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GESTATIONAL DIABETES MELLITUS IN GAZA: PREVALENCE, RISK FACTORS AND GAZA WOMEN’S PERSPECTIVES

Areefa S. M. Alkasseh
PhD (Maternal & Child Health Nursing)

School of Health Sciences, Universiti Sains Malaysia, Health Campus, 16150 Kelantan, Malaysia

Introduction: Recent studies show that the prevalence of gestational diabetes mellitus (GDM) has increased by approximately 10% to 100% in several race or ethnicity groups during the past 20 years. GDM is associated with perinatal complication and their infants are also at increased risk of developing diabetes later in life, it is critical to assess the patterns in GDM prevalence and its risk factors. In addition, there is little knowledge on the impact of GDM on the lived experiences of GDM women in Gaza.

Objectives: The study aimed to determine the prevalence of GDM and risk factors in Gaza; and also examines the women’s experiences of GDM.

Methods: A mixed methods design was conducted in two phases. Phase One, a case-control study, included a combination of questionnaire data on GDM prevalence and risk factors and data from medical records of pregnancy and birth were obtained from the United Nations Relief and Works Agency (UNRWA) primary health care clinics. In Phase One, 189 GDM women were compared with 189 non GDM delivered in 2010 in Gaza. These participants were recruited with respect to maternal socio-demographics, infant outcome, BMI, family income, history of abortion, weight before pregnancy, history of large babies, history of stillbirth, history of Caesarean and family history of diabetes mellitus. The prevalence of GDM diagnosed according to the World Health Organisation criteria. Phase Two was a qualitative exploration of the women with GDM. In-depth, semi-structured interviews with a theoretical sample of 20 mothers were audio recorded, transcribed fully and analyzed thematically using the grounded theory method, assistance with the Nvivo software. SPSS version 18 was used to analyze Phase One data. The proportion was used to identify the prevalence, chi-square and independent t-test was used for comparative analysis between two groups, and multiple logistic regression was used to estimate the odds ratios with 95% confidence intervals, and to control for confounding variables in relation to the associated factors of GDM.

Results: The findings revealed an overall GDM prevalence rate of 1.8% among refugee women in Gaza. The final associated risk factors of GDM from the present study, as assessed by multivariate logistic regression, included: family income (odds ratio [OR] = 0.35, [95% CI 0.14–0.840]); history of abortion (OR = 4.9, [95% CI 2.20–11.04]); weight before pregnancy (OR = 1.07, [95% CI 1.04–1.09]); history of a large baby (OR = 1.43, [95% CI 2.08–8.50]); history of stillbirth (OR = 3.35, [95% CI 1.21–9.23]); history of Caesarean birth (OR = 2.92, [95% CI 1.54–5.53]) and a family history of diabetes mellitus (OR = 17.6, [95% CI 4.84–64.01]).

The present study showed that the majority of patients with GDM do not understand the definition of gestational diabetes did not take their insulin doses at regular times and did not practice any type of exercise. Furthermore, the findings of Phase II revealed a substantive theory in the core category of ‘adjusting to a new lifestyle’ that reflected their past experiences and daily living with the GDM. Three themes emerged from the qualitative data: 1) lack of awareness, 2) coping with the situation and 3) Sustaining lifestyle changes.

Conclusion: The present study concluded that the overall GDM prevalence rate is 1.8% among refugee women in Gaza. Furthermore, the most significantly associated risk factors of GDM among these women were family income, increased pregnancy BMI, history of abortion, history of large baby, history of stillbirth, history of caesarian delivery and positive family history. The majority of women with GDM did not understand gestational diabetes and did not take their insulin doses regularly and did not practice any type of exercise. The study in Phase Two concluded that “Adjusting to a new lifestyle” was the final core category that emerged in this study. Certain motivators have to be available before reaching the final core category. The most important motivators were being more aware about the issue, have self empowerment, able to adapt, being more committed and have enough support. Hence with these motivators the women will be able to adjust and maintain sustainably to new healthy life style.

Supervisor: Dr Soon Lean Keng
Co-Supervisors: Professor Nik Mohamed Zaki Nik Mahmood
Field supervisor: Dr Yousef Al Jeesh

DEVELOPMENT, IMPLEMENTATION AND EVALUATION OF NUTRITION MODULE FOR TRAINERS OF PERSONS WITH DISABILITIES IN COMMUNITY-BASED REHABILITATION CENTRES, KELANTAN

Chen Seong Ting
PhD (Community Nutrition)
School of Health Sciences, Universiti Sains Malaysia, Health Campus, 16150 Kelantan, Malaysia

Introduction: Persons with disabilities (PWD) are susceptible to malnutrition. However, little is known about the nutritional status and nutrition strategies among the local disability population.

Objectives: This study aimed to assess the nutritional status of PWD, develop and evaluate the effectiveness of Nutrition Module for Trainers of Persons with Disabilities in community-based rehabilitation (CBR) centres, Kelantan.

Methods: This study was conducted from June 2010 to July 2012. It included three phases. At Phase 1, nutrition assessment of PWD in CBR centres, Kelantan was conducted. A total of 467 PWD (281 children and adolescents; 186 adults) were recruited and their feeding and anthropometric data were collected using a structured questionnaire. The nutrition module and Nutrition Knowledge, Attitude and Practice Questionnaire about Persons with Disabilities (KAP-nOKU) were developed and validated in Phase 2. At Phase 3, an intervention study was conducted. Forty-five CBR teachers from Kelantan were recruited as the intervention group and 42 CBR teachers from Terengganu as the comparison group.

The intervention group received the nutrition module training while the comparison group was trained on general health care issues about PWD. Baseline (T0) and follow up KAP-nOKU assessments at 1-month (T1) and 6-month (T2) intervals after intervention were administered for both groups. Qualitative semi-structured interviews were conducted among 13 teachers from intervention group to explore the perceived motivations and barriers to their nutrition management for PWD at CBR centres.

Results: Results showed that there was a prevalence of 20.3% of PWD (17.8% children and adolescents; 24.2% adults) who were underweight while 22.8% (15.2% children and adolescents; 33.9% adults) were overweight or obese. At Phase 2, the validated KAP-nOKU contained 57 items with good-to-excellent internal consistencies for knowledge (KR20 = 0.63), attitude (α = 0.67) and practice (α = 0.82) domains. At Phase 3, repeated measures ANCOVA demonstrated that intervention group attained significantly higher nutrition knowledge (P < 0.001) and practice (P = 0.001) scores than comparison group at T1 (mean difference for knowledge = 6.95; mean difference for practice = 2.93) and T2 (mean difference for knowledge = 10.30; mean difference for practice = 4.78). Significant higher nutrition attitude (P = 0.004) score for intervention group was observed at T2 (mean difference = 3.08). Teachers’ positive personal attributes were identified as the primary motivation while PWD’s resistance to teachers’ positive nutrition management and lack of parental social support were the major barriers.

Conclusion: In conclusion, this nutrition module is effective in improving the nutrition knowledge, attitude and practice of CBR teachers in Kelantan.

Supervisor: Dr Sakinah Harith

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Fatimah Othman
MSc (Human Nutrition)

School of Health Sciences, Universiti Sains Malaysia, Health Campus, 16150 Kelantan, Malaysia

Introduction: An antioxidant and environmental factor have been associated to oxidative stress, and oxidative damage that consequently lead to T2DM development. Selenium, a trace mineral acts as antioxidant in the body and has also been ascribed as DNA regulator and free radical scavenger. Despite its valuable effect in redox metabolism, it is recently connected to T2DM risk.

Objectives: The aim of this study was to determine the association of oxidative DNA damage, total antioxidant capacity, dietary selenium and plasma selenium between T2DM and healthy control.

Methods: A case control study had been conducted from March 2011 until September 2011 in outpatient clinic of Hospital Universiti Sains Malaysia. This study has enrolled 82 T2DM patients, who had been diagnosed in less than three years with diabetes and paired with 82 healthy controls. To determine oxidative DNA damage (tail DNA and tail moment) and antioxidant capacity, Comet Assay and FRAP test were utilized respectively. Selenium status was determined in plasma and by dietary assessment using validated questionnaire.

Results: Oxidative DNA damage markers (Tail DNA and tail moment) were significantly elevated in T2DM compared to the control group. TAC level and plasma selenium showed no significant difference between the T2DM and the control group after confounding factors adjustment. It was observed that plasma selenium showed positive association with oxidative DNA damage study groups. A significant association was noted in T2DM patients, where each unit (ug/L) of plasma selenium increased 0.005 of log tail moment in oxidative DNA damage. Overall dietary selenium intake showed positively and significantly to oxidative DNA damage (log tail moment) in the control group. Despite that, the lowest tertile selenium intake seemed to beneficial in the control group where each unit (ug/d) of selenium intake reduced 0.41 of log tail moment oxidative DNA damage (P < 0.001). There was no significant association between dietary selenium intake and oxidative DNA damage in T2DM.

Conclusion: The connection between oxidative DNA damage, antioxidant and selenium status in this study
A randomised controlled trial (RCT) was performed on 50 participants aged between 30-55 years old with type II diabetes mellitus. Participants were randomly assigned to two groups: the traditional dietary counselling (CG) (control group, n = 22) and the DMT (IG) (intervention group, n = 28). The IG received dietary counselling based on DMT while the CG received routine or traditional dietary counselling. The DMT consists of nutrition care modules tailored to the patients’ needs. Anthropometric (body mass index, BMI), biochemical (fasting blood sugar, estimated average glucose and HbA1c) and food pattern outcomes were measured at baseline, 3 month, 6 month and 9 month. Data was collected between June 2009 and March 2010. The nutritional status was determined using anthropometric measurement while dietary intake used a combination of dietary history and food frequency questionnaire (FFQ). Biochemical profile of participants was determined using fasting venous blood.

Results: During the baseline study, 46.4% of IG participants and 45.5% of CG participants were classified as overweight (25–29.9 kgm⁻²) based on World Health Organisation (WHO) classification. Meanwhile, fasting blood sugar (FBS), estimated average glucose (eAG) and HbA1c level of both groups were higher than the normal range. Intake of energy was higher as compared to mean of individual’s energy requirement. Repeated measure of ANCOVA showed that dietary counselling by the dietician for diabetic patients type 2 significantly improved glycaemic control using DMT in terms of improving HbA1c and eAG compared to control group (P < 0.05). However, there were no significant changes in FBS, BMI and food pattern in both groups.

Conclusion: In conclusion, tailored intervention approach using DMT gave positive results only in the improvement of glycaemic control of HbA1c and eAG among diabetic patients. Continuing diabetes education especially dietary counselling via tailored web-based intervention can be an important tool to maintain good metabolic control.

Supervisor: Dr Hamid Jan Jan Mohamed
Co-Supervisors: Associate Professor Dr Sirajudeen KNS

A WEB-BASED TAILORED DIET MANAGEMENT TOOL (DMT) IN MANAGING DIABETES PATIENTS

Juliana Shamsudin
MSc (Nutrition)

School of Health Sciences, Universiti Sains Malaysia, Health Campus, 16150 Kelantan, Malaysia

Introduction: Diet Management Tool (DMT) is a nutrition assessment system developed by the researchers from Dietetic Programme, School of Health Sciences, Universiti Sains Malaysia (USM). The web-based system has been applied in dietary counselling for the treatment of patients with type II diabetes at Hospital Universiti Sains Malaysia (HUSM), replacing the standardised dietary counselling approach.

Objectives: This study examined the effectiveness of the dietary counselling using the DMT in the improvement of dietary management of type II diabetes patients in anthropometric, biochemical measurements and dietary intake pattern.

Methods: A randomised controlled trial (RCT) was performed on 50 participants aged between 30-55 years old with type II diabetes mellitus. Participants were randomly assigned to two groups: the traditional dietary counselling (CG) (control group, n = 22) and the DMT (IG) (intervention group, n = 28). The IG received dietary counselling based on DMT while the CG received routine or traditional dietary counselling. The DMT consists of nutrition care modules tailored to the patients’ needs. Anthropometric (body mass index, BMI), biochemical (fasting blood sugar, estimated average glucose and HbA1c) and food pattern outcomes were measured at baseline, 3 month, 6 month and 9 month. Data was collected between June 2009 and March 2010. The nutritional status was determined using anthropometric measurement while dietary intake used a combination of dietary history and food frequency questionnaire (FFQ). Biochemical profile of participants was determined using fasting venous blood.

Results: During the baseline study, 46.4% of IG participants and 45.5% of CG participants were classified as overweight (25–29.9 kgm⁻²) based on World Health Organisation (WHO) classification. Meanwhile, fasting blood sugar (FBS), estimated average glucose (eAG) and HbA1c level of both groups were higher than the normal range. Intake of energy was higher as compared to mean of individual’s energy requirement. Repeated measure of ANCOVA showed that dietary counselling by the dietician for diabetic patients type 2 significantly improved glycaemic control using DMT in terms of improving HbA1c and eAG compared to control group (P < 0.05). However, there were no significant changes in FBS, BMI and food pattern in both groups.

Conclusion: In conclusion, tailored intervention approach using DMT gave positive results only in the improvement of glycaemic control of HbA1c and eAG among diabetic patients. Continuing diabetes education especially dietary counselling via tailored web-based intervention can be an important tool to maintain good metabolic control.

Supervisor: Dr Hamid Jan Jan Mohamed
Co-Supervisors: Associate Professor Dr Sirajudeen KNS
This study aimed to investigate the association between dietary glycemic index and fiber with plasma adiponectin and leptin concentrations in patients with T2DM. However, limited studies have evaluated dietary predictors of plasma adiponectin and leptin concentrations, especially among Malaysian patients with T2DM.

**Objectives:** This study aimed to investigate the association between dietary glycemic index and fiber with plasma adiponectin and leptin concentrations in patients with T2DM.

**Methods:** A cross-sectional study was conducted in 305 diabetic patients aged 40 to 75 years from the Outpatient Department, Penang General Hospital. Socio-demographic information was collected using a standard questionnaire while anthropometric measurement includes weight, height, waist circumference and body fat composition. Plasma adiponectin and leptin concentrations were measured using a commercial ELISA kit. Dietary details were determined by using a pre-validated semi-quantitative food-frequency questionnaire. Data was analyzed using multiple linear regressions.

**Results:** After multivariate adjustment, dietary glycemic index was inversely associated with plasma adiponectin concentrations (β = -0.272, 95% CI -0.262, -0.094; P <0.001). It was found out that in individuals who consumed 1 unit of food containing high dietary glycemic index the plasma adiponectin level reduced by 0.3 ug/mL. In contrast, intake of fiber was positively associated with increased plasma adiponectin levels, adjusting for lifestyle factors (β = 0.350, 95% CI 0.101, 0.433; P = 0.002). One-gram consumption of fiber will lead to an increment of 0.2 ug/mL adiponectin concentrations. Thirty two percent (31.9%) of the variation in adiponectin concentrations was explained by age, sex, race, smoking status, BMI, waist circumference, HDL-C, triglycerides, magnesium, fiber and dietary glycemic index according to the multiple linear regression model (R² = 0.319). There were no correlation between dietary glycemic index and fiber with plasma leptin concentrations illuminated by scatter plots.

**Conclusion:** These results support the hypothesis that dietary factors influences plasma adiponectin concentrations in patients with T2DM. Controlled clinical trials are required to confirm our findings and to elucidate the underlying mechanism.

**Supervisor:**
Professor Wan Abdul Manan Wan Muda

THE ASSOCIATION OF GLYCEMIC INDEX AND DIETARY FIBER WITH PLASMA ADIPOnectin AND LEPTIN CONCENTRATIONS AMONG MULTIETHNIC PATIENTS WITH TYPE 2 DIABETES MELLITUS IN PENANG GENERAL HOSPITAL

Loh Beng In
MSc (Clinical Nutrition)

School of Health Sciences, Universiti Sains Malaysia, Health Campus, 16150 Kelantan, Malaysia

**Introduction:** Adiponectin and leptin, the adipocyte-derived hormones have been implicated in the control of blood glucose and chronic inflammation in type 2 diabetes mellitus (T2DM). However, limited studies have evaluated dietary predictors of plasma adiponectin and leptin concentrations, especially among Malaysian patients with T2DM.

**Objectives:** This study aimed to investigate the association between dietary glycemic index and fiber with plasma adioponectin and leptin concentrations in patients with T2DM.

**Methods:** A cross-sectional study was conducted in 305 diabetic patients aged 40 to 75 years from the Outpatient Department, Penang General Hospital. Socio-demographic information was collected using a standard questionnaire while anthropometric measurement includes weight, height, waist circumference and body fat composition. Plasma adiponectin and leptin concentrations were measured using a commercial ELISA kit. Dietary details were determined by using a pre-validated semi-quantitative food-frequency questionnaire. Data was analyzed using multiple linear regressions.

**Results:** After multivariate adjustment, dietary glycemic index was inversely associated with plasma adiponectin concentrations (β = -0.272, 95% CI -0.262, -0.094; P <0.001). It was found out that in individuals who consumed 1 unit of food containing high dietary glycemic index the plasma adiponectin level reduced by 0.3 ug/mL. In contrast, intake of fiber was positively associated with increased plasma adiponectin levels, adjusting for lifestyle factors (β = 0.350, 95% CI 0.101, 0.433; P = 0.002). One-gram consumption of fiber will lead to an increment of 0.2 ug/mL adiponectin concentrations. Thirty two percent (31.9%) of the variation in adiponectin concentrations was explained by age, sex, race, smoking status, BMI, waist circumference, HDL-C, triglycerides, magnesium, fiber and dietary glycemic index according to the multiple linear regression model (R² = 0.319). There were no correlation between dietary glycemic index and fiber with plasma leptin concentrations illuminated by scatter plots.

**Conclusion:** These results support the hypothesis that dietary factors influences plasma adiponectin concentrations in patients with T2DM. Controlled clinical trials are required to confirm our findings and to elucidate the underlying mechanism.

**Supervisor:**
Associate Professor Dr Hamid Jan B Jan Mohamed
Co-Supervisors:
Mr S. Daniel Robert

A PROSPECTIVE STUDY ON MATERNAL OXIDATIVE STRESS IN PREGNANCY AND POSTPARTUM AND INFANT ADIPOSITY DEVELOPMENT DURING THE FIRST YEAR OF LIFE

Loy see ling
PhD (Human Nutrition)

School of Health Sciences, Universiti Sains Malaysia, Health Campus, 16150 Kelantan, Malaysia

**Introduction:** In Malaysia, obesity rates are on the rise, particularly among women and even children. Pregnancy is predicted as a critical time for increased risks of postpartum and childhood overweight or obesity. Plausibly, oxidative stress could be the underlying factor of adiposity development in later lives.

**Objectives:** The Universiti Sains Malaysia Birth Cohort Study was thus established in year 2009 to investigate the effects of maternal oxidative stress in pregnancy on the first year postpartum and infant adiposity development.
**Methods:** Pregnant women were recruited in the second trimester of pregnancy, after delivery, 2, 6 and 12 months postpartum. The study was conducted from April 2010 to December 2012 in Kelantan, Malaysia. A total of 153 women aged 19 to 40 years and full-term infants were included in the study. Maternal socio-demographic data and dietary intake were obtained using validated questionnaires. Blood samples were taken in the second and third trimesters for the analyses of lipid profiles and oxidative stress levels. Maternal hair samples were collected at delivery for nicotine analysis. Infant anthropometric measurement and feeding pattern were recorded.

**Results:** By using multiple linear regression analysis, prepregnancy body mass index (BMI) and nicotine level were negatively associated with deoxyribonucleic acid (DNA) damage ($P = 0.003; R^2 = 0.217$), while total cholesterol and triglycerides were positively associated with malondialdehyde ($P = 0.017; R^2 = 0.207$) in the second trimester of pregnancy. Protein carbonyl level was decreased with increasing Healthy pattern score ($P < 0.001, R^2 = 0.249$). At 12 months postpartum, PPWR increased with total gestational weight gain (GWG) ($P < 0.001, R^2 = 0.236$). However, this relationship was not mediated through oxidative stress in pregnancy (partial posterior $P$ value = 0.469). Through infant first year of life, as maternal DNA damage in the second trimester increased, infant weights at birth ($P < 0.001, R^2 = 0.305$), 2 months ($P < 0.001, R^2 = 0.358$), 6 months ($P < 0.001, R^2 = 0.281$) and 12 months of age decreased ($P < 0.001, R^2 = 0.256$). Similar results were noted when infant BMI-for-age Z-scores, abdominal circumference and triceps-skinfold-for-age Z-scores were used as the adiposity indicators.

**Conclusion:** In conclusion, greater prepregnancy BMI, hyperlipidemia and increased nicotine exposure were associated with enhanced oxidative stress, while adherence to Healthy pattern was associated with decreased oxidative stress in the second trimester of pregnancy. Of the prenatal factors, total GWG was directly associated with 12 months PPWR, but this relationship was not mediated by oxidative stress in pregnancy. High DNA damage in the second trimester was related to reduced infant adiposity during the first year of life.

**Supervisor:**
Associate Professor Dr Hamid Jan Jan Mohamed
Co-Supervisors:
Associate Professor Dr Sirajudeen KNS

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**Programme of Nutrition, School of Health Sciences, Universiti Sains Malaysia, Health Campus, 16150 Kelantan, Malaysia**

**Introduction:** Childhood and adolescence are critical periods for bone mass acquisition as peak bone mass (PBM), a major determinant of risk for osteoporosis later in life, is achieved during these growing years. Hence, understanding factors that influencing bone mass accrual is critical to optimize PBM during growth.

**Objectives:** The main objective of the study was to investigate the relationship between body composition profiles, pubertal growth status, dietary behaviours and dietary food pattern and bone health profiles among 455 boy and girl adolescents aged 12 to 19 years in Kota Bharu, Kelantan.

**Methods:** Dietary intake and lifestyle behavioural practices of the participants were assessed using validated questionnaires, while dietary intakes was determined using validated food frequency questionnaire (FFQ). Anthropometry and body composition profiles of lean body mass (LBM) and total body fat (TBF) were assessed using both anthropometry and a dual-energy X-ray absorptiometry (DXA) device, whereas bone mass profiles such as bone mineral content (BMC), bone area (BA) and bone mineral density (BMD) of skeletal sites of whole body (WB), lumbar spine (LS) and proximal femur (PF) were assessed using DXA. Dietary food pattern was determined using a principal component analysis (PCA).

**Results:** The result showed that, mean age of participants was 15.3 years (SD 1.9), with most of them (73%) were in normal body mass index (BMI) ranged. Majority of the participants were in Tanner stage II to V. In general, boys tended to have significantly higher lean body mass (LBM) and bone masses of skeletal sites than the girls, except for the lumbar spine BMD (at least, $P < 0.05$), whereas girls exhibited a significantly higher level of total body fat (TBF) as compared to their boy counterparts. For the dietary behaviours, boys had significantly a higher frequency of weekly fast-food consumption than their girl counterparts, whereas girls had significantly higher consumption of soft drink beverages ($P < 0.001$) and frequency of daily snacking consumption ($P < 0.01$) compared to boys. In term of ethnicity differences, Chinese adolescents had significantly higher frequency of breakfast ($P < 0.01$) and milk consumption ($P < 0.05$) than Malays. Most of the nutrients intakes of the participants were higher than recommendations (RNI) except for energy, calcium, iron (girls only) and vitamin D intake. Three dietary food patterns were derived from PCA and labelled as healthy, western-based and typical food patterns. Generally, the partial Pearson correlation and ANCOVA analysis showed significant relationships between anthropometrical and body composition profiles, pubertal growth, consumption of milk and soft drink and dietary food patterns and bone mass profiles in both genders. Further, analysis by multiple regression revealed that LBM, consumption of milk and healthy food pattern emerged as the positive determinants on BMC of all skeletal sites assessed in boys, whereas height, consumption of soft drink and western-based food pattern appeared as negative

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**Nurul-Fadhilah Abdullah**
MSc (Community Nutrition)
significantly determinants on BMC. Similar determinants emerged for the BA of all skeletal sites measured in this study, with addition of Tanner stage of genitalia growth and TBF as positive determinants on BA. In addition, similar determinants found in boys were found in girls except for puberty growth, in which age at menarche as emerged as negative determinant on BMC and BA for all skeletal sites measured but not the Tanner stage of breast and pubic hair development. In addition, milk consumption did not appear as determinants on BMC or BA of skeletal sites measured, however soft drink consumption emerged as determinants on most of the bone mass parameters in girls except for LSBA and PFBA. Meanwhile, the findings suggested that LBM had stronger influence on bone mass in both gender except for LSBMC and WBBA in girls, whereby TBF appeared as strong determinants on this skeletal sites of girls.

**Conclusion:** The present findings of the study show that higher intake of healthy-based diet such as vegetables, fruits, milk and dairy products exerts significant beneficial influence on bone health status compared to those had lower intake of healthy-based diet. In addition, lean body mass had significant stronger influences on most bone mass parameters assessed compared to the total body fat both in boys and girls. Therefore, the consumption of healthy-based foods that high in fruit, vegetables and dairy products should be highly emphasised among these growing children and adolescents to maximum the attainment of peak bone mass accretion, in addition, active lifestyle to maintain high lean body mass during growing years is also crucial to achieve higher bone mass and consequently could helps to prevent or reduce the risk of osteoporotic fractures in later life.

**Supervisor:**
Dr Foo Leng Huat

**Co-Supervisors:**
Associate Professor Dr Mohd Ezane Aziz

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**EVALUATION OF THRESHOLDING METHODS FOR VOLUME ESTIMATION IN Tc-99m SPECT IMAGING**

**Parimalah A/P Velo**
MSc (Nuclear Medicine Sciences)

**School of Health Sciences, Universiti Sains Malaysia, Health Campus, 16150 Kelantan, Malaysia**

**Introduction:** Accurate volume estimation of target objects in SPECT may assist and improve many clinical applications such as cancer treatments, evaluation of cardiac diseases and perfusion studies. One of the factors that strongly influence the accuracy of volume estimation in SPECT is the type of image segmentation technique used to delineate the boundary of target object. The present study evaluated the accuracy of thresholding methods for image segmentation in order to estimate the volume of the target objects in Tc-99m SPECT imaging. The influence of background activity, object size and target activity was also evaluated.

**Methods:** Three thresholding methods, i) fixed, ii) adaptive and iii) iterative were used to estimate volume of target objects. For each thresholding method, the thresholds were determined in two ways: Method A; Thresholds were obtained using phantoms with no background activity and Method B; Thresholds were obtained using different phantoms having different level of background activity. Target objects with background activities up to 80% of target activity, object sizes ranged from 10 mL to 300 mL and target activity ranged from 0.3 mCi to 10 mCi were used to assess the influence of various physical factors of phantom on volume estimation. The most accurate thresholding method that estimates volume of target objects accurately was reported statistically using simple linear regression analysis. In addition, non-parametric SPEARMAN correlation and one sample t-test were used to assess the influence of background activity and target activity on estimated volume respectively.

**Results:** Iterative threshold that selected based on Method B (ITB) gives the most reliable outcome (relative error within ± 7%) for volume estimation of target objects. Fixed threshold that selected based on Method A is concluded as not a reliable method for the volume estimation of target objects due to the large errors. Background activity and object size highly influences the selection of ideal threshold values that estimate volume of target objects. The increase in target activity only slightly affects the accuracy of volume estimation.

**Conclusion:** Accuracy in volume estimation can be achieved for different object size, background activity and target activity using ITB method in which the thresholds were selected based on level of background activity and object size. Validation of the evaluated method for volume estimation of target objects is warranted using actual SPECT images of patients prior to volume quantification in clinical application.

**Supervisor:**
Professor Ahmad Hj. Zakaria

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**EVALUATION OF UNIVERSAL NEWBORN HEARING SCREENING PROGRAM (UNHS) IN MALAYSIA: OPERATION AND TECHNOLOGY MANAGEMENT APPROACH**

**Sulaiman Bin Hamzah**
MSc (Health Promotion)

**School of Health Sciences, Universiti Sains Malaysia, Health Campus, 16150 Kelantan, Malaysia**

**Introduction:** This paper describes an evaluation for the layout design, work flow, work process and perception from personnel in Universal Newborn Hearing Screening Program (UNHS) from the viewpoint of operation management. UNHS is one of the most important programs in order to detect the hearing loss among babies. UNHS is a new implementation program in Malaysia.

**Objectives:** This study objectively was to evaluate the
Mean age of the adolescents were 15.4 years. Validated questionnaires were used to determine the perception among UNHS personnel.

Methods: The layout design of these 3 centers; HUSM, PPUKM and SMC were measured qualitatively through an observation, experience within the system and interview with the program supervisor from July 2010 until December 2011. Validated questionnaire was applied to determine the perception among UNHS personnel.

Results: Results showed these three layout designs have strengths and weaknesses. However, the efficiency of the current layout was good; 60% at HUSM, 80% at SMC and 50% PPUKM. This study also showed that the awareness, human resource, machine use and technique applied in this program also an important factor. However, there are no significant correlation between age (P > 0.05) and work experiences (P > 0.05) among personnel toward perception of UNHS program. Study suggested a few modifications in work process, human resource management, training and others technical issues will improve the current system. Study believed that this program can be implemented successfully in Malaysia with all issues need to be considered.

Supervisor:
Dr Mohd Normani Zakaria
Co-Supervisors:
Professor Dinsuhaimi Sidek

INFLUENCE OF PHYSICAL ACTIVITY, SEDENTARY LIFESTYLE AND BONE BIOMARKERS ON BONE HEALTH AMONG ADOLESCENTS IN KOTA BHARU, KELANTAN

Teo Pey Sze
MSc (Community Nutrition)

Programme of Nutrition, School of Health Sciences, Universiti Sains Malaysia, Health Campus, 16150 Kelantan, Malaysia

Introduction: Maximum attainment of peak bone mass (PBM) during the growing years is ultimately important to reduce the risk of osteoporotic fracture later in life. Understanding and identification of lifestyle factors such as physical activity (PA) and other lifestyle practices that are associated with higher bone mass accruals in children and adolescents is important in order to optimize the PBM during these critical years of growth.

Objectives: The main objective of the study was to determine the influence of PA, sedentary behaviour and blood biomarkers of bone remodeling on bone health status, as assessed by a dual energy X-ray absorptiometry (DXA) in 455 adolescent boys and girls of Malay and Chinese-origins aged 12 to 19 years of age in Kota Bharu, Kelantan.

Methods: Validated questionnaires were used to assess PA, sedentary small screen recreation (SSR) practice assessments, and dietary food intakes, whereas body composition and muscular strength of the upper and lower extremities were determined using anthropometry measurements, handgrip and isokinetic-dynamometers. For the bone health status, bone mineral content (BMC), bone area (BA) and bone mineral density (BMD) were assessed for total body (TB), at the lumbar spine (L2-L4), proximal femur and specific regions of interest using the DXA device.

Results: Mean age of the adolescents were 15.4 years (SD 1.9), with majority (72.5%) had a normal ranges of body mass index (BMI). Sex-specific comparisons on lifestyle practices showed that adolescent boys had significantly higher levels of daily PA status (1.5hours vs 1.0hours; P < 0.001) and intense moderate-to-vigorous PA (MVPA) (1.2 vs 0.4 hours; all, P < 0.001), compared to the girl participants. In contrast, sedentary SSR practices were similar between genders (3.1 vs 3.3hours/day). In general, about two-thirds of adolescents (63.3%) had low daily active PA practice, as determined by the MVPA less than one hour per day, with higher proportion found in girls (80%) than in adolescent boys (34%). Multiple linear regression analyses showed that age (P = 0.012) and sex (P < 0.001) emerged as significant negative determinants on daily MVPA levels, after adjusting for ethnicity, socio-demographic status and dietary behaviours. Moreover, age (P < 0.001) and daily breakfast consumption (P < 0.05) emerged as negative independent determinants; whereas ethnicity (P < 0.01) was significant positive independent determinant on sedentary SSR levels. The influence of these lifestyle factors was further examined based on duration spent on PA levels and sedentary SSR levels. It showed that participant boys with higher total PA group > 1.5hours/day and MVPA group > 1hour/day, respectively, had a significantly higher size-adjusted BMC of TB, intertrochanter and leg region (all, P < 0.05) and the BMD of the TB, PF, LS, regional arm and leg region (at least, P < 0.01) than that of those at low PA and MVPA levels. Only a significant positive influence was found between high total PA and MVPA with BMC and BMD of the TB and leg region in adolescent girls. Furthermore, boys with high MVPA levels showed significantly higher of muscle strength of the handgrip (P < 0.01) and lower extremity strength of the quadriceps (P < 0.05) and the hamstring strength (P < 0.001) than those at lowest MVPA level. Only a significant positive association was found between high MVPA level and hamstring muscle strength in girls (P < 0.01). On the other hand, sedentary lifestyle practices was also found to be negatively associated with bone health profiles assessed in girls, in which high SSR practice showed a significantly lower lumbar spine BMD (P < 0.05) and bone area of the TB (P < 0.05), arm (P < 0.01) and leg region (P < 0.05) compared to those who only practiced low SSR level. Blood biomarkers of bone remodeling were significantly and negatively associated with all skeletal sites assessed, after adjustments for pubertal growth and ethnicity.

Conclusion: The main findings of the study showed that higher habitual total and intense PA level could contributed to positive bone mass profiles in these adolescents, and it
has profoundly influence on weight-loaded skeletal region assessed. In addition, sedentary lifestyle practices also exert a negative influence on bone health assessed in adolescent girls. Therefore, encouragement of active lifestyle practices in children and adolescents should be promoted to optimize the peak bone mass accretion during the critical years of growth.

_Supervisor:
Dr Foo Leng Huat
Co-Supervisors:
Associate Professor Dr Mohd Ezane Aziz_