Technology that is to be held in Cape Town August 22-26<sup>th</sup>.

A special emphasis will be placed on topics that illustrate how and why the Food Science and Nutrition fraternities should work closer together.

### 4 SA food labelling regulations: are we meeting the guidelines set out by Codex?

Matlala D

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South Africa's participation in *Codex Alimentarius Commission*, a Joint Food Standards Programme established by the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) of the United Nations, dates back to 1994. The purpose of co-operating through this collection of internationally adopted food standards, guidelines, codes of practice and other recommendations is to protect the health of consumers and ensure fair practices in international food trade.

The Codex Committee of Food labelling (CCFL) has over the years done tremendous work with regard to standards and guidelines on food labeling in order to provide clear information to the consumer. Recently South Africa (Directorate: Food Control) published regulations relating to the Labelling and Advertising of Foodstuffs (No R 146 of 1 March 2010), that bears testimony to the country's active participation in Codex and adoption its guidelines and recommendations.

The presentation will focus on the extent to which these new labeling regulations relate to the relevant Codex guidelines.

### 5 Ethical control of food and beverage marketing communications aimed at children

Vos S

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It is generally argued that it is both in the public interest and in the interest of the marketing communications industry itself that advertising be regulated to secure the confidence of consumers and government alike, and to achieve the necessary credibility and reputation to inspire public confidence in advertising.

To ensure that rivals play by the same rules, the food and beverage industry has set ethical rules to govern food and beverage marketing communications strategies, and in particular those communications aimed at children. These rules were drawn up with reference to international precedent and best practice guidelines, and currently form part of the Code of Advertising Practice, as determined and administered by the Advertising Standards Authority of South Africa.

Focussing on the ethical rules for promoting the consumption of food and beverage products; for not undermining the role of parents in guiding children's diet and lifestyle choices; for recognising the impressionability of children of 12 years and under; and providing for prohibitions on food and beverage products not representative of healthy dietary choices and healthy lifestyle, it will be seen that these ethical rules, when effectively self-regulated, may be viewed as an alternative to detailed legislation, but not to legislation itself. Self-regulation is designed and developed to work within and to complement statutory controls producing a result that neither system of control could achieve on its own.

# Poster Presentations

## Nutrition Congress Abstracts

### Clinical Nutrition & Case Studies

#### 1 The effects of phytate and calcium content on the iron availability of African sorghum foods

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The aim of the research is to establish whether sorghum with a low phytate content will have significantly improved iron availability in wholegrain traditional African sorghum food products. Improved mineral availability will benefit communities in rural Africa which are known to have high incidences of iron deficiency. High (HD) and low (LD) protein digestibility sorghums and the African white sorghum Macia (M) were analysed for phytate by anion exchange chromatography. The mineral bioavailability was estimated through in vitro dialysability. Results indicate that sorghum flours with lower phytate contents M (9.4 mg/g flour) and LD (10.5 mg/g flour) compared to HD (15.7 mg/g flour), showed significant higher % iron availability between LD and HD, but not between M and HD; M (6.2%), HD (7.1%) and LD (8.1%). This may be due to M having a 20% higher calcium content. Calcium has been shown to reduce iron availability. It was found that natural lactic acid fermentation decreased the phytate content of M, HD, and LD by 64%, 17% and 9%, respectively, while it increased the in vitro availability of iron by 27%, 61% and 54%.

There is a general trend that mineral availability increases when phytate content is reduced. With the dialysability assay the direction of the effect is more reliable than the magnitude, explaining the lack of linear increase of iron availability after natural lactic acid fermentation. However, more detailed research is needed into other factors affecting the mineral availability in sorghum.

#### 2 Validation of a method for dietary assessment: 24-hour recall supported by photographs for application in rural areas

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The aim of the study was to improve the twenty four hour recall method to measure food consumption of individuals, and also to adjust the method for measurement of dietary intake in poor rural areas.

The 24-h recall method was improved to increase accuracy of dietary intake by addition of two visual aids namely 1) digital photos taken by the subjects on all food consumed during the days in question and 2) a photo album with servings, of the most consumed food in the area, in different sizes. The purpose of the photos taken by the subjects was

to simplify the recall, during the interview, of everything consumed the previous day. The purpose of the photo album was to assist the validation of the amount of food that was eaten.

The present study was carried out in a rural area in the tropical region of Bolivia, South America on 45 women that participated as volunteers. The validation of the developed method was made by comparing the result (recalled amount of food intake) with results from a more precise method (weighed food record) used in parallel. The nutritional assessment according to the evaluated food intake with the two methods was calculated using the Bolivian food composition tables. There were no significant differences between the results from the two methods regarding most of the nutrients studied.

#### 3 Home gardening for low- income households in the Vaal Region: a case study

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The main objective of this project was to conduct an empirical study to assess food insecurity training needs in order to develop an appropriate home gardening training programme for the informal settlement dwellers.

A random selection of 143 households was made from the informal settlement (refer baseline), but only 91 dwellers successfully completed the questionnaires that were administered by four trained fieldworkers. The results were analysed using the SPSS®12.0 program.

The results showed that 72.5 % had some knowledge of home gardening, whereas 29.7 % had some skills in home gardening; 37.4 % responded that they had some knowledge of soil management, while 69.2 % had no knowledge regarding planting management and only 25.3 % had any knowledge regarding storage after harvesting and preparation of vegetables. Only 29.7 % had ever worked in a garden.

A training programme was developed and implemented by the researcher to the 91 participants. This was developed in order to promote sustainable production and consumption of vegetables for better livelihoods, food and nutrition security and health outcomes, particularly for children and women.

Training was conducted over two days (n=91) by the researcher and the field workers. The theory was conducted on one day and on the second day practical training was done.

It was found that most of the householders who participated in this project owned a vegetable garden. Most of the participants felt that they had benefited greatly from the training given in the gardening project, both because they were now able to have year-round access to fresh vegetables, and because of the money-saving aspect.

## 4 Assessment of nutritional status of primary school children in Orange Farms

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**Objective:** The purpose of this study was to assess the nutritional status of primary school children in Orange Farms.

**Method:** A cross-sectional study was undertaken to assess the nutritional status of 100 randomly selected primary school children in two purposively selected schools. Socio-demographic, health, quantified food frequency and 24-hour recall questionnaires were administered by trained fieldworkers and analysed on the Statistical Package for Social Sciences and FoodFinder® software programs respectively. Anthropometric measurements included weight and height and were analysed according to the National Centre of Health Statistics growth charts.

**Result:** Socio-demographic data indicated that household food insecurity contributed to the poor dietary intake of the children as the majority of the caregivers (71%) were unemployed. The monthly household income was less than R1000 in 75% of the households. A mainly carbohydrate-based diet was consumed with limited vegetable and animal protein intakes. The mean±SD dietary intakes were 6214±SD KJ energy, 55±SD g protein, 47±SD g fat, 11±SD g carbohydrates. The prevalence of stunting was 34.9%.

**Conclusion:** The main problem in this sample of primary school children was malnutrition due to poor dietary intake and poverty. These results will be used to plan and implement suitable interventions to improve the nutritional status of these children.

## 5 Perceptions on breastfeeding of lactating women (0-6 months postpartum) in Nairobi, Kenya

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Family structure, interactions and social values determine individual preferences and the development of eating behaviour. Breastfeeding as the preferred method of infant feeding is also subject to cultural and other influences.

**Aim:** To assess cultural influences on breastfeeding practices of lactating women to obtain insight useful for practical policy implementation.

**Setting:** Mbagathi District Hospital, located at the edge of Kibera slum area.

**Population and sampling:** Convenience sampling was used to select seven women into each of the seven focus groups.

**Design and methodology:** Phenomenology by use of structured focus group discussions and Krueger's framework of content analysis (2004).

**Findings:** Relatives were the main source of information on breastfeeding practices. The women knew the importance/benefits of exclusive breastfeeding (baby grows healthy, relieves breasts and

enhances bonding). However, the responsibility of work/business and the perception that breast milk alone was inadequate influenced them to partially breastfeed; often three months after birth. The majority (93%) had good nutrition knowledge as assessed by a standardized questionnaire (NFCS, 2005), however misconceptions were identified, e.g. breastfeeding improved appetite; tea consumption diluted breast milk and some foods affected smell and taste of breast milk. Consumption of millet porridge, black beans, bananas and green leafy vegetables were encouraged during breastfeeding, while tea, coffee and cowpea leaves were discouraged because of perceived negative effects on volume and composition of breast milk.

**Conclusion:** External factors (e.g. culture) and internal factors (e.g. knowledge and beliefs) influence breastfeeding. These influences ought to be understood for optimal promotion of breastfeeding.

## 6 Food consumption patterns of orphaned children in the Vaal region

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**Objective:** The aim of this study was to assess the food consumption patterns of HIV/AIDS affected orphans (n=108), aged 9-13 years in an informal settlement in the Vaal region.

**Materials and methods:** The Food and Agricultural Organisation (FAO) food frequency questionnaire (FFQ) was used to measure the food consumption patterns. Data was captured on Microsoft Excel and analysed for frequencies, mean and standard deviation (SD) using Statistical Package for Social Science version 17.

**Results and findings:** From the roots and tubers food group, maize meal porridge (77.8%), rice (53.7%), bread (58.3%) and samp (47.0%) were the most consumed food cereals amongst the orphans. The vegetable food group, most commonly used was onions (49.1%), cabbage (39.8%) and tomatoes (38.0%). Intake of dairy products and fruits were very low. Fruit group items included apples (11.1%), bananas (8.3%) and oranges (13.0%), consumed rarely despite availability within the community. From the fat group, most commonly used was sunflower oil (51.9%) and margarine (29.6%).

**Conclusion and recommendation:** Poor dietary intake was evident from this investigation. A recommendation is made to implement a nutrition education programme (NEP) amongst the children, families and caregivers with the aim of encouraging healthier and inexpensive food choices from all food groups.

## 7 Are dieticians the missing link in the prevention, management and treatment of pressure ulcers?

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Evidence-based studies show that as many as 17% of all patients suffer from pressure ulcers (PU), with a mortality rate of about 60%. As a results management of PU's should focus on prevention rather than treatment.

The prevention and treatment of PU's should involve coordination between nursing, medical, physical therapy and dietary interventions.

Although risk factors for PU development include many nutritionally associated symptoms, the role of the dietician in the prevention, management and treatment of PU's are significantly underestimated.

Together with an integration of various preventative and treatment regimens, nutritional objectives include screening and assessment of individual nutritional status of patients; estimation of individual nutritional requirements; provision of an appropriate nutrition intervention; and monitoring and re-evaluating the nutritional outcome. Additional calorie, protein and fluid requirements are necessary and should be based on the combination with the classified category of the PU as well as disease-specific guidelines.

Various studies have shown positive evidence on the role of micronutrient supplementation in wound healing, especially that of Omega fatty acids, Vitamin C, Zinc, Arginine and Glutamine.

The role of the dietician and nutrition in the prevention, management and treatment of PU's should not be underestimated in the current clinical setting, where both health professionals and managers are daily faced with the challenge of providing good quality healthcare with limited resources. It could be argued that it is unethical for Dieticians not to be involved in the prevention, treatment and care of pressure ulcers.

## 8 Daily physical activity and diet intervention for individuals with type 2 diabetes mellitus: a randomised controlled trial

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**Background:** Urbanisation, a sedentary lifestyle and increasing obesity due to westernization and changed eating habits have been identified as independent risk factors for type 2 diabetes in the South African population.

**Aim:** To establish the effectiveness of a daily walk and diet education intervention program.

**Setting and design:** A randomized controlled trial was performed. The study population consisted of men and women of all races, ages 40 to 65, with Type 2 Diabetes Mellitus (DM) with duration of at least one year attending the Steve Biko Diabetes Outpatient clinic. Patients who had an HbA1c > 8 – 9.5% were included in the sample.

**Method:** Four weekly group educational classes considered essential for nutrition self-management and physical activity were held. Topics discussed included general DM knowledge, lifestyle changes, food selection, portion sizes and meal planning. Walk prescriptions based on average number of steps walked in three days were given. Participants were followed-up at 16 weeks and one year.

**Statistical analysis:** Intervention and control groups were compared with respect to changes from baseline, using analysis of covariance (ANCOVA) with baseline values as covariates.

**Results:** The difference between the intervention and control groups in the change in HbA1c from the baseline was significant at the 16-week follow-up assessment ( $p=0.041$ ), and in the total cholesterol ( $p=0.047$ ) and LDL-cholesterol ( $p=0.014$ ) at the one-year follow-up assessment.

**Conclusions:** These results suggest that HbA1c can be improved over a period of four months. More frequent contact with the patients is necessary for better long-term diabetes management.

## 9 Is there a need for nutrition education of pregnant women in the Vaal region?

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**Introduction:** Although there may be basic and underlying causes for malnutrition in pregnant women, the immediate causes are related to incorrect dietary intake of nutritious foods.

**Objectives:** The main aim of this project is to develop a nutrition education programme (NEP) to improve the nutrition knowledge and the dietary intake behaviour of pregnant women in the Vaal Region so that they are able to make informed food choices. This paper will focus on the needs assessment for an NEP.

**Methodology:** A nutrition knowledge questionnaire was developed and tested for internal reliability (Cronbach's Alpha). The pre-tested questionnaires were completed with the assistance of trained fieldworkers in 90 purposively selected pregnant women in two randomly selected clinics. Dietary intake data were obtained by 24-hour recall questionnaires. Data were captured and analysed for descriptive statistics on SPSS, version 17.0.

**Results:** Mean $\pm$ SD dietary intake levels were below the EAR for energy (9636 $\pm$ 4582 kJ), dietary fiber (20 $\pm$ 9 g), calcium (487.3 $\pm$ 299.0 mg), iron (12.6 $\pm$ 6.9 mg) and a number of other nutrients. The results further indicated poor knowledge on a number of nutrition-related topics. The majority of respondents (97.8%) suggested that nutrition education was needed.

**Conclusions and recommendations:** The general nutrition knowledge of the respondents was poor. This was evident by the poor nutrient intakes. A need for nutrition education was therefore identified. The results of the needs assessment were used as a basis of the NEP planned for pregnant women in the Vaal region. The preliminary results of the NEP will be reported.

## Elderly Nutrition

### 1 Nutritional status and dietary intake patterns of the elderly in Kwazulu-Natal

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**Background:** Malnutrition, specifically overnutrition is a key predictor of poor nutritional status amongst the elderly. Epidemiological transition from rural to urban has greatly influenced dietary patterns amongst the elderly, therefore increasing the prevalence of diet-related related disease.

**Objectives:** The aim of this study was to determine the nutritional status and dietary intake patterns of the elderly in KZN.

**Methodology:** Sixty randomly selected men and 190 women aged 60+ participated in this study. Anthropometric measurements determined the BMI according to the WHO and Asian cut-off points to identify the weight status. Two 24-Hour Food Recall questionnaires were completed by the 250 respondents to identify actual food intake and measured against the Dietary Reference Intake (DRIs). A FFQ determined the respondent's food variety score over a period of one week.

**Results:** Anthropometric results indicated that 38% of Indian women and 27% Indian men sorted in the Obesity Class I (BMI, Asian cut-off points 25.0 - 29.9) category. Fourty percent of the African women ranged in the Obese (WHO standard BMI cut-off points,  $\geq 30.00$ ) category and 75% of the African men ranged highest in the Normal BMI (18.5 - 22.9) category. The mean Food Variety Score was 33.32 ( $SD \pm 15.2$ ) various foods consumed in seven days. Seven percent ( $n=17$ ), of the respondents have a poor food group consumption, consuming food from group one to six of the nine nutritious food groups.

**Conclusion:** The results of this study indicate that obesity is prevalent at a high rate in this community.

## Food Based Strategies for Optimal Nutrition

### 1 Consumer acceptability of home processed soybean based foods: a focus on Northern Mozambique

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**Introduction:** Households in northern Mozambique mainly depend on subsistence farming to meet their food and nutrition needs. In the past five years, research and development agencies working in the area have introduced soybean production for its versatile uses, including use as a rich source of protein and energy for humans. Available literature from other parts of the world has reported low consumer acceptability of soybean- based foods; thus, the need to investigate acceptability of the novel foods in northern Mozambique.

**Methods:** Five home processed soybean- based foods were introduced to 112 consumers in a formal setting. Acceptability of the foods were ranked on a five-point hedonic scale. The sensory attributes studied were colour, texture/consistency, taste, smell, mouthfeel, aftertaste and overall acceptability. Additional information on acceptability was obtained from 2,037 consumers as feedback during community based demonstrations on preparation of the five foods.

**Results and Discussion:** All soybean- based foods were scored significantly high within the scales of like moderately to like extremely for the attributes of colour, texture, taste, smell, mouthfeel aftertaste and overall acceptability. Within the study population, stiff porridge containing 50% soybean flour was found to be acceptable by 93.4% of the participants. This could be attributed to the nutty roasted aroma and taste of toasted soya flour used which could have been similar to that of toasted peanut, which the community eats with regular meals.

### 2 Retention of provitamin A carotenoids during processing and consumer acceptability of provitamin A-biofortified maize food products

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In South Africa (SA) approximately 63.6% of children aged 1-9 years have inadequate vitamin A status which continues to be a serious public health problem. Development of maize varieties with high concentrations of provitamin A carotenoids is at an advanced stage. However, the feasibility of using provitamin A-biofortified maize to alleviate vitamin A deficiency (VAD) should be assessed. Processing of the biofortified maize into food, including milling and cooking, may result in significant loss of provitamin A carotenoids. In addition the yellow/orange colour of the provitamin A-biofortified maize may act as a deterrent among target populations in SA. There seems to be no South African data on either the retention of provitamin A carotenoids during processing or consumer acceptability of provitamin A-biofortified maize foods. In this study about five provitamin A-biofortified yellow/orange maize varieties will be milled and cooked into samp, phutu and thick and thin porridges. Provitamin A retention during milling and cooking of the provitamin A-biofortified maize foods will be determined. The sensory characteristics of these foods and their acceptability will also be determined using both trained and consumer panelists. It is envisaged that data on provitamin A retention could be used when setting breeding targets for provitamin A. Also, data on consumer acceptability of provitamin A-biofortified maize foods could be used to identify traits that the breeders need to focus on. Data from this study will hopefully provide additional information that could be used to alleviate VAD in SA.

### 3 Vitamin C but not thiamine deficiency in black African patients with heart failure in South Africa: identifying the need for nutritional intervention

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**Background:** Malnutrition may be of particular importance in the natural history of heart failure (HF).

**Methods:** Demographic, anthropometric and clinical data were collected from 28 consecutive black African patients with HF from Soweto, South Africa. Baseline, macro- and micronutrient intake were measured via the validated Quantitative FFQ and compared to DRIs with MRC Food Finder.

**Results:** 17 men were older than the 11 women ( $51 \pm 61617$ ; 14 vs.  $47 \pm 61617$ ; 18 years;  $p < 0.05$ ), BMI profile ( $26 \pm 61617$ ; 5 vs.  $26 \pm 61617$ ; 7 kg/m<sup>2</sup>, respectively;  $p = ns$ ). Predominant form of HF was hypertensive HF (58%). Compared to the DRI, both men and women were deficient in respect to their intake of Vitamin C but adequate for thiamine. In men, Vitamin C intake was  $71 \pm 61617$ ; 90 vs. 90 mg/d compared to  $1.3 \pm 61617$ ; 0.47 vs. 1.2 mg/d for thiamine.

In women Vitamin C intake was  $66 \pm 61617$ ; 80 vs. 75 mg/d compared to  $1.1 \pm 61617$ ; 0.44 vs. 1.1 mg/d for thiamine. Plasma vitamin C concentrations were deficient in both men ( $7.6 \pm 61617$ ; 5.1  $\mu\text{mol/L}$ : normal range 23 – 85  $\mu\text{mol/L}$ ) and women ( $17.4 \pm 61617$ ; 13.63  $\mu\text{mol/L}$ : normal range 23 – 85  $\mu\text{mol/L}$ ). Both men ( $19.4 \pm 61617$ ; 5.03  $\mu\text{mol/L}$ : normal range 9 – 14 nmol/L) and women ( $20.7 \pm 61617$ ; 5.60 nmol/L: normal range 9 – 14 nmol/L) reached target thiamine plasma concentrations.

**Conclusions:** These preliminary data highlight potentially inadequate consumption of vitamin C, but not thiamine, in a group of black African patients from an urban African community. Improving fruit and vegetable consumption (for HF prevention and management) via “healthier food” programs may be particularly effective in this context.

#### 4 Consumer education on the role of red meat as part of a healthy balanced diet

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Alternative food quality movements globally have led to a turn from the mass consumption model toward a growing qualitative differentiation of products. Consequently other attributes such as food composition are gaining importance in product quality considerations.

This paper first presents food quality trends observed in the international context and the manifestation of these and other trends within the food industry. Specific focus on trends such as low fat animal products, bioavailability of nutrients such as iron and the case of supplements versus food sources will be highlighted.

From a consumer perspective improved knowledge on the composition and function of foods has contributed to many of these changes. Science driven education on health could continue these positive changes in nutritional behaviour.

Changing agents in this process should be seen as believable and trustworthy. In the case of health and wellbeing, health influencers, such as scientists and medical practitioners, are seen as the key towards change.

The role of consumer education projects in the aim to promote awareness of health and nutritional advantages of foods will be discussed. Specific reference will be made to the South African Sheep Meat Marketing Forum and the activities, successes and lessons learned since its initiation in 2007.

## Food Safety, Functional Foods

### 1 New South African food labelling regulations and the use of data from food composition tables

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**Introduction:** New food labelling regulations (R.146/2010) stipulate that when voluntary information is placed on food labels, and no nutrition claim is made, the Medical Research Council (MRC) Food Composition Tables (FCT) can be used as a source of information for single ingredient agricultural commodities (SIAC).

**Objective:** To determine to what extent the MRC FCT can be used for the new labelling regulations.

**Methodology:** The labelling regulation (no.50) pertaining to nutritional information was examined. The MRC FCT was scrutinised to identify SIAC as defined by the regulations. To correctly identify unprocessed SIAC, particular attention was given to the different meanings of processed food. Food items in the MRC FCT are categorised into 16 food groups (e.g. vegetables, fruit, beverages etc.) and the percentage SIAC in each group was calculated.

**Results:** Twenty different SIAC categories are identified in the new labelling regulations, e.g. single ingredient frozen vegetables, raw fresh tree nuts or single ingredient raw oil seeds etc. Of the 1 472 food items in the MRC FCT, 345 (23%) food items were identified as SIAC. The majority of SIAC was found in the vegetables (53%) group, followed by the fruit group (21%). Fewer (6% in the legumes group) SIAC were identified in other groups. Sixty percent of all SIAC identified is of South African origin, 36% is American and 3% is British.

**Conclusion:** Findings show that the MRC FCT can be a source of information for voluntary labelling of many SIAC in some groups but fewer in other groups.

### 2 Factors influencing the composition of South African milk

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Milk is a food with high nutritional benefits and is therefore considered an important source of food for all age groups. Already in 1963 Laben reported that whole milk provides energy from carbohydrates, essential amino acids, fatty acids, vitamins and minerals in varying amounts, brought about by both environmental and genetic differences. Not only has the economic impact of variation in fat and protein content led to much research on manipulation and alteration of these constituents, but the different amino acid, fatty acid and micronutrient profiles, and their consequent impact on health, have become current topics of debate. Increased knowledge on the impact of feeding on the quality and quantity of milk production has led to more sophisticated diet formulations for cattle. Apart from diet, breed and other environmental factors influence the composition of milk. Nutritional composition forms the basis of consumer education, and currently the focus lies mostly on the accuracy of country specific composition values. Unfortunately, the difference in composition of milk exists not only between countries, but between regions, breeds and feeding regimes within a single country. These differences, seen against the current practices, will be presented as it influences milk composition.

### 3 The importance of continued composition studies on red meat

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The nutritional content of meat is non-homogenous and dynamic. Recent composition studies on meat across the globe reflect the substantial changes over time in the composition of meat, especially a reduction in the amount of fat both on the carcass itself and after trimming in the shop or at home, as well as changes in cooking

methods (Chan, Brown, Lee & Buss, 1995; Higgs, 2000). The percentage fat present in New Zealand beef carcasses has decreased from 23.3 % in 1981 to 7.1 % in 1997 (EuroFIR, 2008). In South Africa similar results have been found with the average fat content of target grade beef which has decreased from 32 % in 1949 to 18 % in 1981 to 13 % in 1991 (Naudé, 1994). According to the 1999 edition of the Composition of South African Foods, the fat content for lamb was listed as 21.6 % (Sayed, Frans & Schönfeldt, 1999), but was derived from the United States Department of Agriculture (USDA) Food Composition

Database which has been updated since. Recent studies on the most commonly consumed South African lamb and mutton cuts reported fat values of less than 10 % on average (Van Heerden, Schönfeldt, Kruger & Smith, 2007).

Accurate and up-to-date composition data on red meat provides a critical resource for a variety of applications including the calculation of nutrient intakes of individuals and groups as well as aiding in the formulation of nutritional strategies.

#### 4 An exploratory investigation of South African consumers' perceptions of food packaging

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Consumers form perceptions of food products through their comprehension of visual stimuli on food packaging that attract their attention. These perceptions directly affect consumers' product choice which emphasises the importance of attention capturing packaging attributes. However, little research is available regarding consumers' perceptions of food packaging, especially in the South African context. This study aimed to explore a sample of South African consumers' perceptions of food packaging and how these perceptions were formed through the perceptual process.

A qualitative, exploratory study was conducted consisting of 25 semi-structured interviews assisted by ambiguous mock packaging. Participants were questioned regarding their general perceptions of food packaging. The attention capturing ability of packaging as well as consumers interpretation thereof after exposure to the mock packaging was also under discussion.

Findings from the study indicated that participants mainly perceived food packaging based on its functional (serve a purpose and aid in using the product) and physical attributes (adhere to visual criteria). Information and appearance attributes of packaging were also important in gaining consumers' attention in-store. Participants associated food products with specific types of packaging and have certain quality interpretations of the associated packaging. Negative associations with packaging mostly entailed poor quality associations and a lack of reusability.

This study indicates which product attributes are regarded as most important stimuli by participants in forming positive perceptions regarding food packaging. These findings could be applied in a larger quantitative study, ultimately leading to more positive consumer shopping experiences and consumer satisfaction regarding food packaging.

#### 5 South African consumers' opinions and beliefs regarding health benefits of soy and soy products

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Studies linking diet and health and consumers' demand for health information, has led to an increasing awareness of the role of nutrition in health and disease and also that of soy. This study assessed South African (SA) consumers' opinions and beliefs regarding the health benefits of soy and soy products.

This cross-sectional study randomly selected 3001 consumers from metropolitan and rural areas. Data of 81% of the respondents (n=2437) who had heard of soy were used. Trained fieldworkers administered questionnaires, probing consumers' opinions regarding the health benefits of soy. The data were weighted to be representative of the SA adult population (n = 18 251 000) based on gender, age and race distribution.

No practically significant differences between either gender, age groups or between rural and metropolitan respondents' opinions were found. Most respondents in the total population (50%-75%) and race groups agreed that soy has many health benefits; lowers cholesterol; helps keep your heart healthy and is good in general and for milk-allergic people, diabetes and growing children. Practically significantly more adult black consumers believed that soy is only for people with a low income, and fewer that soy milk is good for people with a milk allergy than do white, Indian and Coloured consumers.

The results indicate that SA consumers held positive opinions and associated consumption of soy with several health benefits in playing a more preventative role. It may represent a challenge to industry to design soy-containing products that appeal to a broader spectrum of consumers.

#### 6 A critical appraisal of statistical methods used in the validation of a dietary assessment tool

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The RAPP tool was developed to determine fumonisins exposure of rural, Xhosa-speaking adults in the Eastern Cape. The aim of this paper is to describe and interpret statistical methods used to determine the validity of the tool.

Sixty adult volunteers were recruited. The tool was validated against four non-consecutive 24-hour recalls (included a week-end day). Food group data was analysed with FoodFinder and statistically analysed with Stat (percentage differences (PD); Spearman correlation coefficients; tertile classifications, Kappa statistics and Bland-Altman data).

Mean PDs indicated good agreement (< 20%) for cereals, combined dishes, meat and condiments. Spearman correlations indicated good correlations (> 0.20) for cereals, combined dishes, condiments and beverages. Tertile classifications showed good classification (> 50%



in the same tertile) for combined dishes, meat and condiments, while Kappa statistics were acceptable ( $> 0.20$ ) for combined dishes, meat, condiments and beverages. Bland-Altman data indicated good agreement ( $> 95\%$ ) for cereal, condiments and beverages but indicated bias for bread, cereals, meat and beverages.

The statistical methods used for validation provide conflicting results. It is important to use various statistical methods and determine validity on the majority of the test results. Results should be interpreted based on the disease investigated, the target population (education levels, food choices and demographics) and the type of food groups/nutrients consumed.

## 7 Development of a cultural specific dietary assessment tool for people in the Eastern Cape province

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The prevalence of oesophageal cancer in rural areas of the Eastern Cape Province is high. Because of cultural diversity a culturally specific dietary assessment tool was developed to determine the maize consumption and therefore fumonisin exposure.

The SFFQ was developed with focus groups and in-depth interviews. Participants mix maize meal porridge and vegetables in combined dishes. The ratio of the combined dishes varies according to availability. The photographic set includes three portion sizes per dish and three ratio photographs per dish. Portion sizes were estimated during cooking sessions. Small, medium and large portions were determined by using the 25th, 50th and 75th quartiles of portion weight. A local resident prepared the dishes according to the traditional manner.

The RAPP tool therefore comprises a SFFQ with photographic aids representing different dishes. The FFQ has 33 food items, with frequencies ranging from once a month to number of times per day. The food photographs include portion sizes of all food items and ratio photographs for 11 dishes.

The RAPP tool is a culturally specific dietary assessment tool, which can be used in rural areas of the Eastern Cape Province in South Africa.

## 8 Validation of portion size photographs used for the RAPP tool

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The aim was to develop a dietary assessment tool to determine fumonisins exposure of Xhosa-speaking people in rural areas of the Eastern Cape. This tool included a food frequency questionnaire (developed with focus groups) with three portion size photographs and where applicable, three ratio photographs. The ratio photographs were included because participants mix maize meal porridge with vegetables (mainly spinach/imifino or pumpkin) and the ratio depends on availability.

Sixty participants were recruited from rural villages. Participants were asked to select a photograph representing their usual portion size

of eight dishes. Thereafter participants were required to dish-up the actual portion size usually eaten from a corresponding prepared dish.

Six of the dishes (porridge, stiff porridge- pumpkin, stiff porridge-imifino, samp-beans, kernels and soup) were mild to moderately (10-25%) over-estimated from the photographs. Two dishes were either correctly estimated (stiff porridge by 4%) or grossly over-estimated (crumbly porridge by 44%). Participants experienced difficulty in estimating the depth of the serving dish and used the surface area as portion size indicator. This was most probably because the chosen dishes were all amorphous in consistency. Accuracy was not influenced by gender or education. However, those older than 65 years and those with a body mass index larger than 30 over-estimated more.

## 9 The composition of South African lamb and mutton carcasses

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The objective of this study was to compare the nutrient quality of South African lamb and mutton. In South Africa, sheep carcasses are classified according to age and, subjectively, according to their fat cover. Consumers perceive meat from lamb carcasses as considerably lower in fat when compared to mutton of the same fat class. In this study, the nutrient quality of 18 lamb carcasses and 18 mutton carcasses of the most popular grade of fat code 2 were analysed. Chilled carcass sides were subdivided into the respective wholesale cuts. The cuts were dissected into meat (muscle, intermuscular and intramuscular fat), bone and subcutaneous fat (SCF) in order to determine and compare the composition per cut and for the whole carcass. The soft tissue of the carcass was analysed for percentage total fat, protein, ash and moisture. Differences in fat content were observed between the age groups, as well as between cuts. The mutton carcasses had an average of 17 % total fat in the carcass compared to 11 % found in lamb carcasses of the same fat class. In all cuts, except the neck, it was found that mutton contained higher contents of subcutaneous fat. The flank cut of the lamb carcasses contained 96 % less subcutaneous fat but 43 % more intermuscular fat when compared to the mutton carcasses. Differences were also observed between vitamin and mineral contents of meat of the different age carcasses.

## Food Security and Biodiversity

### 1 Availability and utilisation of traditional vegetables by rural Xhosa households in the Eastern Cape

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Micronutrient deficiency is a major challenge in South Africa. Traditional vegetables have been identified as one of the strategies towards alleviating the problem. The research addressed the availability of traditional vegetables at eMantlaneni village in Lusikisiki, Eastern Cape, the extent to which the traditional vegetables were utilised and the potential future use of traditional vegetables.

The data was collected using questionnaires and focus groups as well as verification and identification of traditional vegetables by a herbarium.

Findings revealed that good availability of traditional vegetables exists, but that there was a decline in traditional vegetable use in this village and that future use was threatened by a negative attitude towards traditional vegetables and associated loss of indigenous knowledge.

There is therefore a serious need for a vigorous awareness campaign to promote traditional vegetable use and nutritional education including proper cooking and preservation techniques.

## 2 Intra-urban disparities in the food security status of households in Ibadan, Nigeria

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Access to adequate food is a major public health challenge. Intervention priority is often given to rural households oblivious of the fact that there are socio-economic inequalities within urban areas as well. This study assessed food security status using an adapted and pre-tested 18-core module questionnaire in three (high (Bodija), medium (Mokola) and low (Foko) income) locations of Ibadan among 360 randomly selected women. Differentials were found in household monthly income as highest earning was found in Bodija 25 (71.4%) followed by Mokola (36.2%) and Foko (6.2%). Main household source of food was market purchase (90%) while 66% of all households surveyed were food insecure with the highest in Foko (82.1%), followed by Mokola (56.2%) and Bodija (14.3%). Food insecurity with severe hunger was highest in Foko (35.4%), followed by Mokola (15.4%) and none in Bodija ( $p < 0.05$ ). These results highlight the need for strategic site specific interventions.

## 3 The possible impact of inflation on nutritionally vulnerable households in South Africa

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Food is a basic human physiological need that is important for survival, growth and health. Without an adequate supply of food a human being cannot grow or develop optimally, nor utilize energy for sustained livelihood, thereby implying food insecurity. South Africa (SA) is classified as a developing country, with developing countries representing a third of the world population. It is recognized that the current rate of food inflation is a worldwide phenomenon and it is argued that the case study is presenting a much wider insight than just an individual country. About 35% of the SA population is food insecure and categorized as being poor. With the current increase in food prices, especially staple food prices, most households need to employ food coping strategies (FCS) to survive. Some of these FCS have significant negative impact on their often already deprived nutritional status. The possible added impact of inflation on the nutritional status of vulnerable SA households is discussed.

A consequent potential reduction in portion sizes consumed due to increased food prices, as well as a snapshot of the cost of a balanced varied diet compared to average household income, are argued in the context of SA's prevailing inadequate nutritional situation.

## 4 Ownership of a pressure cooker associated with better food security in HIV/AIDS affected Indian households

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**Background and objectives:** While households affected by HIV/AIDS have increased costs related to food and health care, little is known about modifiable determinants of household food security. This study explored associations between household food security and potentially modifiable household-level factors in low-income families affected by HIV/AIDS in Aurangabad India.

**Materials and methods:** Households belonging to a network of PLWH were confidentially invited by the network to participate. Adult caretakers were interviewed to assess household food security, household environment and assets. Associations compared households with low versus very low food insecurity, using logistic regression to control for confounding variables.

**Findings and results:** The study identified 132 food insecure households. The strongest result was that owning a pressure cooker was protective against high food insecurity after controlling for confounding variables by SES (OR = 0.19; 0.09-0.40).

**Conclusion:** The results show providing pressure cookers, which reduce fuel costs, may decrease cooking fuel costs, reduce burden on income and improve household food-security.

## 5 Contribution of bananas to household nutrition and food security in the Rakai district

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**Rationale and Objectives:** Bananas are key to both the food security and the agricultural sustainability in Lake Victoria Basin where the Rakai district is situated. Therefore, there was need to establish the contribution of matooke (green cooking bananas) to household nutrition and food security.

**Materials and Methods:** A total of 173 people living with HIV/AIDS (PLHIV) were purposively selected. Gibson's 24 hour recall method, food frequency and food security questionnaires were used.

**Results:** Overall, 85% of respondents ate matooke the day before interviews. It contributed 38% of their total energy intake (1676kcal). Matooke was also the most consumed food (88%) (at least 3 times a week) and it was the crop most often sold (73%) for household income.

**Conclusion:** Bananas make a significant contribution to household nutrition and food security in Rakai district.

## Micronutrients

### 1 What form of minerals is more bio-available and easily absorbed by the body?

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Minerals are a class of micronutrients described as solid, crystalline substances and cannot be synthesized by the body for nutritional purposes. Minerals exist in the body and food predominantly in an ionic state forming positive and negative ions and also as components of organic compounds bound to proteins or complexed.

Many minerals are considered vital and mineral supplementation is an essential part of nutritional therapy.

There is a presupposition that minerals in supplements are easily absorbed by the body. However, to be effectively absorbed and utilised at a cellular level for metabolic processes, minerals need to be ingested in a bio-available state.

Bio-availability is the measure of the availability of a mineral within the small intestine for absorption of the mineral; implies retention of the mineral in the body and its use in cellular or tissue functions. Regardless of high nutrient levels or how well formulated the product, if minerals are not bio-available, money and effort have been wasted. Chelation is a naturally occurring process in the body to facilitate transport of minerals across the intestinal wall as part of digestion. A mineral is only chelated when chemically bonded to amino acids with at least two bonds from each amino acid. The chelation process markedly reduces all known mineral interactions in the body by increasing their bioavailability significantly.

When used as part of nutrition supplementation chelated minerals increase the effectiveness of mineral supplementation, decrease the risk for nutrient toxicity and increase cost-effectiveness of mineral supplementation.

### 2 Why is bioavailability important in mineral nutrition?

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Mineral supplementation is an essential part of nutrition therapy for all patients. However, the concern is how much of these minerals that are ingested, are available for metabolic processes. Minerals have to be absorbed by the body before it can be utilized in the body; a concept known as bioavailability.

Bioavailability is vital as nutritional intake needs to be available to various body systems for growth, maintenance of body tissues, reproduction and other performance factors. Regardless of how high the nutrient levels or how well formulated the product, if the nutrient is not bioavailable for use by body tissue, money and effort have been wasted. Scientific data shows that nutrient antagonisms between various nutrients, nutrients and non-nutrients and nutrients and drugs, influence the absorption of minerals by the body. As a result of this, patients taking chronic medication tend to be micronutrient deficient.

Chelation occurs naturally in the body to facilitate transport of minerals across the intestinal wall as part of digestion. A mineral is only chelated when it is chemically bonded to amino acids with at least two bonds from each amino acid. The chelation process markedly reduces all known mineral interactions in the body by increasing their bioavailability significantly. When chelated minerals are used as part of nutrition supplementation, not only is the effectiveness of mineral supplementation increased, but in addition the risk for nutrient toxicity is decreased and the cost-effectiveness of mineral supplementation increased.

### 3 Effect of different maize meal diets on growth and vitamin A status

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The Department of Health of South Africa embarked on fortification of wheat flour and maize meal in 2003 as part of a multipronged approach to alleviate malnutrition. Considerations beyond the methodologies employed in the addition of micronutrients to foods influence to a large extent the potential of food fortification to meet its nutritional objectives.

One of these considerations is the availability of certain micronutrients in the fortified foods. Although it would be ideal to use humans directly to answer this critical question regarding vitamin A availability and carotenoid absorption, appropriate animal models can be used. The metabolism of vitamin A and carotenoids in humans is closely related to that of chicken. Chickens are also very susceptible to vitamin A deficiencies with symptoms very similar to humans and results are most likely to be obtained. Chickens are also manageable and affordable.

The aim of this study was to determine the relative efficacy of the daily consumption of maize meal in sustaining or improving the vitamin A status, by using a chick-model. Five treatments were administered in the study, including three white maize meal treatments and two yellow maize meal treatments, with or without added vitamin A. Growth, feed conversion and liver retinol stores were measured. Vitamin A status was evaluated by the liver retinol stores of the chickens on different diets over a six week period and conclusions will be presented.

### 4 Iodine deficiency in school-going children in Bie province, Angola

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With limited national data on the iodine status in Angola, there is concern for iodine deficiency and its disorders. The aim of the study was to determine the iodine status of school-going children in the Bie Province (population of 1.2 million) of Angola. A cross-sectional study was conducted in 24 schools of Bie Province. A total of 826 urine samples of school children, aged 6 to 10 years, were collected for urinary iodine (UI) analysis. In addition, 22 retail salt samples purchased at markets in the close vicinity of the participating schools were analysed quantitatively for iodine content.

The overall median UI concentration was 28.7 mcg/l, which indicates a moderately deficient population. Of these children 78% had UI below 50 mcg/l. The median UI in all schools were below 100 mcg/l.

Children in five schools were severely iodine deficient with UI medians below 20 mcg/l, and 17 schools had UI medians between 20 and 49 mcg/l. Furthermore the median iodine content of the retail salt samples was 4 ppm.

The widespread occurrence of severe and moderate iodine deficiencies have serious implications for the cognitive development of Angolan children, as well as for Angola's development in terms of productivity and economic potential. From this data it is clear that the responsible authorities should immediately take urgent public health measures to eliminate the iodine deficiency in the study areas.

## Nutrition Programming & Maternal and Child Health

### 1 Micro-environmental factors influencing breastfeeding and weaning practices of mothers/caregivers at a clinic in Hammanskraal

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**Objective:** To qualitatively investigate the micro-environmental factors that influence breastfeeding and weaning practices of mothers and caregivers.

**Setting and subjects:** The study included 65 women that were attending the Rakopantswe Clinic for health care services in the Swartdam district of Hammanskraal (North West Province) during February 2009. Convenience sampling was used.

**Methods:** Structured focus group interviews were conducted according to the phenomenological approach, and were analyzed by means of content analysis. Descriptive statistics were used for the analysis of the biographical questionnaire.

**Results:** Though the majority of participants had sound basic knowledge and positive attitudes regarding breastfeeding and weaning practices, they revealed contradicting beliefs and values. Although most participants had a positive inclination towards the practice of exclusive breastfeeding, this study revealed that the implementation thereof was contradictory. Clinics and grandmothers were found to be the most influential external micro-environmental factors. The influence of the grandmothers was often controversial. False beliefs seemed to be the most influential/interfering internal micro-environmental factor.

**Conclusion:** The clinic was the main disseminator of nutrition education to the majority of the participants. External micro-environmental factors seemed to interfere with the implementation of the nutrition messages with regards to correct breastfeeding and weaning practices. Confusing nutrition education messages seemed to cause many misconceptions. Addressing the external micro-environmental factors can be beneficial to the community in respect of practising correct breastfeeding and weaning practices. Thus the mothers/caregivers will probably be more participatory in adhering to the recommended practices.

### 2 The nutritional status of pregnant women in the Vaal region, South Africa: is there a need for intervention?

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Pregnant women have to meet their own nutrition requirements and also supply nutrients to the growing foetus, therefore low dietary intake in these women will have adverse effects on the health and nutritional status of both the mother and her offspring (Ramachandran, 2003). This study aimed to assess the demographic profile, anthropometric indicators and eating patterns of pregnant women in the Vaal region, South Africa. The main purpose of this study was to determine the nutritional status of the pregnant women in order to determine the need for an intervention study to improve the nutritional status of the pregnant women (n=86). A validated demographic, health and medical questionnaire, and QFFQ was used and statistically analysed. Trained fieldworkers conducted interviews. The anthropometric measurements included weight and height. The daily intakes of the women were follows (mean  $\pm$  SD) : 11284.59  $\pm$  4002.16kJ, 85.85  $\pm$  36.88g protein, 97.99  $\pm$  43.66g fat, 337.04  $\pm$  132.96g carbohydrate, 13.74  $\pm$  7.48mg iron, 295.80  $\pm$  237.79  $\mu$ g folic acid. The results showed that 77% of the pregnant women were unemployed and 63% of the sample population were overweight or obese. There is a clear indication that the sample population was not aware of proper dietary guidelines. Most of the items consumed were low in iron. Therefore there is a need for an intervention study to improve the food and nutrition security of low-income, pregnant women in the Vaal region in order to prevent malnutrition during pregnancy and improve the iron status of the mothers and their babies.

### 3 The effect of nutrition education about iron deficiency anaemia on the practises of junior high school girls

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**Objective:** Iron deficiency anemia is the most common nutritional deficiency worldwide and Iran is no exception. It can cause reduced work capacity in adults and affects motor and neural development in children and adolescents. This study was carried out to evaluate the effect of nutrition education on the practices of junior high school girls about dietary iron.

**Method:** During the study, 70 students with iron deficiency anemia (based on hemoglobin (Hb). Ferritin (Fr) & total iron binding capacity percentage (TIBC %) levels were randomly selected and assigned to a control or intervention group (35 students each). Socio-economic practice and nutritional habits data were collected using pre- and post-test questionnaires. The post test was conducted three months after the nutrition education programs. The variables were analyzed using pair sample t-test (SPSS 14). Results: The results showed significant improvement in the dietary practices (P<0.05). Biochemical findings showed a significant increase in the Hb, Fr & TIBC%.

**Conclusion:** It seems that a nutrition education program about dietary iron in adolescent girls could be an effective strategy to improve the nutritional habits, increase dietary iron, prevent iron deficiency anemia and reduce its' complications.

#### 4 A nutrition education programme for primary school children: short- and long-term changes in nutrition knowledge

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**Introduction:** The objective of this study was to improve nutrition knowledge amongst primary school children within an informal settlement.

**Materials and Methods:** A nutrition knowledge questionnaire was developed and tested for internal reliability (Cronbach Alpha). Pre- and post-evaluation tests were completed with an experimental and control group. The questionnaires were analysed statistically for descriptive statistics on SPSS, version 17.0. The Nutrition Education Programme (NEP) was implemented over nine hours (11 weeks), with seven hours for teaching from the activity book and two hours for games.

**Results:** An immediate improvement of 0.13 units was found from pre- (0.47) to post (0.60) results but there was a slight decline in the long-term (0.54) measurements. Topics with significant improvement were related to the servings of foods to be consumed on a daily basis from each food group, nutrient content and function of specific fruit and vegetables. Poor nutrition knowledge occurred within topics of the importance of specific nutrients, importance of variety within the diet, linking of fruit and vegetables to nutrients, identification of low-fat snack items, and the classification of the starch food group with serving size and daily requirements. Poor long-term retention occurred for topics relating to calcium-rich foods and function thereof, linking of fruits and vegetables with specific nutrients, serving size of protein-rich foods, the importance of health and physical activity, and the importance of breakfast.

**Conclusions:** Although nutrition knowledge retention occurred for certain nutrition-related topics, a method needs to be identified to encourage continuous revision of the work covered in the NEP.

## Nutrition, Human Rights and Ethics

### 1 South African clinical private practising dietitians' perceptions on the relevance of health care service specific marketing principles and communication

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South African dietitians are confronted with the challenge of effectively marketing themselves as a sound source of nutrition information to both the public and other health professionals. The marketing

initiative should be focused on the promotion of the profession itself and individual practices.

**Aim:** To assess the perception of South African clinical private practising dietitians on the relevance of health care service specific marketing principles and communication elements (within the ambit of Act 53 of 1974).

**Sample:** Convenience sampling was used (N = 79) for a descriptive cross-sectional survey in the quantitative domain.

**Methodology:** Data were collected by means of an electronic questionnaire. The response rate was low (16.8%) and results could not be generalized.

**Results:** The dietitians seemed more focused on the science of nutrition than on marketing their profession and individual practices. There was an overall awareness about the need for marketing in the dietetic private sector but the importance and implementation thereof did not receive the amount of attention that it justified. A number of health care service specific marketing principles received "slightly relevant" or "not relevant ratings".

**Conclusion:** For the dietetic profession to reach its full potential in South Africa and for dietetic private practices to be successful on all levels, dietitians need to focus more of their energy and time on business related aspects such as marketing. By integrating the theory from the literature and the findings from the study a profession specific marketing model.

## Obesity and Chronic Diseases of Lifestyle/Non-Communicable Diseases

### 1 The Vitality Nutrition Assessment, 2006-2010: a review

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**Introduction:** Chronic diseases of lifestyle result in prolonged illness, disability, and decreased quality of life. But many are preventable through interventions that include healthy eating and regular activity. In 2006 Discovery Vitality launched a Vitality Nutrition Assessment (VNA) to increase awareness about healthy dietary practices and to identify members at risk for developing chronic disease.

**Objectives:** To review: • VNA uptake and trends, including self-reported dietary practices of Vitality members; • The VNA's association with other health-related activities; • To compare dietary practices and health claims patterns of members with chronic conditions to members without. **Methodology:** Data was collected from 8607 assessments completed between January 2006 and December 2009. Self-reported medical history, dietary scores and claims data were analysed.

**Results:** Of the 8607 completed VNA's, 998 respondents undertook more than one VNA. Forty six percent of respondents had improved dietary scores on completion of their second VNA. There was a 24% increase in the number of VNA's completed since the launch of the HealthyFood™ benefit, 172% increase in the number of health risk assessments completed, and a 16% increase in gym benefit utilization. Of the respondents, 10.5% (n=747) reported diagnosis of

a chronic disease. Those with chronic conditions and poorer dietary scores had 7.8% higher admission rate than those with superior eating habits. For healthy individuals, hospital admission rates were 3.6% lower for those with superior dietary scores.

**Conclusion:** The VNA provides an important avenue for member education and lifestyle intervention, particularly targeting individuals at risk for developing chronic conditions.

## 2 Nutrition education needs of adults with type 2 diabetes mellitus in a resource-poor setting

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**Aim:** To explore and describe the nutrition education needs in adults with type 2 diabetes mellitus to guide the development of a tailored nutrition education (NE) programme.

**Setting:** Makapanstad and Mathibestad Community Health Centres in Moretele Sub-District, North West Province, South Africa.

**Study design:** Phenomenological study in the qualitative domain.

**Participants:** Convenience sample of 31 non-insulin dependent type 2 diabetic patients and ten health professionals.

**Methods:** Focus group discussions, using semi-structured questions, were held with the diabetics. Open ended self-administered questionnaires were used with the health professionals. Data analysis was done using qualitative content analysis.

**Findings:** Disease-related knowledge deficits (causes/risk factors, complications) were common. Reported dietary intake revealed problems with portion control, intake of balanced meals and unsatisfactory intake of fruits and vegetables. Recommendations for a NE programme included topics related to the disease (e.g. causes, complications) and others related to the diet. The health professionals identified starch portion control and balanced meals as essential topics. Group education at the clinic, a competent educator and comprehensive education were indicated by the patients. Participation of family and provision of pamphlets were aspects recommended by both groups of participants. Barriers that could impact the NE included financial constraints and food insecurity, conflict in family meal arrangements and access to appropriate foods. Support from family and health professionals and empowerment through education were identified as facilitators to following dietary recommendations.

**Conclusion:** Insight was obtained for the development of a tailored NE programme. Input from the health professionals can complement that of the patients. This research is supported by a research grant from the South African Sugar Association

## 3 Dietary pattern and biochemical indices related to BMI in the personnel of ACECR-Khuzestan, Iran

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**Objective:** This study compared dietary pattern (DP) and biochemical indices to BMI among the personnel of ACECR-Khuzestan.\*

**Method:** In a cross-sectional study, 198 subjects aged 21-62 years old were examined. Lipid profile, fasting blood glucose (FBG),

systolic- (SBP) and diastolic blood pressure (DBP) levels were determined. Obesity, overweight, normal and underweight were defined as BMI >30 kg/m<sup>2</sup>, 25-29.9 kg/m<sup>2</sup>, 18.5-24.9 kg/m<sup>2</sup> and ≤ 18.5 kg/m<sup>2</sup>. DP was evaluated with a qualitative food-frequency questionnaire. ANOVA test and Pearson correlation coefficient were used for data analysis.

**Results:** Obese subjects reported a higher monthly consumption of pasteurized and more daily consumption of native (high fat) cheeses than underweight ones (P=0.042 and 0.047, respectively). There was a significant positive association between BMI and monthly consumption of grains (r=0.874, P=0.023) and weekly consumption of commercial juice (r=0.635, P=0.008). Overweight subjects had higher total serum cholesterol levels when compared to normal subjects (P=0.004). Obese subjects had higher FBG compared to underweight (P=0.017), normal (P=0.001) and overweight participants (P=0.001). SBP was higher in overweight (P=0.01) and obese (P=0.004) and DBP was higher in obese (P=0.008) than normal weight subjects.

**Conclusion:** The study found that a DP that includes a high consumption of grains, commercial juice and high fat dairy products, is associated with obesity in adults.

\*ACECR: Academic Center for Education Culture and Research – Khuzestan

## 4 Dietary pattern of patients with non-insulin dependent diabetes mellitus

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**Rationale and Objective:** The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030. The crude prevalence of non-insulin dependent diabetes mellitus was 2.1% (men 3.1, women 1.3%) in Bangladesh.

The objective of the study was to determine the dietary pattern of patients with non-insulin dependent diabetes mellitus.

**Methodology:** A cross sectional study was undertaken involving 60 patients with non-insulin dependent diabetes mellitus, aged ≥30 years, both male and female and selected randomly between May and August 2006. The patients who had a fasting blood glucose of more than 6 mmol/L and lived in Zigatola, Kalabagan and Dhanmondi area was selected for the study.

**Results:** Of the patients surveyed 43% ate rice and 62% ate bread twice a day. 43% ate egg, 77% pulse, 44% meat and 27% ate fish twice a day. Only 33% and 17% of patients ate leafy- and coloured vegetable respectively twice a day. Nearly 37% of patients used artificial sweeteners and only 26% did exercise daily to control their diabetes. Among all patients high fasting and random blood glucose levels were 20% and 25% respectively. 22% of patients had high blood pressure levels and 55% patients had high BMI.

**Conclusion:** The study observed that diversification of food behavior existed among the patients and that patients do not follow the recommended diet as was prescribed.

## 5 Piaget's vertical-horizontal illusion in portion size estimation

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**Background and aim:** Portion size estimation, particularly in children, may be influenced by visual illusions, e.g. Piaget's vertical-horizontal illusion, where a vertical line is perceived to be longer than a horizontal line of the same length. This study aimed to determine if this illusion affects grade 6 and 7 children to the same extent as their caregivers by using inverted T-drawings and drinking glasses as test objects.

**Methods:** In a cross-sectional study 49 children (mean age 12.5±0.8y) and 38 caregivers (median age 41.5y) compared the segment-lengths of inverted T's with identical vertical and horizontal dimensions, and the volume of five differently-sized perpendicular drinking glasses relative to a reference can, which agreed in volume to two of the glasses (one "short and broad", the other "thin and high"). Fisher's exact and McNemar's test for symmetry were respectively used for between and within group comparisons.

**Results:** Piaget's vertical-horizontal illusion based on the inverted T-test affected the majority (61 – 89%) of children and adults. In the case of glasses, this illusion was much less common, yet caregivers and children differed significantly ( $p=0.019$ ) with respect to the proportion where visual illusion was present (5.3% vs 24.5%). There was a significant ( $p=0.0003$ ) asymmetry in visual illusion between glasses and the inverted T-test, in particular the asymmetry was toward the inverted T.

**Conclusion:** Perceiving vertical lines as longer than horizontal lines of identical length is common in adults and children. The practical effect of this for estimating drinking glass capacity is much less, yet may be of importance for children.

## 6 Waist-height ratio, body mass index and waist circumference as predictors of adult dyslipidaemia

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**Background and Aim:** Waist-height ratio (WtHR) has been proposed as a new measure of abdominal obesity and predictor of non-communicable disease risk. The aim of this study was to compare WtHR, body mass index (BMI) and waist circumference (WC) as predictors of adult dyslipidaemia.

**Methods:** In a cross-sectional study at Steve Biko Academic Hospital (Gauteng, South Africa) the WtHR, BMI, WC and lipogram values (total cholesterol [T-chol], LDL cholesterol, HDL cholesterol and triglycerides [TG]) of 57 in- and outpatients (male:female ratio 3:2; age: 54±1y; 51% black, 42% white, 7% coloured) were dichotomised. Ability of the three anthropometric indicators to predict abnormalities in serum lipoproteins was determined using diagnostic testing and receiver operating characteristic (ROC) curves.

**Results:** All three anthropometric indicators individually showed higher sensitivity than specificity with many false positives. The mean sensitivities against all indicators of dyslipidaemia combined were WtHR 0.93, BMI 0.84 and WC 0.70; the mean specificities were

WtHR 0.25, BMI 0.31 and WC 0.46. Thus WtHR was the most sensitive, but the least specific of all three indicators. Low values for the area under the ROC curve (T-chol 0.53; LDL 0.59; HDL 0.60; TG 0.68) indicated that a combination of the three anthropometric indicators did not predict abnormalities in any of the serum lipoproteins well. Overall, WtHR appeared not to be superior to BMI or WC for predicting dyslipidaemia.

**Conclusion:** WtHR, BMI and WC were sensitive, but not specific predictors of dyslipidaemia in this sample.

## Public Health Nutrition

### 1 Hair and saliva as indicators of zinc and iron status in children

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**Background:** The current method of determining the iron and zinc status for children involves the drawing of blood, so that serum levels can be determined. However, the drawing of blood samples is an invasive, costly procedure. The aim of this study is to determine whether hair and saliva samples can be used as an alternate, yet accurate method for determining zinc and iron status in children.

**Study Design and Population:** This is a community based cross-sectional study conducted in Ceres, Western Cape Province. A total of 236 subjects between the ages of 7 and 9 years were randomly selected from the six primary schools during 2003 and 2004.

**Methods:** Age and gender were captured on a simple questionnaire whilst one hair, one saliva and one venous blood sample were collected under medical supervision following aseptic and trace element free procedures. The blood samples were analyzed by a registered pathology laboratory for iron and zinc, whilst hair and saliva samples were analyzed by the researchers using atomic absorption spectrophotometry after Aqua Regia digestion.

**Results:** A statistically significant association was found between blood ferritin levels and hair iron stores in the 2004 sample group ( $p=0.033$ ). No association was found for the serum ferritin or serum zinc levels with the 2003 hair and saliva samples nor with the 2004 serum zinc and hair/saliva samples.

**Conclusion:** A significant relationship was found between hair iron samples and serum Ferritin levels for the 2004 study sample.

### 2 Knowledge, attitude and practices regarding the baby friendly hospital initiative in Cape Town obstetric units

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**Objectives:** To assess nursing staff knowledge, attitudes and practices regarding BFHI, to assess unit managers knowledge and attitude regarding the Baby Friendly Hospital (BFHI) principles and to describe the barriers and constraints to implementation of BFHI principle for 8 non accredited Maternity Obstetric Units (MOU) in Cape Town.

**Subjects:** Data were collected from 8 MOU unit managers and a random sample of 45 nursing staff.

**Results:** The study demonstrated a fair awareness and knowledge of some of the recommended BFHI principles. Only 56.6 % of staff could define rooming – in, 47.2 % could define the components of BFHI and 52.8 % of the respondent could name 3 baby friendly care practices and routines. Eighty nine percent of the nursing staff was able to demonstrate correct positioning of the baby for breastfeeding and 91.1 % could demonstrate the correct attachment of the baby to the breast. Only 8.9 % of the nursing staff was able to adequately demonstrate correct hand milk expressing technique, 35.6 % knew about the correct management of painful nipples and 22.2 % the management of engorgement. An alarming 40 % could adequately describe the safe preparation of infant formula. The majority of the nurses had positive attitudes toward BFHI principles and practices.

**Conclusion and Recommendations:** The findings of this study have highlighted that there is a need for BFHI training in the non accredited MOU's. Special attention needs to be given to training of the lower level staff especially the enrolled nursing assistant and enrolled nurse.

### 3 The toolkit approach used for the Healthkick intervention project

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**Background:** The HealthKick project aims to promote healthy lifestyles in primary schools in the Western Cape. An intervention programme was introduced at eight of 16 urban and rural schools.

**Intervention Format:** Participating schools identified the necessary areas where they could optimise their nutrition and physical activity environments. An action planning process was followed by developing a planning guide to direct the process. The five “action zones” are, School Health Policies and School Environment; Life Orientation curriculum; Parent and community involvement; Sport and Physical activity; and Staff Health Promotion. The action planning process involved firstly, “taking stock”, whereby educators could assess their school according to the five zones and identify those areas where action is needed, and secondly, deciding which steps to follow and who would be responsible.

Schools are supported in their actions by a “toolkit” containing, 1) Activities and assessment possibilities within the existing life orientation curriculum document aimed at Grades 4-6; 2) A Resource Box comprising nutrition and physical activity-related information in six magazine holders in a stow-away file box and a plastic bin with the physical activity equipment, e.g. soccer balls; and 3) A Resource Guide containing information about existing resources.

The intervention material is collated in an “Educator’s Manual” which could be used by educators for incorporation into any school environment.

**Conclusion:** Utilising an action planning process supported by a toolkit containing existing and updated resources could contribute to healthy nutrition and physical activity environments at primary schools in disadvantage settings.

### 4 The impact of sociodemographic characteristics on anthropometric patterns of adults in Botswana

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**Introduction:** In view of the nutritional transition in African countries, an investigation of the nutritional status of adults in Botswana is important for the development of nutrition intervention programmes. Sociodemographic and economic characteristics are very influential and have an impact on the nutritional status of an individual.

**Objective:** To determine the Anthropometric patterns of adults in Botswana and the impact of sociodemographic factors on their nutritional status.

**Methodology:** The study was a cross sectional survey and included 1407 adults in Botswana. Sociodemographic status of each household was assessed by a questionnaire and Anthropometric measures were taken using standard procedures. The t-test, analysis of variance and multivariate linear regression analysis were performed using SPSS version 17.0.

**Results:** The overall prevalence of underweight was 8.7%, and more men (13.0%) than women (7.6%) were undernourished. In contrast, about 49.7% of females were either overweight or obese compared to 20.4% of males. Both under nutrition and over nutrition are of public health significance in adults in Botswana. Low socioeconomic status influenced adiposity differentially by being protective of overweight/obesity in males (overweight, OR, 0.33, CI, 0.17 – 0.76; obesity, OR, 0.17, CI, 0.04 – 0.71) but increased the odds of obesity in women (OR, 2.59, CI, 1.46 – 4.50). Urbanization increased the risk of overweight in women.

**Conclusions:** Botswana is undergoing a nutrition transition, therefore an integrated nutrition strategy is needed to solve the nutritional problems facing Botswana, as it will address all underlying factors that impact on nutrition.

### 5 The role of the food retail milieu and socioeconomic position on food purchasing patterns in Khayelitsha

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**Background:** An understanding of individual-level socioeconomic as well as upstream environmental predictors of food purchasing and thus healthy eating is imperative in order to develop appropriate nutrition and health interventions. Understanding the complex world of food choice requires a meticulous examination of multiple stimuli and deterrents of food choice such as, inter alia: micro-level compositional socioeconomic aspects as well as macro-level contextual influences of food cost, availability and accessibility.

**Aim:** This study sought to uncover some of the widely known environmental (contextual) and compositional (individual-level) socioeconomic factors that influence Health Club Members’ (HCMs) ability to access and afford healthy foods within the community where they live.



**Study design:** The research employed both descriptive quantitative and qualitative study designs.

**Study population and sample:** The target population which was also the sample comprised 50 Health Club Members who were residing in Harare and the surrounding area within Khayelitsha at the time of the study.

**Data collection and analysis:** Data was collected by means of face to face quantitative interviews using a questionnaire, in-depth interviews, Key informant interviews, as well as observations. Quantitative data was analyzed using SPSS version 16.0 and MS Excel 2007 for Windows. Qualitative analysis was executed using framework and content analysis techniques.

**Results and conclusion:** The study established that low socioeconomic status, poor access to healthy food choices, and lack of constant availability of such foods were primary challenges facing some of the HCMs in their quest to afford and access healthy food.

## 6 Relation between BMI and gender among a group of children and adolescents in Jordan

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**Background:** The BMI growth charts shows health care providers how kids are growing compared with other kids of the same age and gender.

**Aim:** To evaluate the current BMI for a group of children and adolescents in Jordan using the BMI for age charts.

**Methods:** The study was done in Red crescent in Ashrafieh, Jordan. Children and adolescent families residing in Ashrafieh were contacted by phone to participate in the study during March 2009. Height and weight measurement were obtained from 61 children and adolescent aged 3-16 years old, 34 girls and 27 boys. Height and weight were plotted against BMI for age growth charts.

**Results:** BMI distribution for all participants: (below 5th percentiles, 13% of the study group), (5th percentile, 2%), (10th percentile, 11%), (25th percentile, 20%), (50th percentile, 18 %), (75th percentile, 16%), (85th percentile, 5%), (90th percentile, 7%), (95th percentile, 3%) and (5% had a BMI above 95th percentile). The majority of males (33%) had a BMI at the 25th percentile, while 22% of males had 50th percentile BMI, and 15% had a BMI at the 50th percentile. While the majority of females (21%) had a BMI below 5th percentile, and 18% of females had BMI at the 10th percentile, and 18% had a BMI at 75th percentile. Nine females showed a BMI below and above the normal BMI trends compared to only 2 males. However, t-test showed no significant difference between males and females in the BMI growth trends.

**Conclusion:** One measurement of BMI do not allow for interpretation of growth status but it helps to identify kids and adolescents who are at risk for becoming malnourished. This study may suggest a growth problem among children and adolescents particularly females. A larger sample group and follow up will help to give more insight about growth trends in Jordanian children and adolescent.

## 7 Relation between breakfast skipping and daily consumption of milk among a Jordanian group of children and adolescents

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**Background:** Many studies have evaluated the positive health effects of eating breakfast.

**Aim:** To evaluate the relation between breakfast skipping and daily consumption of milk among a Jordanian group of children and adolescents.

**Methods:** The study was done in Red crescent, Ashrafieh branch, Jordan. Children and adolescents families residing in Ashrafieh were contacted by phone to participate in the study during March 2009. Direct assessments by interview were obtained from 61 children and adolescents aged 5-16 years old, 33 girls and 28 boys.

**Results:** In this study, 55% of children and adolescents ate breakfast daily, 25% ate breakfast occasionally (2-3) times per week especially over the weekend (Friday and Saturday), while only 13% did not eat breakfast at all as they said did not like to eat in the morning or they did not have time for breakfast. 40% of the study group consumed milk daily at home as it is not offered in school cafeteria (in schools where the participants of this study group go). 79% of those who ate breakfast daily drank milk, out of those who ate breakfast occasionally 38% drank milk, while only 26% of those who skip breakfast drank milk. This shows that breakfast eating was associated with higher daily consumption of milk but not significant ( $p > 0.05$ ).

**Conclusion:** The results suggest that eating breakfast was associated with higher consumption of milk. However, further research about predictors of consumption and food environment at home and school may help identify ways to improve diets of children and adolescents in Jordan.

## 8 Assessment of the nutrition status of adolescent students at the National Ribat University, Sudan

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Adolescence is considered a nutritionally vulnerable period because of the increased needs for all nutrients and the changes in lifestyle and food habits that affect nutrient intake. Good nutrition during adolescence is essential for survival, physical growth, mental development, performances, productivity, health and well-being. Nevertheless, many adolescents experience a variety of health and nutritional problems. The aim of this study was to estimate the nutritional status of adolescent students at the National Ribat University and compare it with the RDAs. An epidemiological, cross-sectional, descriptive, facility-based study was conducted at the National Ribat University. Health students ( $n = 121$ ) from different colleges were included. Weight and height were measured twice and BMI was calculated. Dietary assessment was achieved using repeated 24-hr recall records. SPSS and Excel were used to analyse

the data. The mean age of students was  $17.7 \pm 0.5$  years. 78% of students had a normal BMI, while 21% were either overweight or obese. Only one student was underweight. Average energy intake was less than the recommended amounts by the WHO amongst both male and female adolescents, while protein and carbohydrate intake were more than the RDAs. Average intake of calcium and fibre were inadequate amongst male and female adolescents, while intake of iron was inadequate amongst female adolescents only. The majority of students took two meals and 2-3 times of snacks per day.

## 9 Determination of fruit and vegetable consumption among primary school children (7-12 years) in Khartoum province

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Fruits and vegetables in the daily diet have been strongly associated with reduced risk of some forms of cancer, heart disease, stroke, and have a significant protective effect against other chronic diseases. During childhood, many children do not meet the recommended guidelines for fruits and vegetables and may refuse them all together. The aims of this study were to determine the daily amount of fruits and vegetables taken by primary school children aged 7-12 years and compare it with the recommended daily allowance as well as to determine the factors associated with children's intake of fruits and vegetables. An epidemiological, descriptive cross-sectional, retrospective community-based study was conducted in El Mansheya area. Healthy school children ( $n = 150$ ) aged 7-12 years were included. Data was collected using a structured locally developed food frequency questionnaire. Serving sizes of fruits and vegetables were estimated according to the USDA food pyramid for this age group. SPSS was used to analyse the data. The mean age of the children was  $(10 \pm 1.7)$  years. The majority of children (59.3%) did not consume fruits and vegetables and the main reasons for not consuming these food items were either due to the dislike of taste (48.7%) or financial reasons (10.6%). Overall children had a low intake of fruits (12%) and vegetables (26%) whether cooked or raw as compared to the recommendations (3-4 servings). Fewer children (14%) ate fresh fruits and vegetables.

## 10 Provision of nutrition education by the internet: the DietDoc experience

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Experience gained in the provision of nutrition education via the Internet during the past 14 years as DietDoc, can serve as a guideline for future use of the powerful electronic media for transmission of nutrition and health messages to the public. An analysis of the history and development of the DietDoc Service on WorldNet-Africa, MWeb and Health24 is used to illustrate the strengths and weaknesses of Internet nutrition communication. The statistics of direct communication to the public in a typical year will highlight the gaps that exist in public knowledge of nutrition, diets and health. The most popular nutrition-related, public topics are weight loss and every

aspect associated with the present obesity epidemic, underweight, IBS, insulin resistance, and infant and child nutrition. The lack of imparted nutrition information and referral to dietitians by the medical profession remains a serious stumbling block to assisting patients with serious conditions that require and would benefit from dietetic interventions. In addition, the proliferation of fad diets and over-the-counter slimming pills and products, are challenges that the Dietetic Profession must address sooner, rather than later. This paper includes a breakdown of slimming pill ingredients, both pharmacological and herbal, and the side-effects they can cause. The DietDoc experience clearly shows that South Africa needs a dietetic forum to control exploitation of the public by untrained individuals who regard themselves as weight loss 'experts' and distribute potentially dangerous and misleading diets, dietary information and slimming products.

## 11 Anthropometric status, dietary adequacy, iron status and school performance of learners attending Sunnyside Primary School, Pretoria.

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**Objective:** To examine the relationship between (i) iron status and school performance among grade 3 and 4 learners, and (ii) the dietary adequacy and anthropometric status among grade 6 and 7 learners.

**Design:** A descriptive, cross-sectional study.

**Subjects:** Conveniently sampled learners in grade 3 and 4 ( $n=100$ ) and grade 6 and 7 ( $n=62$ ).

**Outcome measures:** Haemoglobin (Hb) was used as indicator of iron status. Marks for numeracy, life skills and the average mark on all subjects were used to assess school performance. Average food variety score (FVS) and dietary diversity score (DDS) were calculated as indicators of dietary adequacy. Anthropometric z-scores were calculated.

**Results:** Mild anaemia ( $Hb < 11$  g/dL) was present in 9% of grade 3 and 4 learners, with a mean Hb (SD) of  $12.7$  ( $1.3$ ) g/dL. School performance showed no significant correlation with iron status, and did not differ between mild anaemic and non-anaemic children. The prevalence of underweight and overweight in grade 6 and 7 learners was 5% and 10%, respectively, with a mean BMI (SD) of  $19$  ( $3.5$ ) and 19% a having height-for-age z-score  $< -1$ . Mean FVS (SD) and DDS (SD) was  $10.7$  ( $2.1$ ) and  $7.2$  ( $1.2$ ) respectively. FVS and DDS showed no significant correlations with BMI-for-age and height-for-age z-scores.

**Conclusion:** The role of iron status in school performance probably does not correspond to its role on cognition as was found in previous studies. The dietary intake of grade 6 and 7 learners are adequate as reflected by their food variety ( $>6$ ) and dietary diversity ( $>4$ ) scores.

# The Health Care Professional Network

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