

# FOLIC ACID AWARENESS AND SUPPLEMENTATION: A CROSS SECTIONAL STUDY AMONG PREGNANT WOMEN IN NORTH LEBANON

L. Faddoul<sup>1</sup>, F. El Jabbour<sup>2</sup>, L. El Osta<sup>3</sup>, and A. Aoun<sup>4</sup>

<sup>1</sup>Université Saint-Esprit de Kaslik, <sup>2</sup>Université Libanaise, <sup>3</sup>Université Saint-Joseph, <sup>4</sup>Notre Dame University

**Background:** Folate deficiency among pregnant women has been strongly associated with severe birth defects. Many countries have adopted food fortification policies and educational programs in order to ensure adequate levels of this vitamin during pregnancy. Although folic acid (FA) awareness and intake have been studied internationally, a limited number of studies evaluated pregnant women practices in North Lebanon.

**Material & Methods:** This cross sectional study was performed to assess pregnant women's knowledge and intake of FA supplements. A total of 509 women were selected by convenient purposive sampling among pregnant women who visited gynecology clinics in different areas of North Lebanon from May to September 2013. Of these, 44 women did not provide full information, with the remaining 465 subjects being included in the current analysis. A questionnaire was completed following face-to-face interviews conducted by a trained local dietitian. Questions covered socio-economic variables, medical history, maternal characteristics, obstetric and neonatal complications, smoking and alcohol consumption, knowledge and use of folic acid supplements. The height and weight of each participant were measured at the time of the visit. The body mass index (BMI), initial weight at conception and daily dose of supplemented folic acid were calculated. Food items considered rich in folate were those containing more than 20% of the daily value needed, which is more than 80µg. The recommended daily dose is considered to be between 400µg and 1000µg in normal cases and 5000µg if the participant has one or more of the following disorders: BMI over 30, diabetes, epilepsy, spina bifida history, and smoking or alcohol consumption during pregnancy. The Statistical Package for Social Sciences (SPSS) version 15.0 was used for statistical analysis.

**Results:** Out of the 465 women surveyed, 97.4% are taking folic acid supplements during pregnancy, though only 25.37% started the supplementation at the preconception stage. Nonetheless, 41.1% of the subjects reported that the use of supplement during preconception was recommended by their gynecologist.

Regarding the prescribed daily dose, 77.6 % noted adequate intake of folic acid during preconception. However, women with special criteria had a low dosage of FA supplements compared to recommended daily intake.

Besides, knowledge levels in relation to FA supplements and natural food sources of folate were assessed. While 39.8% of the women reported that they heard about folic acid, a small percentage of them (7.9%) understood that the use of FA supplements during preconception could help prevent congenital malformations and birth defects such as spina bifida. Surprisingly, only 27.7% of the women could maximum identify one or two kinds of food rich in folate. These levels seem highly correlated with women's educational background and preconception visits to the gynecologist.

**Conclusion:** Folic acid intake during preconception and awareness regarding its supplementation and food sources are relatively low in North Lebanon. Therefore, a national healthcare policy to increase the knowledge and use of folic acid is required.

# Ingestion of phosphorus containing high carbohydrate meal increases postprandial energy expenditure

M. Assaad, C. El Mallah, A. Olabi, O. Obeid

Department of Nutrition and Food Science, American University of Beirut, Beirut, Lebanon

**Descriptive Statement:** Phosphorus is required for ATP production and is known to be involved in energy metabolism. However, it's not clear whether phosphorus ingestion with meal can affect energy expenditure.

**Introduction:** Both overweight and obesity are increasing globally and recognized to cause main health problems nowadays. Weight gain results from an imbalance between energy intake and energy expenditure. Diet induced thermogenesis (DIT) accounts for 5-15% of total energy expenditure and is mainly related to ATP production that depends on phosphorus (P) availability. Our objective was to determine the effect of P ingestion with high carbohydrate meal on postprandial energy expenditure. We hypothesized that P ingestion increases diet induced thermogenesis of the subjects.

**Methods:** A cross over study was conducted on six lean male subjects. Subjects received a 500 Kcal high carbohydrate meal with (500 mg of P) or without P. Energy expenditure was measured at baseline and at 30 minute intervals for 4 hours following meal ingestion using a ventilated hood and canopy system COSMED QUARK CPET unit.

**Results:** Postprandial energy expenditure of meal containing P was significantly higher than that of placebo ( $p=0.007$ ). This increase was associated with a significant rise in fat oxidation (%) ( $p=0.022$ ), while carbohydrate oxidation (%) was decreased ( $p=0.023$ ).

**Conclusion:** P was able to increase postprandial energy expenditure mainly due to increased fat oxidation. This data may have promising effect for the management of obesity.

# **Impact of Healthy Schools programs on children BMI and nutritional knowledge in Lebanon**

M. Bou Kheir and S. Fallows

Department of Clinical Sciences and Nutrition, University of Chester.

**Introduction:** Urbanization, lifestyle and physical inactivity are now causing severe non-communicable diseases. Among them, obesity is one of the major issues, especially childhood obesity. The global prevalence of obesity in 2010 was estimated around 6.7%. However, trends are estimating an increase in obesity prevalence making it around 10.8% in 2025. Therefore, interventions among preschoolers are a necessity in preventing obesity and also in preventing lifetime diseases at adult age such as diabetes, cardiovascular diseases and many others. In order to implement a healthy lifestyle, school policies have been designed by many government and communities among them, the United States Department of Agriculture (USDA), the School Nutrition–Environment State Policy Classification System (SNESPCS) and the World Health Organization (WHO), aiming all to reduce children obesity too. However, in Lebanon few health policies have been implemented among all schools and competitive foods are still sold to children without any condition. This research may influence health professionals and government to take action in preventing non-communicable diseases at adult age.

**Study aims:** The aims of this study is to prove the hypothesis that school policies can reduce obesity prevalence by suggesting healthier choices in the school and healthier lifestyle overall.

**Design and Methods:** Heights and weights will be collected from schools records across middle and high school in order to calculate their Body Mass Index (BMI). The data will be collected among at least two schools, some having nutrition policies implemented and others with none. In addition, a questionnaire will be distributed for the children to assess whether a health policy can increase their knowledge.

**Exposure:** School meals and competitive venue food and beverage availability.

**Main outcome and Measures:** BMI calculated from schools records of weight and height. A comparative study will show the difference between the BMI of children enrolled in healthy schools system compared to the ones with none nutritional prevention. Also, nutritional knowledge will be assessed using a questionnaire that will be distributed to children in schools. This questionnaire would suggest the influence of health policy on children food and beverages choices.

**Estimated Results:** Aiming that the schools implementing nutrition policies would have students with lower BMI and a better nutritional knowledge and choices than the one without any school policy. This kind of research will not only emphasize on the nutritional role held in schools but will also prevent and save a whole next generation from non-communicable diseases.

## **Adherence to the Mediterranean diet and risk of metabolic syndrome in Lebanese urban adults**

C. Cordahi, MSc<sup>1</sup>, F. Naja, PhD<sup>1</sup>, H. Tamim, PhD<sup>2</sup> and L. Nasreddine, PhD<sup>1\*</sup>

Department of Nutrition and Food Sciences, American University of Beirut, Lebanon

The prevalence of the metabolic syndrome (MetS) is reaching epidemic proportions in countries of the Eastern Mediterranean region. Preventive strategies aiming at curbing the rise of the MetS are needed given its association with increased disease risk including type 2 diabetes and cardiovascular diseases. The aims of this study were to (1) assess the prevalence of the MetS across gender in a sample of Lebanese adults living in Beirut and (2) investigate the association of the MetS with adherence to a Mediterranean dietary pattern (MD).

This is a cross-sectional study of Lebanese adults aged  $\geq 18$  years ( $n = 501$ ) living in Greater Beirut. Using standardized techniques, anthropometric measurements were taken and biochemical analyses were performed. A comprehensive questionnaire was administered to study participants to inquire about family history, medical history, and sociodemographic and lifestyle characteristics. Physical activity was assessed using the International Physical Activity Questionnaire. Dietary habits were assessed in an interview setting by trained dietitians by means of an 86-item, semi-quantitative, and culture specific food frequency questionnaire (FFQ). Adherence to the MD was assessed using 2 different scores: the Mediterranean Diet Score (MDS) and the Lebanese Mediterranean Diet (LMD).

Based on the International Diabetes Federation (IDF) classification criteria, the overall prevalence of the metabolic syndrome was 50.2% in the total sample. According to the NCEP ATP III definition, the overall prevalence of the metabolic syndrome was 43.2%. Among subjects with the MetS, the main contributors to the MetS were elevated waist circumference, followed by elevated fasting blood glucose and low HDL-C. After adjusting for confounding variables (age, gender, and energy intake), findings of the logistic regression analysis showed that a higher adherence to the Mediterranean diet (assessed using the Mediterranean Diet Score and the Lebanese Mediterranean Diet score) was negatively associated with MetS prevalence (defined by the IDF). Subjects in the second tertile (diet score 4-5) of the Mediterranean Diet Score, presented a 47% lower prevalence of the MetS (OR = 0.530, 95% CI = 0.300-0.936,  $p = .029$ ). No significant association was found between a Mediterranean Diet Score of 6-9 and MetS. Subjects in the second and third tertiles (diet score of 16-20 and diet score of 21-27 respectively) of the Lebanese Mediterranean Diet presented a 57% (OR = 0.430, 95% CI = 0.234-0.788,  $p = .006$ ) and 55% (OR = 0.453, 95% CI = 0.214-0.961,  $p = .039$ ) lower prevalence of the MetS respectively.

The relatively high prevalence of metabolic syndrome among Lebanese urban adults is an alarming sign and highlights the need for immediate public health action. The observed negative association between adherence to the Mediterranean diet and the risk of the metabolic syndrome calls for efforts aiming at promoting the Mediterranean dietary pattern in Lebanon, with its cardioprotective constituents, including olive oil, fish, fruits, and vegetables.

# **Prevalence of Hypertension among University Students and Its Association with Anthropometric Measurements and Lifestyle Factors: A Cross-Sectional Study**

Rana El Said, Jocelyne Matar Boumosleh, Doris Jaalouk, Maya Abou Jaoude, Jessy El Hayek  
Notre Dame University

**Background and Objectives:** Hypertension (HTN) is considered a leading public health problem that can result in several health complications, disability and death if left untreated or unidentified. Recent studies found that the prevalence of asymptomatic primary HTN is increasing drastically worldwide among adolescents and young adults leading to cardiovascular mortality and morbidity at older ages. Therefore, early detection and treatment of elevated blood pressure (BP) becomes essential in improving prognosis of the disease. The role of diet in hypertension has become a hot research area worldwide and therefore multiple studies were done to examine the association between individual nutrients and HTN. One major limitation of the previous studies, however, is that they all failed to take into account the interaction among the different nutrients and therefore the effect of the individual's diet as a whole, rather than effect of individual nutrients, on HTN. This will be the first study to assess the prevalence of primary HTN in young adults in Lebanon and to examine the association between the identified dietary patterns (western, Mediterranean diet, etc.) and primary HTN. Accordingly, the primary objective of this study is to examine the prevalence of primary HTN among young adults in Lebanon, and its association with dietary patterns, controlling for important confounding factors. A secondary objective is to identify correlates (anthropometric and lifestyle factors) of primary HTN in our sample of young adults.

**Subjects and methods:** In this cross-sectional study, randomly selected undergraduate students at Notre Dame University (NDU), Lebanon, were asked to complete a self-administered survey including a food frequency questionnaire (73 food items), background questionnaire (socio-demographic and lifestyle factors), and the International Physical Activity Questionnaire (IPAQ) - Short Form). Height, weight, WC, and BP (taken three times at an interval of 10 minutes) of all subjects were measured and BMI was calculated as:  $\text{Weight (kg)} / \text{Height (m)}^2$ . BMI categories were classified as (1) underweight (UNDWT):  $\text{BMI} < 18.5 \text{ kg/m}^2$ , (2) normal weight (NW):  $18.5 \text{ kg/m}^2 < \text{BMI} < 24.9 \text{ kg/m}^2$ , (3) OVWT:  $25.0 \text{ kg/m}^2 < \text{BMI} < 29.9 \text{ kg/m}^2$ , and (4) obese (OB):  $\text{BMI} \geq 30.0 \text{ kg/m}^2$ . BP in adults was classified according to the seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high BP as: (1) normal : systolic blood pressure (SBP)  $< 120 \text{ mmHg}$  and diastolic blood pressure (DBP)  $< 80 \text{ mmHg}$ , (2) pre-HTN :SBP between 120–139 mmHg and/or DBP between 80–89 mmHg, (3) stage 1 HTN: SBP between 140-159 mmHg and/or DBP between 90-99 mmHg, (4) stage 2 HTN:  $\geq 160 \text{ SBP}$  and/or  $\geq 100 \text{ DBP mmHg}$ . Waist circumference values were classified according to the National Heart, Lung, and Blood Institute guidelines, whereby a WC  $> 102 \text{ cm}$  in men, or  $> 88 \text{ cm}$  in women, is considered an indicator of increased disease risk. To calculate the prevalence of

primary HTN and its association with anthropometric measurements and lifestyle factors, we excluded participants who reported having medical comorbidities, alcohol and drug abuse, and taking medications known to cause secondary HTN such as metabolic steroids, caffeine containing pills, glucocorticoids, etc.

Quantitative and qualitative measurements were summarized as mean  $\pm$  standard deviation and n (%), respectively. Comparisons of continuous and categorical variables were performed using independent 2-sample T Test (Mann-Whitney-U-test)/Analysis of variance (Kruskal Wallis test) and the chi square test /Fisher's exact test, respectively. The distribution of the dependent variable was checked for normality by examining its shape and the significance of the Shapiro-Wilk test. Spearman correlation coefficients were used to evaluate the association among the different variables. Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) version 22 for Windows. A p-value  $< 0.05$  was considered statistically significant.

**Results:** The sample consisted of 415 undergraduate students (62% M) with a mean age of 21.27  $\pm$  1.88 years, BMI of 24.33  $\pm$  4.24 kg/m<sup>2</sup> and WC of 88.58  $\pm$  10.64 cm for males, 74.69  $\pm$  8.13 cm for females. Of the 415 participants, 43.3% were found to have pre-HTN, 16.1% stage 1 HTN and 5.9% stage 2 HTN. BMI was found to be significantly associated with HTN, with OVWT and OB individuals having the highest prevalence rates of primary pre-HTN/ HTN compared to the other BMI categories, respectively (Pre-HTN: UNDWT (13.7%); NW(45.5%); OVWT (51.7%); OB (26.2%); HTN UNDWT (0 %); NW(11.7%); OVWT (31.0%); OB (64.3%),  $P=0.000$ ). WC was also found to be associated with HTN, with students with a risky WC having a higher prevalence rate of primary HTN than students without a risky WC (48.5% vs. 19.3%,  $p=0.000$ ). Primary HTN was found to be significantly associated with alcohol drinking but not with smoking. The prevalence of primary pre-HTN and HTN were found to be significantly higher among students who reported higher alcohol consumption (occasionally 20.4%, 1-2 drinks/week, 22.7%,  $\geq 1$  drink/day, 28.6%,  $p=0.02$ ). Data analyses pertaining to the association between dietary patterns & HTN are still undergoing. Mean SBP and mean DBP were found to be positively correlated with WC; ( $r=0.521$ ,  $p=0.000$  and  $r=0.483$ ,  $p=0.000$  respectively), BMI ( $r=0.510$ ,  $p=0.000$  and  $r=0.461$ , respectively  $p=0.000$ ), and alcohol intake ( $r=0.126$ ,  $p=0.012$ ;  $r=0.166$ ,  $p=0.001$ , respectively). Mean DBP was also found to be positively correlated with breakfast, with students reporting to have breakfast rarely having higher mean DBP values ( $r=0.104$ ,  $p=0.037$ ).

**Conclusion:** Pre- HTN and HTN were shown to be highly prevalent in our sample of NDU students. WC and BMI were found to be strong correlates of primary HTN and therefore could act as simple and reliable screening tools, in this population. These findings also highlight the importance of having regular on-campus screening and obesity awareness campaigns to identify students with pre-HTN/ HTN and to reduce the burden of HTN and its complications in the Lebanese population, respectively.

## Nutritional Assessment of Patients with End Stage Renal Disease Undergoing Hemodialysis in Alexandria, Egypt

Doaa M. Genena<sup>a</sup>. Dr. Eman E. Elgohary<sup>b</sup>

<sup>a</sup> MD , PhD , Assistant professor , Nutrition & Dietetics Department, Faculty of Health sciences – Beirut Arab University

<sup>b</sup> MD , Assistant Professor , Internal Medicine Department , Faculty of Medicine - Alexandria University

**Background:** Malnutrition (MN) is so prevalent in hemodialysis patients (HD patients) worldwide that it adversely affects their prognosis; being associated with an increased morbidity and mortality in these patients. However, recent data regarding the nutritional status among HD patients in Egypt is lacking. The purpose of this study was to evaluate the nutritional status of these patients at the dialysis unit of ElMoasat University hospital and medical research institute in Alexandria, Egypt using an economical nutritional assessment protocol consisted of anthropometric measurements, a biochemical blood measurement (serum albumin) and the seven-point Subjective Global Assessment (SGA)

**Settings and Design:** A cross sectional study was done at the dialysis unit of ElMoasat University Hospital and Medical Research Institute in Alexandria, Egypt.

**Subjects and Methods:** The study included 160 patients undergoing maintenance hemodialysis. Their nutritional status was assessed using subjective global assessment, anthropometric and biochemical measurement (serum albumin).

**Statistical analysis used:** Data were fed to the computer and analysed using IBM SPSS software package version 20.0.

**Results:** The present study revealed that among HD patients, 86.3% were mild to moderately malnourished. Mean serum albumin, BMI, TSF and MAMC were significantly lower in malnourished patients compared to well nourished ( $p < 0.001$ ). MN was more prevalent among HD patients aged  $\geq 45$  years (51.4%). Older HD patients ( $\geq 45$  years) had a significantly lower level of Serum Albumin ( $3.96 \pm 0.41$ ,  $p = 0.039$ ), BMI ( $23.36 \pm 4.34$ ,  $p = 0.004$ ), TSF ( $14.29 \pm 4.07$ ,  $p = 0.001$ ) and MAMC ( $18.18 \pm 2.82$ ,  $p = 0.001$ ) when compared with younger HD patients ( $< 45$  years). The seven-point SGA correlated positively with objective nutritional markers including Albumin, BMI, TSF, MAMC and Age.

**Conclusions:** The study concluded that MN is prevalent among HD patient in Alexandria, Egypt and that the Subjective global assessment is a reliable, precise, and rapid method for estimating the nutritional status in patients on HD.

**Key Messages:** Periodical monitoring of the nutritional status should be part of the follow-up of dialysis patients, and is fundamental for preventing, diagnosing, and treating MN.

# **Breakfast Patterns Among Lebanese University Students and Its Relation With BMI and Nutritents Intake**

Caroline Hammoura

LebaneseUniversity

**Background:** Breakfast skipping is often associated with a greater likelihood of overweight and obesity in adults.

**Objective:** Our study aimed to assess breakfast consumption in a sample of Lebanese University students and to study its relationship with body mass index and nutrients intake.

**Methods:** A sample of 415 students (196 men and 219 women) aged over 18 years, was recruited randomly from different Campus of LU-section I. A survey was conducted using a breakfast questionnaire (QFA and 24-hour recall). Analysis of nutrient intakes was conducted by *Nutrilog* and statistical analyzes were by SPSS.

**Results:** The majority of students had a normal weight (66%) and were breakfast eaters (88%). An inverse association was found between breakfast consumption and BMI. In addition, subjects who consumed Bread / Dairy products; Bread / Milk products / Fruits; Grains / Milk and Fruits / fresh juice, had significantly lower BMI compared to other breakfast eaters and to skippers. Similarly, consumers of healthy breakfast, had significantly lower BMI ( $22.3 \text{ kg/m}^2$ ) compared to unhealthy breakfast eaters ( $24.8 \text{ kg/m}^2$ ). Taking breakfast was associated with a high intake of protein and fat but low intake of MUFA, SFA and added sugars compared to non-consumers. The breakfast contribution to the RDA was satisfying equal to 25%. A healthy breakfast was also associated with high intakes of proteins and fiber and low intakes of energy, carbohydrates, fats, added sugars, SFA, PUFA and cholesterol compared to unhealthy breakfast.

**Conclusion:** Taking a healthy breakfast reduces BMI and help maintain nutrient intake consistent with the recommendations.



## Severity of depressive Symptoms among University Students and its association with dietary, lifestyle factors and stressful life events: A Cross-Sectional Study

Lea Helou, MSc candidate in Human Nutrition; Jocelyne Matar Boumosleh, MPH, PhD; Doris Jaalouk, PhD, MPH; Maya Abou Jaoude, MSc.

Department of Nursing and Health Sciences, Notre Dame University- Louaize (NDU),  
Lebanon

**Background:** Major depression is classified as a global health priority and burden on societies. The burden of depressive disorders in the Mediterranean region, including Lebanon, is substantial. Multiple individual, family, and environmental factors were found to impact the risk of depression. Lately, the role of lifestyle factors and diet in aggravating or attenuating depressive symptoms has started to gain interest among the scientific community worldwide.

**Objective:** The purpose of this study is to assess the severity of depressive symptoms among a sample of Notre Dame University (NDU) students in Lebanon, and its association with dietary, lifestyle factors and stressful life events.

**Methods:** A total of 457 randomly selected undergraduate students at NDU, were asked to complete a self-administered survey constructed of four sections; food frequency questionnaire (73 food items pooled into 9 groups), background questionnaire (socio-demographic and lifestyle factors), International Physical Activity Questionnaire (IPAQ) - short form and Patient Health Questionnaire-9 (PHQ-9), a 9-item depression scale used to assess severity of depressive symptoms. Each of the 9 items is scored 0 to 3, providing a 0 to 27 severity score, with scores of 5, 10, 15, and 20 representing cut-off points for mild, moderate, moderately severe and severe depression, respectively. Height, weight, WC, and blood pressure (taken three times at an interval of 10 minutes) of all subjects were measured. Blood pressure in adults was classified according to the seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure as: normal : systolic blood pressure (SBP) < 120 mmHg and diastolic blood pressure (DBP) < 80 mmHg, (2) pre-HTN :SBP between 120–139 mmHg and/or DBP between 80–89 mmHg, (3) stage 1 HTN: SBP between 140-159 mmHg and/or DBP between 90-99 mmHg, (4) stage 2 HTN:  $\geq 160$  SBP and/or  $\geq 100$  DBP mmHg. Waist circumference values were classified according to the National Heart, Lung, and Blood Institute guidelines, where by a WC > 102 cm in men, or > 88 cm in women, is considered an indicator of increased disease risk.

**Statistical analysis:** Descriptive statistics for the total sample were performed. Quantitative and qualitative measurements were summarized as mean  $\pm$  standard deviation and n (%), respectively. Comparisons of continuous and categorical variables were performed using independent 2-sample T Test (Mann-Whitney-U-test)/Analysis of variance (Kruskal Wallis Test) and the chi square test /Fisher's exact test, respectively. Spearman correlation coefficients were used to evaluate the association among the different variables. Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) version 22 for Windows. A p-value less than 0.05 were considered statistically significant.

**Results:** The sample consisted of 457 undergraduate students with a mean age of  $21.28 \pm 1.91$  years (63% males). The prevalence of depression, as reported by students, was found to be 2.4% (11/457). , with 7/11 (63.6%) being females. Using PHQ-9 depression scale, 36.3%, 39.6%,

17.3%, 4.3% and 2.5% of the students in our sample were found to have no, mild, moderate, moderately-severe and severe depression, respectively. Mean PHQ-9 score was found to be higher in females than males, but the difference did not reach statistical significance (6.99 vs. 6.79, NS). Mean PHQ-9 score was found to be significantly higher among those with a risky WC than those without a risky WC (8.49 vs. 6.68,  $p=0.066$ , respectively). Severity of depression was found to be associated with unhealthy lifestyle habits/behaviors and stressful life events. Specifically, a significant difference in mean PHQ-9 score was found among those who reported to eat meals rarely, occasionally and often, with higher mean score being among those who reported to eat meals rarely (10.29, 7.6, 6.52, respectively  $P=0.019$ ). Mean PHQ-9 score was also found to be significantly higher among those who reported to eat 2 meals/day than those who reported to eat 3 meals/day (7.72 vs. 6.15,  $p=0.029$ , respectively), among students who reported to eat breakfast rarely than students who reported to eat breakfast daily (8.15 vs. 6.18 respectively  $P=0.004$ ), among previous smokers than non-smokers (8.96 vs. 6.52,  $p=0.044$ ) and among students who reported to drink at least 1 drink /day than those who reported to drink alcohol occasionally (8.28 vs. 6.32,  $p=0.039$ , respectively). The mean PHQ-9 score was found to be significantly higher among those who reported to have any of the unhealthy eating behaviors in the past 3 months (9.56 vs. 6.46  $p=0.001$ ), make themselves sick (10.6 vs. 6.75  $P=0.01$ ), lose control over how much they eat (8.49 vs. 6.15,  $P=0.000$ ), believe to be fat when others say they are thin (8.24 vs. 6.44,  $P=0.001$ ) and state that food dominates their lives (68.34 vs. 6.40  $P=0.000$ ). Mean total PHQ-9 score was found to be positively correlated with hypertension ( $r=0.112$ ;  $P=0.026$ ), family history of hypertension and heart disease ( $r=0.133$ ;  $P=0.09$ ;  $r=0.105$ ;  $P=0.037$ , respectively), living away from parents ( $r=0.128$ ;  $P=0.11$ ), loss of a close friend ( $r=0.181$ ;  $P=0$ ), taking care of a family member with a physical disability ( $r=0.113$ ;  $P=0.025$ ), serious conflicts with parents, financial problems and academic difficulties ( $r=0.154$ ;  $P=0.02$ ;  $r=0.184$ ;  $P=0$ ;  $r=0.169$ ;  $P=0.001$ , respectively), physical abuse ( $r=0.12$ ;  $P=0.017$ ) and number stressful life events ( $r=0.284$ ;  $P=0$ ).

Further data analyses are underway to identify dietary patterns and examine the independent effect of dietary patterns on severity of depressive symptoms in our sample of students.

**Conclusion:** Severity of depression was found to be associated with unhealthy lifestyle habits / behaviors, stressful life events and central obesity. These findings highlight the importance of having regular on-campus screening and awareness campaigns in order to identify students with depression/ depressive symptoms and to alleviate the negative impact that depression has not only on individuals but also the society as a whole.

# **Females are more adherent to the Lebanese Mediterranean Diet than males among university students**

Carine Issa  
LebaneseUniversity

**Introduction:** Although the Mediterranean Diet has been shown to be protective against several diseases, nutritional transition continues to take place in several countries, particularly among youth. The aim of this study was to evaluate adherence of Lebanese university students to the Mediterranean Diet Score, along with its correlates, obesity in particular.

**Methods:** A cross-sectional study was carried out in 17 universities of Lebanon; standardized questions were asked about food frequency and adherence to a Lebanese Mediterranean Diet using a Lebanese Mediterranean Diet Score (LMDS). Physical activity, anthropometric data, smoking and other socio-demographic factors were also taken into account.

**Results:** The study involved 3384 students, with a mean LMDS of 25 (SD=5). We found that adherence to the Lebanese Mediterranean diet was moderate among university students in Lebanon; it was however higher for females in comparison to males ( $p<0.001$ ). As for the relationship with obesity, lower adherence to the Lebanese Mediterranean diet was found to be correlated to obesity status among female students and in the total sample; among men, all BMI categories had the same Lebanese Mediterranean diet scoring.

**Discussion:** Young adults, mainly men, have a low to moderate adherence to the Lebanese Mediterranean diet; they represent the appropriate age bracket in which health-promotion activities should be carried out, aiming at facilitating the adoption of health-promoting behaviors and eventually reducing premature mortality at a later stage.

## **Comparison of the Food and Nutrition Security Status of Syrian Refugees and their Lebanese Host Communities in Lebanon: The Case of Akkar**

Lamis Jomaa, PhD\*, Sara Daher, BS, Farah Naja, PhD, Nahla Hwalla, PhD  
Department of Nutrition and Food Sciences, Faculty of Agricultural and Food Sciences,  
American University of Beirut

**Background:** Food insecurity is a serious concern among populations in the Middle East and North Africa (MENA); particularly after the most recent regional conflicts [1]. Lebanon, a small middle income country in the MENA region, is facing the most pressing challenges regarding the food and nutrition security of its populations, particularly after the high refugee influx from neighboring nations including Syria. Recent reports have been highlighting increased tension between refugees and host communities due to competition for limited livelihood opportunities, including adequate housing, health, educational services, as well as job opportunities [2, 3]. This tension has been most evident within regions in the country previously vulnerable to poverty and food insecurity, including North of Lebanon [3].

Studies have shown that household food insecurity can have serious adverse effects on the most vulnerable groups, particularly children and mothers [4]. In fact, mothers and children may be at a disadvantage with respect to food distribution within their households placing them at a high risk of nutrition insecurity [5]. In addition, household food insecurity has been associated with detrimental health and developmental consequences among children, including higher risk of malnutrition, poorer academic performance and inadequate social skills [6].

**Objectives:** This study aimed to compare the food and nutrition security status of Syrian refugee households and their Lebanese host communities in the region of Akkar, North of Lebanon. More specifically, the study explored the dietary intake and nutritional status of mothers and children from both communities.

**Methods:** This is a cross-sectional study that is currently being conducted in Akkar, a district in the North Lebanon known to be hosting a large number of Syrian refugees. A sample of 100 households have been recruited to date from a total of 324 households intended to be included in the final analysis. Mothers and their children (aged 4-10 years) from Syrian refugee and host Lebanese households within villages in Akkar were approached within their home setting to take part in the study. Trained research assistants conducted face-to-face interviews with mothers and children, after securing their consent, to collect data on household food security, coping strategies, and socio-demographic information. In addition, dietary and anthropometric measurements were taken using validated dietary recall measures and calibrated scales to assess the nutritional status of mothers and children. Comparisons of the food security status, coping strategies, nutritional status and dietary intake among Lebanese households and Syrian refugees were carried out using chi-square analyses and independent t-tests. Associations between household food security status (food secure vs food insecure) and nutritional parameters of mothers and children will be examined separately through multivariate logistic regression models.

**Results:** Data from a total of 100 households have been collected and analyzed to date. The majority of Syrian refugee households were severely food insecure compared to Lebanese households (80% vs 20% respectively). However, the prevalence of mild to moderate food

insecurity was higher among Lebanese households (40% vs 14%), p-value <0.001. In addition, significant differences were observed between Syrian refugee and Lebanese host community households with respect to socio-demographic characteristics with higher monthly income, spouse's educational level and employment status among the Lebanese communities. Syrian refugee and Lebanese households reported various coping mechanisms to deal with food insecurity, including reducing the number of meals eaten per day, borrowing money to buy food, and sending family members to eat elsewhere when there is food shortage. Significant differences were observed between Lebanese host community and Syrian refugee households with respect to their children's nutritional status whereby 16% of Lebanese children were classified as overweight compared to 4% of Syrian refugee children, p-value=0.046. Surprisingly, 4% of Lebanese children were classified as wasted due to low body weight to height, whereas none of the Syrian refugee children fell into this category. When addressing the micronutrient intake of children, the majority of children from the Lebanese and Syrian refugee households had inadequate intakes of calcium, potassium, vitamin D, vitamin E, and vitamin B12. In addition, a higher proportion of Syrian refugee children were consuming inadequate amounts of key micronutrients, including sodium, zinc, vitamin C, and most of the B vitamins. As for mothers, a larger proportion of Lebanese mothers were classified as obese with BMI  $\geq 30$  kg/m<sup>2</sup> compared to Syrian refugee mothers (44% vs 33%); however this difference was not found to be statistically significant (p-value=0.368).

**Conclusion:** The study highlights the high levels of moderate to severe food insecurity among refugee and host Lebanese households in Akkar. Households are adopting various risky coping mechanisms to secure food for their family members. Furthermore, we observed a high risk of nutrient inadequacies among children from both impoverished Syrian refugee and Lebanese host communities, with more severe deficiencies indicated among refugee children. Findings from this study highlight the need for adequate social and food assistance programs and increased livelihood opportunities for refugees and host communities, particularly in impoverished and rural areas within Lebanon to help reduce the burden of food insecurity. In addition, further efforts are required by national and international humanitarian agencies to tailor public health interventions that can alleviate the double burden of overweight and micronutrient deficiencies among children and mothers in food insecure households.

## **Assessment of the nutritional status and related correlates of Lebanese children and adolescents living in orphanages**

Germine El-Kassas M.D., PhD <sup>1</sup>, Sara Daher L.D.<sup>2</sup>

<sup>1</sup> Nutrition & Dietetics Department, Faculty of Health Sciences, Beirut Arab University.

<sup>2</sup> Department of Nutrition and Food Sciences, Faculty of Agricultural and Food Sciences, American University of Beirut.

**Background:** Childhood is the most crucial period affecting physical and intellectual development. The dual burden of under and over nutrition among children and adolescents is a major challenging public health problem in developing countries. Although children living in orphanages are among the most vulnerable groups at risk of malnutrition, there is scarcity of data concerning their nutritional status in Lebanon.

**Objective:** To assess the nutritional status and associated dietary and lifestyle factors of children and adolescents living in orphanages in Tripoli.

**Design and setting:** Through a cross sectional survey, a sample of 153 institutionalised orphans aged 4-14 years from both sexes were chosen from all orphanages in Tripoli. Data were collected using a standardized questionnaire to determine socio-demographic, dietary patterns, physical activity and sedentary behaviors. Nutritional status was assessed using clinical, dietary and anthropometric tools. The height for age (HAZ), weight for age (WAZ) and weight for height (WHZ) Z scores and BMI for age percentiles were computed and compared to the World Health Organization reference values.

**Results:** Interpretation of anthropometric data of the studied sample had shown that 13.8%, 2% & 1.3% were stunted, underweight and wasted respectively while 19% were overweight and obese. Clinical manifestations of nutritional deficiencies were obvious in about one quarter of the studied sample. In addition, dietary intake evaluation revealed that about half of the participants had inadequate dietary intakes of proteins, fruits and vegetables and 92 % had inadequate milk & dairy intakes recommended for their age specific needs.

**Conclusion:** The coexistence of under and over nutrition among institutionalised orphans calls for the implementation of comprehensive intervention strategies committed to reducing under nutrition while simultaneously preventing over nutrition through improving diet quality and physical activity of these orphans.

# PREVALENCE OF MALNUTRITION IN MAJOR HOSPITALS IN BEIRUT AND THE NEED FOR AN EFFICIENT SCREENING SYSTEM

K. Ouaijan 1,\*, L. Mattar 2

1SAINT GEORGE HOSPITAL UNIVERSITY MEDICAL CENTER, Beirut, Lebanon

2 LEBANESE AMERICAN UNIVERSITY, Beirut, Lebanon

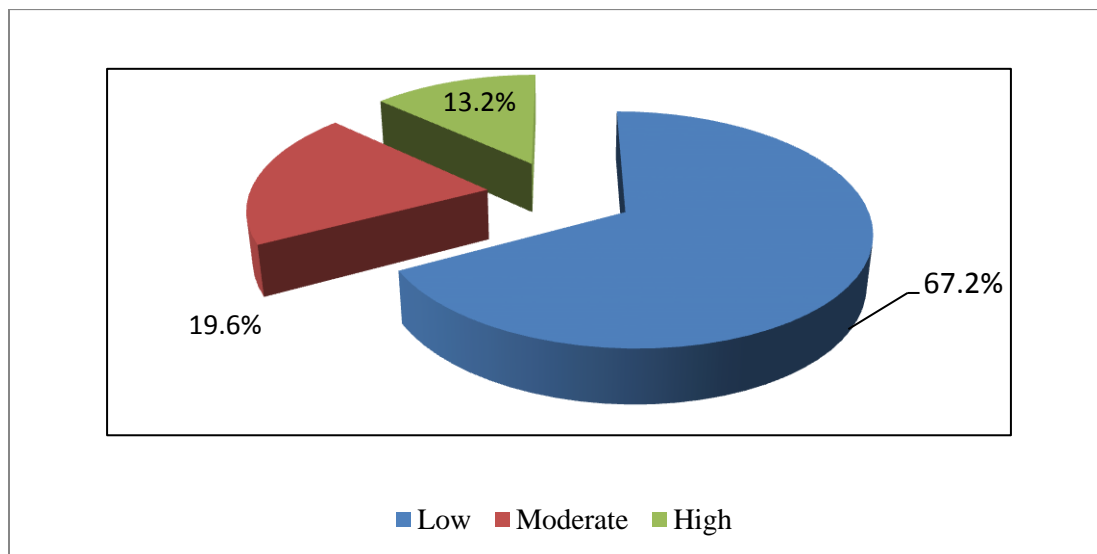
**Rationale:** The main objective is to analyze the prevalence of malnutrition upon admission of patients to major hospitals in Beirut. We will also verify if patients were appropriately referred to dietetic consultation in absence of a well-established screening system in one of the hospitals.

**Methods:** During the period of April to September 2014, all adult patients admitted to the hospital during one month period were screened for risk of malnutrition using the Nutrition Risk Screening (NRS) tool. Three categories were created: low (0-1), moderate (2-3) and high (>3) nutritional risk based on final NRS score. Descriptive statistics were performed and the relationships between the different variables were tested using Pearson's Chi-Square tests.

**Results:** 922 patients were included in the study. 32.8% are at risk of malnutrition, of which 19.6% had a moderate score and 13.2% had a severe score. When comparing the prevalence of malnutrition between a governmental hospital and a private hospital, 24.8% of patients in the private hospital were at risk of malnutrition as compared to 43.8% in the governmental hospital. This difference was statistically significant using a paired-t test ( $p \leq 0.005$ )

In one of the hospitals, 46.5% of these patients at risk for malnutrition were not assessed by a dietician due to absence of a screening system.

Figure 1: Patients classified according to risk of malnutrition in major hospitals in Beirut



**Conclusion:** 1 of every 3 patients admitted to the major hospitals in Beirut is already at risk of malnutrition, with a higher prevalence in the governmental hospital. This prevalence is in agreement with the reported prevalence worldwide (Norman et al. 2008).

This study also showed that malnourished patients were not consulted by a dietician due to absence of an effective screening system emphasizing the importance of systematic screening for malnutrition, using validated tools, in order to implement targeted nutritional interventions.

## **Evaluation of fruit and vegetable consumption as phytonutrient potential in Lebanon**

Yonna Sacre, Rachad Saliba, Michael H. Böhme

Humboldt Universität zu Berlin, Faculty of Life Sciences, Dept. of Horticultural Plant Systems,  
Germany, Lentzeallee 75, 14195 Berlin  
Lebanese University, Faculty of Agriculture, Lebanon, Dekwaneh

Fruits and vegetables (FV) are known to contain considerable amounts of vitamins and minerals in addition to phytonutrients and bioactive compounds having many positive health effects in the prevention of diseases such as cardiovascular illnesses, cancer, etc. Therefore, it is crucial to evaluate the FV consumption as sources of phytonutrients of the Lebanese population. A cross sectional analysis of 390 Lebanese individuals aged between 20 and 65 years old located in six Mohafazat (Beirut, Mount Lebanon, North, South, Nabatieh and Bekaa), was conducted. Sociodemographic, lifestyle, eating behaviour, food frequency questionnaire (FFQ) and awareness information were collected through a questionnaire specifically adapted for the purpose of the study. Statistical analysis was carried out and multivariate models were used in order to evaluate the association between fruits and vegetables consumption and different independent factors. The FV consumption among the Lebanese population was acceptable compared to the international recommendations. Regarding vegetables, 38.5% of the Lebanese respondents, showed a high level of consumption versus 37.98% having a low level of consumption. Related to fruit consumption, 38.08% Lebanese respondents consuming high levels of fruits compared to 36.54 % of the Lebanese respondents, showing a low fruits intake. Furthermore, it was observed that the majority of the study population was highly aware of the importance of phytonutrients in FV and were willing to consume these food items more and more, 49.23 % of the Lebanese population. The FV consumption was the most associated with the area of residence, age, education level, work, salary ranges, weight loss diet, physical activity, smoking, supplement intake the monthly amount of money spent on food and consumptions of starch, dairy products, meat, herbs and juices. The findings stated that the consumption of FV in Lebanon is acceptable, even though it is affected by several socio demographic and lifestyle factors. Future governmental or national programs and interventions could be settled to encourage and increase the FV consumption among all the population age levels and areas of residence.

**Keywords:** Fruit, vegetable, health, phytonutrients, bioactive compounds, awareness



# **Assessment of the Nutritional Status of Syrian Refugees in Lebanon**

Yara Tarabay

Department of Geography, Environment and Disaster Management, Faculty of Business,  
Environment and Society, Coventry University, United Kingdom

Food insecurity is a challenging matter for Syrian refugees in Lebanon due to their exhausted savings and assets. Thus, the aim of this project was to assess the nutritional status of Syrian refugees living in Lebanon, especially vulnerable groups such as children, pregnant and lactating women, and to identify some of the factors likely to undermine their nutritional status, and therefore make recommendations to practitioners and policy makers for an effective nutritional management. For the purpose of this research, only secondary sources for data collection were used.

The findings of the research indicated that the prevalence of acute and chronic malnutrition, as well as anaemia among Syrian children refugees was within acceptable levels based on WHO classification. Moreover, 5% of all Syrian refugee women were malnourished, among which 1% were severely malnourished. However, anaemia prevalence among the same group was within acceptable levels. Furthermore, the majority of Syrian refugees in Lebanon relied on employment as their primary livelihood sources, followed by food vouchers from the WFP, loans and cash. Nevertheless, despite the WFP food assistance to registered refugees, and the availability of food in the local market, high cost of food was shown to be a major obstacle to food access for Syrian households. Also, food access of Syrian refugees was hindered by lack of money and unemployment, and 27% of all Syrian families in Lebanon were considered food insecure, due to their consumption of low nutritional value food. Additionally, the limited legal status of Syrian refugees in Lebanon, their informal shelter situation, negative food coping strategies, poor hygiene practices, inadequate water in quality and quantity, and improper child feeding practices were all likely to jeopardize their nutritional status.

Accordingly, some recommendations were deemed necessary such as accepting the UNHCR registration as an alternative documentation, facilitating access to income generating activities, providing fortified complementary foods for children, providing iron fortified foods, increasing awareness of on appropriate breastfeeding and complementary feeding practices, scaling-up activities that promote sanitation and hygiene, and others.

## **EFFECT OF METFORMIN ON SERUM VITAMIN B12 LEVELS IN TYPE 2 DIABETIC LEBANESE PATIENTS**

J. ZALAKET (1), E. ABOU JAOUDE (2)

(1\*): Holy Spirit University of Kaslik, Faculty of Agricultural Sciences, Department of Human Nutrition and Dietetics.

(2): Middle East Institute of Health, Department of Endocrinology, Obesity Center COCP

1) *Background:* Metformin is the only biguanide derivative used to treat type 2 diabetes mellitus in the Lebanese market. Several studies have suggested that its use for more than 3 months, contributes to vitamin B12 deficiency in 10-30% of patients, but the results vary sometimes from one study to another. To our knowledge, up to now, we have no published data on this subject in Lebanon.

2) *Objectives:* We will be able to check if there is an effect of Metformin on the serum level of vitamin B12 in these patients, and we will investigate if there is a difference in the duration and dose of treatment with Metformin; as well as the effect of the deficiency of vitamin B12 on the development of neuropathy and megaloblastic anemia.

3) *Methods:* A retrospective descriptive study was conducted on 200 Lebanese patients. These patients aged between 18 and 90 years from both genders were chosen from four different clinics in Mount-Lebanon and Beirut, between January and April 2015. They were diagnosed with type 2 diabetes mellitus and treated with Metformin for at least three months and in whom serum vitamin B12 was tested. The medical record of each of them was consulted extensively and a questionnaire was adopted.

3) *Results:* 33% of patients have borderline values of the serum vitamin B12 while 22.5% had a deficiency. There is a very highly significant correlation between the dose of Metformin and the serum levels of vitamin B12; when the dose increases, the concentration of vitamin B12 decreases. The mean vitamin B12 level decreases with increasing duration of taking Metformin (for three months and over: 232.11 pmol/L, beyond one year: 177.83 pmol/L). The levels of serum B12 are lower in patients with at least one neurological symptom. Finally when the level of vitamin B12 decreases, the mean corpuscular volume increases and hemoglobin level decreases.

4) *Conclusion:* It is important to draw the attention of the medical community to this serious problem. It should aim to maintain normal serum vitamin B12 and thus reduce the risk of complications.

## **Blue Caravan Project: Epidemiology of diabetes prevalence in Lebanon, a National Lebanese Study**

Georges RAMMOUZ<sup>1</sup>, Joyce KHAIRALLAH<sup>1</sup>, Nathalie KOSSEIFI<sup>1</sup>, Charlise KHATER<sup>1</sup>, Angela CHERKEZIAN<sup>1</sup>, Antoine SAKR<sup>1</sup>, Joseph KEIROUZ<sup>2</sup>, Najib El HADDAD<sup>3</sup>

<sup>1</sup> Nutrition and Dietetics Department, Faculty of Applied Sciences, American University of Technology – Halat.

<sup>2</sup> Faculty of Applied Sciences, American University of Technology – Halat

<sup>3</sup> Dean, Faculty of Applied Sciences, American University of Technology – Halat.

The number of people with diabetes is increasing due to sedentary way of life, population growth, aging, urban life styles, and increasing prevalence of obesity and physical inactivity. The complications associated to diabetes pose a significant health care burden and a deterrent to overall quality of life. Quantifying the prevalence of diabetes and the number of people affected by diabetes complications, now and in the future, is important to allow rational planning and allocation of resources by national health authorities. High rates of diabetes have been observed among Arab populations in the Middle East, especially in Lebanon, where the average rate ranges between 19 and 25%. We aimed to determine the prevalence of previously diagnosed and undiagnosed diabetes in four governorates: North, Mount Lebanon, Beirut and South. This coastal part of Lebanon is home to 70% of the population and represents a mixture of urban and rural areas with different socioeconomic classes. The Blue Caravan initiative, launched by the American University of Technology in collaboration with the International Diabetes Federation and the Lebanese ministry for Public Health, with a research team composed of a medical doctor, clinical nutritionist and senior nutrition students, screened a total of 3,941 Lebanese citizens (40% male; 60% female) for Diabetes and Hypercholesterolemia. Random citizens were interviewed and asked about prior medical diagnosis of diabetes, family history and smoking habits. Blood was collected from subjects who did not report a previous diagnosis of diabetes and accepted enrolment in the study. Blood could not be obtained from people who did not fast for 12 h overnight. Fasting plasma glucose and Cholesterol concentrations were measured by an automated Accutrend Plus device using Roche Diagnostics test strips. All statistical analysis was done using Excel and data analysis and data analysis plus.  $P < 0.05$  was considered statistically significant.

Of the 3,941 individuals recruited, the prevalence of diabetes was higher (7%) in men than women. The sampled groups were not statistically different concerning age. The combined prevalence of previously diagnosed and newly diagnosed was 22% for diabetes and 26% for Hypercholesterolemia. A variation in diabetes and cholesterol prevalence was evident between districts in different governorates, representing diverse lifestyle and eating habits. These results suggest that the prevalence of diabetes in Lebanon is high and in concordance with the regional prevalence as reported by WHO. Larger samples covering different areas in Lebanon are needed to estimate the national prevalence of diabetes including the non-coastal areas.

# **Why is HACCP Failing?**

## **In Lebanon, Germany and Poland**

Karine Haddad

Faculty of Organic Agriculture

Kassel University/Hochschule Fulda

This study has examined multiple types of food safety systems such as ISO 22000, IFS, CODEX HACCP, BRC, and FSSC 22000 implemented in Lebanon, Germany and Poland. The research topic investigated reasons behind these systems' success or failure in the three countries. Primary research has showed that in spite of the increase of food safety systems between 2001 and 2014, food borne outbreaks have also been increasing specifically in Germany and Poland. Using an inductive approach, a literature research was done on the relationship between foodborne outbreaks and HACCP systems. This research was followed by a close examination of the differences among existing HACCP based food safety systems and how such differences are affecting hazard analysis steps, and the choice of critical control points. Afterwards, a qualitative research was done by interviewing 50 food experts from the three countries such as caterers, industrial experts, consultants, auditors and governmental inspectors. The questionnaire was formulated using open ended questions regarding how experts understood the different parts of a HACCP system and how they practically implemented them in their work fields.

The results of the research highlighted four major areas of importance and influence:

- 1- Preliminary HACCP Steps: Flow charts
- 2- HACCP Principle 1: Hazard analysis
- 3- HACCP Principle 2: Critical Control points
- 4- HACCP Principle 6: Verification (and Validation)
- 5- Roles of Consultants, Auditors, Governments and Guidelines

The presentation will only cover the results from point 4 being HACCP Principle 6: Verification (and Validation). Out of 50 experts, only 5 were implementing Validation according to 'Codex 2008 Validation Guideline'. This guideline is not present in the original Codex HACCP document updated in 2003. Validation is classified differently in the different HACCP-based standards. This has caused the inability to understand the actual meaning, and role of validation in HACCP. While ISO22000 has a complete section on validation for example, IFS mentioned validation for HACCP and GMP steps as well. This difference in classification and explanation of validation has caused confusion for different food experts in the different countries. This has naturally led the experts, whether consultants, auditor's or governmental inspectors to teach about validation as they have understood it which is not necessarily right. Another challenge in understanding validation was that different guidelines were presenting it and explaining it differently. While some guidelines understood validation well, other have explained it exactly as if it was verification or auditing.

Another challenge validation had in HACCP was that companies don't often understand that systems can have process variation. Process variation comes from the different midranges

existing in processes due to machinery settings or variation in raw material, or variation in process ability. Because of the lack of awareness of this topic, several experts perform validation without taking into consideration max/min abilities in their processes and products. This leads to several misses of control point ranges which yields to system shut downs or eventually, food borne outbreaks.

In conclusion outbreaks will continue to occur because HACCP is not yet scientifically and uniformly well understood by many food experts. This leads to the challenge that industries will apply whatever they are taught by inspectors, consultants, auditors, guidelines and standards. This can be changed if we start by spreading awareness among the latter experts and transferring it practically into the food industries.

## Functional Foods: Knowledge, Attitudes and Acceptance of Lebanese Consumers

Fatayri, M., Chammas, R., Makdessi, R., El-Hayek, J. and Bou-Mitri, C.\*

Department of Nursing and Health Sciences, Notre Dame University, Zouk Mosbeh, Lebanon

**Background:** Consumer awareness of the relationship between diet and health has increased considerably in recent years, allowing functional foods to constitute the single fastest growing segment in the food market. The development and commerce of these products is rather complex, expensive and risky, as special requirements should be addressed. Besides potential technological obstacles, legislative aspects, consumer demands need to be taken into consideration when developing functional foods. In particular consumer acceptance has been recognized as a key factor to successfully negotiate market opportunities. In Lebanon, the development and marketing of functional foods and ingredients are still at an early stage. Data about acceptability, attitudes and knowledge of functional foods by consumers has not been previously assessed. Therefore, the aim of this study was to assess the Lebanese consumer's knowledge, attitudes, acceptance of functional foods and ingredients. In addition, factors affecting their acceptance, the willingness-to-know and willingness-to-pay for those products were also investigated.

**Methods:** A cross-sectional study recruited a convenience sample of adults living in Mount Lebanon between November and December 2015. An interviewer-based questionnaire was developed to assess socio-demographic and medical status, food consumption patterns and knowledge about functional foods and functional ingredients. The data collected was coded and analyzed using SPSS, version 20. Descriptive analyses were summarized as mean  $\pm$  standard deviation and n (%). Comparisons of continuous and categorical variables were performed using independent samples T Test and the chi square test, respectively. A p-value  $< 0.05$  was considered statistically significant.

**Results:** Out of the 251 respondents, 61% were females, 48.6% were aged between 18 to 30 years old and 76.9% had a Bachelor or higher degree. Of the respondents, 40.6% and 32.6% were found to know what are functional foods and functional ingredients, respectively. About 54.5%, 42.6%, 36.2%, 16.7%, and 11.9% of the respondents were actually consuming cereal bars, whole grain bread or bran bread, probiotic yogurt and protein bars, respectively.

Participants identified the most important functional ingredients to be calcium (48.0%), omega-3 (38.6%) and vitamin D (36.7%). The main reason to consume functional foods was because they have nutritional benefits beyond basic nutrition (44.2%). Young participants belonging to age quartile 1 (18-25 years) knew more about functional foods (57.1%) and functional ingredients (41.3%) than participants belonging to the fourth quartile (42-67 years; 29.0% and 21.0%, respectively;  $p < 0.01$ ). Females (61.7%) were more highly interested to learn about functional foods than men (42.3%;  $p = 0.01$ ). Among the primary grocery shoppers in the household 62.2% were highly interested to learn more than those who were not (49.0%;  $p < 0.05$ ). Of the respondents 41.8% and 14.5% could spend between 50-100, or  $\geq 100$  USD per month on those foods, respectively. Further data analyses are still undergoing.

**Conclusion:** Those findings may be useful for market orientation, development and successfully negotiating new market opportunities of functional foods for both the food industries and policy makers.

## **Effect of modified manufacturing procedure on the overall quality attributes and safety of Kishk**

H. Dib, E. Hajj, R. Yaacoub, O. Muhyeddeen, M. Al-Amin, Z. Mcheik  
(Lebanese University, Faculty of Agriculture and Veterinary, Dekwaneh, Mount-Lebanon)

Kishk is a resultant of a fermented mixture of yoghurt and Bourghul (wheat grits), dried and packed in moisture-tight containers as strategic home reserve (Mouneh) for almost a year. It is traditionally produced using various methods and therefore, leading to a non-homogenous physico-chemical characteristics and vulnerable safety conditions.

The specific objectives of the study are to contribute to food security of rural communities through encouragement and facilitation of traditional nutritive food production, assure safety and quality of end-product, harmonize quality attribute of end-product to allow better local and international marketability, and create an enhanced industrialization opportunity. To serve objectives, a modified method of Kishk production has been examined and assessed for its convenience and feasibility through assessment of chemical, physical, microbial and sensory properties in comparison to the traditional method. Major modifications included the addition of all required dairy solids at one time in the form of strained yoghurt, rather than adding yoghurt twice a day for the whole period of fermentation.

To assess socio-economic importance of the product, an initial field survey was carried out on Kishk production. The survey targeted different villages of the Bekaa and South Lebanon and covered a total of 133 Kishk producers, both artisanal and industrial productions. The results revealed that the total estimated average Kishk production in Lebanon amounted to about 4000 MT, with Beqaa being the greatest producer (over 1600 MT). It was observed that industrialization of Kishk is emerging fast particularly in the Beqaa Valley, either by specialized firms or as a partial outcome of granaries. About 95 % of Kishk is produced by housewives contributing to home food security and socio-economic stability. The most common practices used in the production of Kishk and their variations according to region and type of production were also identified.

Modified produced Kishk was of comparable quality attributes to that of the traditional. Chemically, moisture content ( $< 65\%$ ) was significantly lower than that of traditional, whereas titratable acidity (about  $1.2\%$ ) was significantly higher ( $p < 0.05$ ). This may be an indication of a better fermentation course in the modified method as well as better stability during storage. Protein, both soluble and total, acid value and TBA showed insignificant differences between both products ( $P > 0.05$ ). Peroxide values were found to be zero for both products throughout the processing stages. Regarding physical attributes, only texture and viscosity showed a significant difference ( $P < 0.05$ ), where modified Kishk showed harder texture and higher viscosity during fermentation period at room temperature (about  $23\text{ }^{\circ}\text{C}$ ). On the other hand, coarseness, density, water activity and solubility index showed no significant differences. However, dried kishk obtained by traditional method showed better reconstitution characteristics i.e. dispersibility and wettability, than that obtained by the modified method. As per microbiological quality, both products proved to be totally safe for consumption, considering that traditional Kishk was produced under laboratory control. However, the average Total Viable Count (TVC) for both was about  $6 \log_{10}$  CFU/g. On the other hand, beneficial Lactic Acid Bacteria (LAB) ranged from

6.6 – 12.5 log<sub>10</sub> CFU/g with no significant differences between both products ( $P > 0.05$ ). Total coliforms, *E. coli*, *Salmonella*, *Listeria monocytogenes* and anaerobic sulphite reducing bacteria were not detected in any sample. Using the descriptive profiling method, sensory analysis showed no significant differences ( $P > 0.05$ ) in the perception of both products except for color, where modified method has produced whiter color. No sensory defects namely off-flavor, foreign flavor, bitterness and aftertaste were detected in both traditional and modified products. When Kishk was cooked in the form of soup, appearance, odor and overall acceptability were significantly ( $p < 0.05$ ) better scored for modified produced Kishk.

In conclusion, the modified method of Kishk production proved satisfactory enough to meet the objectives of the research. Its adoption will provide better control over the manufacture hence better reproducibility as well as better standardization of end-product characteristics, ensure better practicability for the producer, and finally allow a safer production through minimized handling.



## **Setting up innovative antimicrobial packaging to improve the safety, quality and shelf-life of foods**

Loyal Karam, Charafeddine Jama, Pascal Dhulster, Nouredine Chihib  
Université Lille 1

The globalization of food trade and changes in lifestyles present new major challenges for food safety. Setting up active food packaging, via antimicrobial peptide adsorption on materials, is an innovative and proactive approach to improve the safety, quality, and shelf-life of packaged foods. Peptide adsorption on surfaces and the antimicrobial activity of the functionalized materials depend mainly on surface properties, on surface treatments allowing the modification of such properties, and on peptides-materials-bacteria interactions. In this work, nisin, an antilisterial bacteriocin, produced by *Lactococcus lactis* subsp. *lactis*, was used as the antimicrobial peptide. The selected packaging was the low density polyethylene, a commonly used packaging in the food sector. Different cold plasma processes were optimized to develop surfaces with various characteristics and specific functionalities needed for the adsorption studies. Physico-chemical surface characterization techniques permitted from one side, to confirm the surface functionalization by surface treatments and by nisin and from another side, to study the surface interactions. The antimicrobial study was undertaken to compare and confirm the antimicrobial activity of the different treated packagings.

The effectiveness of the activated surfaces was assessed against *Listeria innocua* and the food pathogens *Listeria monocytogenes*, *Bacillus cereus* and *Staphylococcus aureus*. *Staphylococcus aureus* was more sensitive than the three other test bacteria toward nisin-functionalized films. Simulation tests to mimic refrigerated temperature showed that the films were effective at 20 and 4°C with no significant difference between the two temperatures after exposure to culture media.

## **Involvement of low molecular weight peptides released by *Saccharomyces cerevisiae* BDX in the inhibition of malolactic fermentation performed by *O. oeni* Vitilactic F**

Ziad Rizk<sup>a,b,c</sup>, Youssef El Rayess<sup>d</sup>, Chantal Ghanem<sup>a,d</sup>, Florence Mathieu<sup>c</sup>, Patricia Taillandier<sup>e</sup>,  
Nancy Nehme<sup>b,f</sup>

<sup>a</sup> Lebanese Agricultural Research Institute (LARI), Fanar, <sup>b</sup> Faculty of Sciences, Holy Spirit University of Kaslik, <sup>c</sup> Laboratoire de Génie Chimique, Université de Toulouse, <sup>d</sup> Faculty of Agricultural and Food Sciences, Holy Spirit University of Kaslik, <sup>e</sup> Laboratoire de Génie Chimique, Université de Toulouse, <sup>f</sup> Faculty of Agricultural Engineering and Veterinary Medicine, Lebanese University

The production of most red wines and certain white and sparkling wine styles requires two consecutive fermentation steps. The first one is the alcoholic fermentation (AF) and is carried out mainly by *Saccharomyces cerevisiae*. At the end of the AF, the wines undergo malolactic fermentation (MLF) carried out mainly by *Oenococcus oeni*. However, the MLF is often difficult to trigger and accomplish because of the individual or synergistic antibacterial activity of several physical chemical wine parameters and yeast inhibitory metabolites.

In this context, the study of the interactions that may occur between specific strains of yeasts and bacteria is important for choosing the adequate strain combination and inoculation strategy.

In the present work, *S. cerevisiae* BDX strongly inhibited *O. oeni* Vitilactic F during sequential fermentations performed in synthetic grape juice (SGJ) media. Protease and heat treatments of the SGJ media showed the protein nature of the yeast inhibitory metabolites. Fractionation by ultrafiltration of the same media revealed that an extracellular peptidic fraction of 5-10 kDa was responsible for the inhibition. It was gradually released during AF and reached its highest concentration at late stages of the stationary phase. The MLF inhibition was maintained in natural grape musts (Cabernet-Sauvignon and Syrah) presenting low and high phenolic contents. Therefore, the activity of the inhibitory peptides was not affected by grape phenolic compounds. The 5-10 kDa fraction was tested *in vitro* on cell-free bacterial cytosolic extracts containing the malolactic enzyme in a pH range between 3.5 and 6.7. Results showed that it was able to directly inhibit the malolactic enzyme activity with an increasing inhibitory kinetic correlated to the AF time at which it was collected.

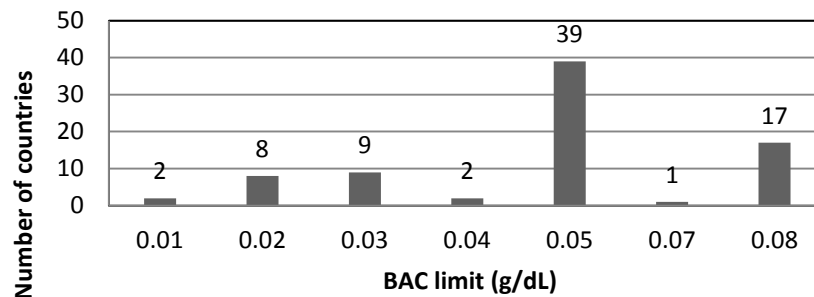
It was then analyzed by both anionic and cationic exchange chromatography (AEXC and CEXC). Eluates recuperated with 0.5 M NaCl from both AEXC and CEXC contained inhibitory peptides and were further migrated by SDS-PAGE. The bands of interest were excised and sequenced by LC1D-nanoESI-LTQ-Orbitrap. Results gave 12 different peptidic fractions that may have worked synergistically. 2 GAPDH fragments of 0.9 and 1.373 kDa having a *pI* of 9.074 and a Wtm2p fragment of 2.42 kDa having a *pI* of 3.35 were involved in the MLF inhibition.

## Alcohol Content in Foods and Potential for Becoming Drunk

Ahmad Houry\* and Ali Safadi

Natural Science Department, Lebanese American University

It has been known that ethanol undergoes a specific biological metabolism pathway in the human body. Starting with absorption, where the stomach absorbs 20% of the ethanol and the remaining is absorbed by the small intestines (Freudenrich 2015). Studies have revealed that complete absorption requires 30-60 minutes to be reached (Benjamin 2015). However several factors lead to variations of the rate of absorption. Excessive alcohol consumption allows alcohol to reach the central nervous system and causes signs of impairment. An analysis of the concepts of intoxication in blood and the required amount of alcohol to reach that level was analyzed from a physiological perspective. An analysis of the blood alcohol concentration after which a person is considered intoxicated in a number of countries (Fig 1) indicates that a majority of countries consider a BAC of 0.05% (w/v) as a legal limit. For the purposes of this study, this value will be adopted as the level beyond which a person will be considered drunk.



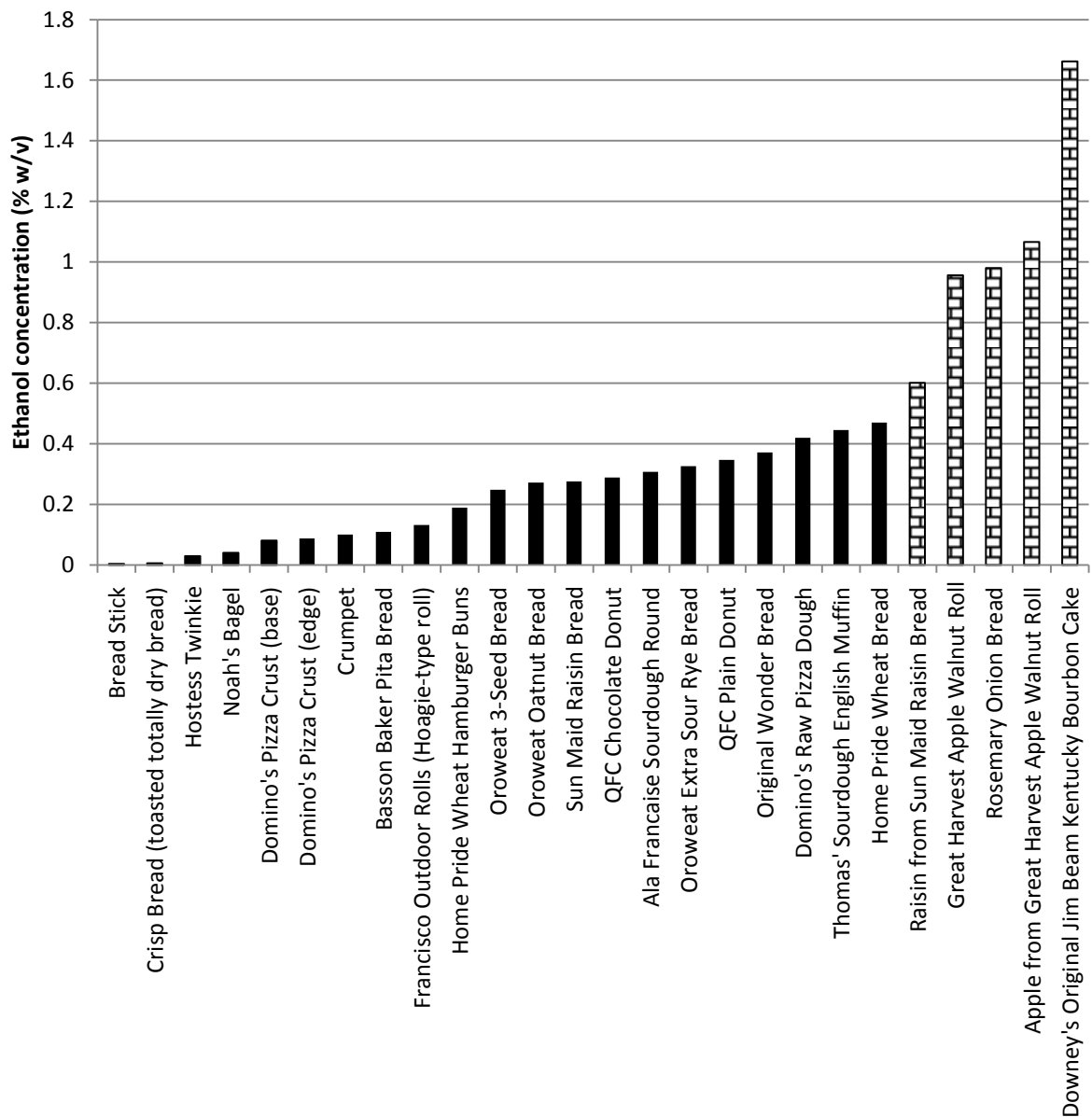
**Fig 1.** BAC limit in various countries (Policies 2013)

The Widmark equation is the most comprehensive and scientifically accepted equation that simulates the effect of alcohol consumption on BAC (Gullberg, 2007). This equation is represented as follows:  $BAC = (NZd - Wr\beta t) / Wr$

Where, N: Number of drinks; Z: Ethanol per drink; d: Density of alcohol; W: Body weight; r: Volume of distribution;  $\beta$ : alcohol elimination rate; t: time since drinking began.

The stomach capacity is 2-4 L under normal circumstances (Johnson *et al* 1994). However, the maximum volume that an average person can accommodate is 6 L (Mills 2013) under extreme competition style condition. The Widmark formula was used to estimate the amount of alcohol required to reach a 0.05% (w/v) BAC level. An average 80 kg male individual needs to consume 50 mL (39 g) of pure ethanol while an average 70 kg female needs to drink 35 mL (27 g) of pure ethanol to reach the determined drunkenness level. According to the various classifications and perspectives, once the alcohol content of a substance exceeds the 0.45% (w/v), it is automatically considered alcoholic and has the potential to cause drunkenness. This is in line with the limits set by US, Australia and other countries. Alcohol is commonly present in various types of food and in many prepared dishes. An analysis of alcohol content in various cooked foods showed an interesting spread in the alcohol content (Fig 2). The bars in the graphs are marked in different patterns depending on whether their alcohol content is higher or lower than 0.5%. According to

figure 2, this set value would mean that a number of clearly non-alcoholic foods may be classified as alcoholic under these regulations. This will have significant implications on BAC tests for drivers and the legality of importing such foods to certain countries.



**Fig 2.** Ethanol content in various foods. Derived from data obtained from (Logan and Distefano 1998)

# **Food safety and young consumers: Testing the impact of the Lebanese food safety campaign on students-An exploratory study at the University of Balamand**

Mireille Serhan<sup>1\*</sup> and Rami Hallab<sup>1,2</sup>

<sup>1</sup>University of Balamand, Faculty of Health Sciences, Nutritional Sciences Program, Deir El Balamand, P.O. Box 100, Tripoli, Lebanon.

<sup>2</sup>Rafaat Hallab and Sons, P.O. Box 1207, Tripoli, Lebanon.

A questionnaire-based survey was conducted to explore the food safety knowledge of Lebanese young adults and to assess the impact of the food safety campaign (food crisis of year 2015) on their consumption and eating patterns. Participants were mostly senior undergraduate students recruited from health-related and non-health-related faculties of the University of Balamand in Northern Lebanon. They completed a questionnaire containing ten questions grouped into four subsections: subjective knowledge about HACCP/ISO, perception of personal risk (how worried they are/what specific kind of food), market purchasing decision and eating in restaurants.

In general, participants were, usually, aware about the food safety campaign (92%). However, only 71% were supportive to the fact that food safety issue should be given needed attention.

Students from faculties delivering health-related programs (58%) outperformed those from other programs, on food safety knowledge. Participants expressed a high level of worry (73%) about the quality of food they are consuming. They were concerned about the quality of poultry (51%), meat (35%), fish (10%) and sweets (4%). However, only 56% reduce or stop going to the market or restaurant that faces food safety problems.

These results substantiate the urgent need for educational initiatives tailored to develop the food safety knowledge of young Lebanese students. At present, it should be helpful to work on new projects to expand the food safety campaign by promoting a positive food safety culture among consumers and food establishments.

## **Assessment of dietary exposure to sulfites and nitrites in Lebanon**

R. Yaacoub, D. Nasr, S. Mouawad, Z. Mounajjed, J. Hajj

(Department of Food Science and Technology, Lebanese University, Faculty of Agriculture and Veterinary medicine, Dekwaneh, Mount-Lebanon)

The main objective of this study was to assess the risk associated with the intake of selected food additives, namely sulfites and nitrites, through a dietary exposure assessment for the adult population in Lebanon.

Dietary exposures to these food additives were obtained by combining the food consumption data obtained from two individual cross sectional food surveys carried out on a population aged between 25 and 64 years living in Beirut, with the residues data obtained by chemical analysis. The risk was characterized by comparing the estimated dietary intakes with the acceptable daily intake (ADI) established for these substances by the international bodies like JECFA and also by calculating the percentage of individuals that have dietary intakes exceeding these ADI.

A total of 126 and 161 samples were purchased from the Lebanese market, prepared as normally consumed and analyzed for nitrite and sulfite content respectively. The sampling targeted food products that are susceptible to contain such additives, taking into account national and international standards for food additives, and at the same time representative of the typical Lebanese diet according to previous dietary studies.

The results showed that only 20% of all analyzed samples for sulfites were not complying with the national standard regarding the authorized maximum residue level, whereas all samples analyzed for nitrites were within the authorized limits. Nitrite content varied between 1.5 ppm in Salami and 28 ppm in Pastrami. The highest levels of nitrite content were recorded for Pastrami (28 ppm) and corned beef (25.2 ppm), followed by canned luncheon (13.4 ppm) and luncheon (13.1 ppm). On the other hand, sulfite content varied between 5.3 ppm in non-alcoholic beer and 2486 ppm in dried apricots. Dried fruits had the highest sulfite content especially dried apricots and raisins, followed by nuts (527.8 ppm), whereas condiments, frozen shrimps and pickles showed a moderate sulfite content (between 88 and 186 ppm). Comparing the different types of wine, sweet wine followed by white wine had the highest sulfite contents (131.7 and 72 ppm respectively).

The average dietary exposure to nitrites from all food items, as well as the 95 and 97.5 percentiles were, according to the realistic scenario (considering the average nitrite content for each food type), estimated at 0.006; 0.02 and 0.03 mg/kg of body weight/day respectively, representing 6, 20 and 30% of the ADI. Even when considering the worst-case scenario, where the consumption curve was multiplied by the maximum nitrite content recorded for each food type, the ADI was not exceeded even at the highest percentiles. Approximately 50% of the average daily intake of nitrites was brought by luncheon meat (28%) and ham (21%), being the main contributors to this exposure. Regarding sulfite intake, the average dietary exposure from all sulfite containing food as well as the 95 and 97.5 percentiles were, according to the realistic scenario estimated at 0.36; 1.19 and 1.58 mg/kg of body weight/day respectively, representing 52, 171 and 226% of the ADI. When considering the worst-case scenario, the average total exposure, as well as that at the 95 and 97.5 percentiles represented 86, 276 and 352% of the ADI

respectively. Nuts (57%) and dried apricots (13%) were the major contributors to this exposure, contributing to more than 70% of the total average intake of sulfites.

In conclusion, this study shows that the risk from sulfites and nitrites intake can be excluded for the average population since the ADI was not exceeded at the average level. However, regarding sulfites intake, we cannot exclude the risk for the 5 % of the population representing the heavy consumers of sulfite containing food.

## Sensory Characterization of Bowel Cleansing Solutions

Ala I Sharara<sup>1</sup>, Hamza Daroub<sup>2</sup>, Camille Georges<sup>2</sup>, Rani Shayto<sup>1</sup>, Ralph Nader<sup>1</sup>, Jean Chalhoub<sup>1</sup> and Ammar Olabi<sup>2</sup>

<sup>1</sup>*Department of Internal Medicine, Division of Gastroenterology,* <sup>2</sup>*Nutrition and Food Sciences Department, Faculty of Agricultural and Food Sciences, American University of Beirut*

**Funding source:** This research received no specific funding.

**Keywords:** laxatives; sensory evaluation; taste; preparation; acceptability; colonoscopy

**Descriptive Statement:** To evaluate the sensory characteristics of commercial bowel cleansing solutions.

**Introduction: background and aims** Bowel preparation is an important quality indicator in colonoscopy. Patient adherence may be significantly affected by the unpleasant taste of purgative solutions and patients may suffer from several reported side effects including abdominal bloating, nausea and vomiting. To date, no major studies have investigated the sensory properties of bowel cleansing solutions using comprehensive sensory evaluation techniques.

**Methods:** Descriptive analysis was conducted with trained panelists (n=14) for 4 commercial bowel cleansing solutions [polyethylene glycol electrolyte solution (PEG), PEG + ascorbic acid (PEG-Asc), sodium picosulfate (SPS), and oral sodium sulfate (OSS)] using a 15-cm line scale with the Compusense at-hand® software, to create a sensory profile for the solutions. Acceptability testing (n=80) was conducted with untrained panelists (n=80) using the 9-point hedonic scale. Moreover, a Just-About-Right (JAR) scale was included for the four basic tastes to determine their intensity compatibility with acceptability levels in the products.

**Results:** Samples were significantly different on descriptive analysis for all attributes ( $p < 0.05$ ) except sweetness. SPS received the highest ratings for turbidity, viscosity-appearance, orange odor and flavor; PEG-Asc for citrus odor and flavor; OSS for sweetener taste, sweet aftertaste, bitterness, astringency, mouthcoating, bitter aftertaste and throatburn, and along with PEG-Asc, the highest ratings for saltiness, sourness and adhesiveness. Acceptability results showed significant differences between the samples ( $p < 0.05$ ). SPS received significantly higher ratings for overall acceptability, taste, and mouthfeel ( $p < 0.05$ ). Ratings on the JAR scale showed that PEG and PEG-Asc were perceived as slightly too salty; SPS and OSS were slightly too sweet, while SPS, PEG-Asc and OSS were slightly too sour and OSS slightly too bitter.

**Conclusion:** Further improvements are needed to enhance the sensory profile and optimize consumer acceptability for better compliance with bowel cleansing solutions.



## **Fatty acid composition including trans-fatty acids in selected cereal-based baked snacks from Lebanon**

Carol Saadeh<sup>a</sup>, Imad Toufeili<sup>a\*</sup>, M. Zuheir Habbal<sup>b</sup>, Lara Nasreddine<sup>a</sup>

a. Department of Nutrition & Food Sciences, Faculty of Agricultural & Food Sciences

b. Department of Pathology and Laboratory Medicine, Faculty of Medicine  
American University of Beirut, Lebanon

Ten samples of biscuits (including plain, whole meal, cream-filled and chocolate-coated), 7 samples of cakes (including plain, chocolate and cream-filled), 4 samples of wafers (including plain, chocolate-filled, coated and chocolate-filled) and 3 samples of croissants (including plain and chocolate-filled) were collected from Lebanon and analyzed for their fatty acid composition including trans fatty acids (TFA) by AgNO<sub>3</sub>-thin layer chromatography and gas chromatography. All samples contained TFA ranging between 0.7 and 25.8 g/100 g fat and 20 out of the 24 analyzed samples contained more than 2% TFA on fat basis. The ratios of trans 18:1/(trans 18:2 + trans 18:3) ranged between 4 and 15.3 thereby indicating formulation of the products with partially hydrogenated oils. The content of TFA in the samples showed similarities to those reported in similar product categories in developing countries. This study is the first to report data on the levels and spectrum of TFA in snack products in Lebanon and underlines the importance of developing effective policies for reducing the intake of TFA by populations in the Middle East.

## **The Influence of Feeding Olive Cake to Baladi Caprine Females on Milk Quality**

Georges MAHFOUD, Mohamad MASRI (EL), Ghanem CHAMSINE, Rodrigue BALAA (EL)

University of Balamand

Despite their chemical, physical and nutritional properties, placing them within low quality forages category, research indicates that olive cakes can replace at relatively high rates some imported ingredients in the diet of small ruminants. Based on previous findings that studied the incorporation of olive cake as a part of animals feed, this study examines the influence of the use of olive cake in caprine feed on milk quality.

The study group included 8 caprine females of the same age and within the same weight range distributed into two groups: the first group received a normal ration (8% soya, 40% corn, 20% barley, 15% rye, 10% cotton seeds), the second received the same ration with gradual introduction of olive cake to reach a proportion of 5%. The test duration was 15 days. Milk tests were made every 48 hours by a milk analyzer which yielded the following parameters: lipid ratio; density; lactic rates and non-fat solids.

For the first group, lipid ratio varied between 23.9 (g/l) et 20.2 (g/l), as for the olive cake fed group, lipid ratio varied between 25.3 (g/l) and 19.2 (g/l); however, there was no significant difference between the two results. On the other hand, results showed a strong correlation between lipid ration and milk density. Moreover, heat stress had a negative influence on milk composition.

The influence of the incorporation of olive cake over the chosen parameters was not significant, which is in accordance with previous studies that noted an influence over the profile of lipids rather than on its ratio. This study shows the possibility of decreasing feeding cost while maintaining the same milk quality; moreover, it opens the way to a deeper analysis of the lipids profile through Gas Chromatography and Mass Spectrometry especially for the presence of both oleic and linoleic acids.

## **Quantitative Determination of Pesticides Residues in Selected Lebanese Foods and Risk Characterization for the Consumer**

Maria Rehaime

Instructor: Haigazian University, School of Arts and Sciences, Division of Sciences, Nutrition Sciences and Dietetics

Supervised by: Dr. Lara Nasreddine

Assistant Professor: American University of Beirut, Faculty of Agricultural and Food Sciences, Department of Nutrition and Food Science

The existence of pesticide residues in food may lead to major health concerns, especially if it reaches unsafe levels of contamination. Surprisingly, there has been little official documentation in Lebanon of surveys or results regarding this important matter. This study used the “Total Diet Study” (TDS) design, which is a method recommended by the World Health Organization and applied in different countries to assess the dietary exposure of the average consumer to food contaminants, including pesticide residues. The TDS consists of analyzing a ‘market basket’ of foods representative of the dietary habits of the population under investigation and which are prepared as for usual consumption (i.e.; washed, peeled, cooked etc.). The TDS methodology takes into account the effects of kitchen preparation on the levels of contaminants in foods and hence provides dietary intake data for use by regulatory agencies and the public. It also identifies which food groups are the main dietary sources of the different contaminants, and when repeated regularly, it constitutes a monitoring tool for checking the effectiveness of regulatory measures to control the levels of contaminants in the food supply.

The main objectives of this study were to detect the presence of pesticides residues in the selected market basket, and later characterize their risk using the dietary exposure calculations after applying the theoretical maximum dietary intake TMDI calculations. According to the consumption and contamination data collected, the dietary exposure assessments were calculated. A market basket of 55 and 58 food items in both rural and urban areas respectively was selected, collected, prepared, and aggregated for analysis through Quesher’s method using MS-GC. Out of 43 tested pesticides residues, only 12 of them were detected in the analyzed food samples. These include chlorpyrifos, primiphos methyl, dimethoate, Endosulfan sulphate, DDP, Dieldrin, alpha endosulfan, beta endosulfan, Kresoxim methyl, procymidone, propoxur, and fludioxonil. The actual dietary exposures to pesticides residues ranged between 0 and 10% for all pesticides except for dieldrin. When applying both an upper and a lower approach the dietary exposures did not exceed the ADIs even for dieldrin which assures that no risk is imposed when applying the most conservative methods of calculation.

## **Carcinogenic and neurotoxic risks of acrylamide and heavy metals from potato and corn chips consumed by the Lebanese population**

E. Hariri, M. Abboud, S. Demirdjian, S. Korfali, M. Mroueh, R. Taleb  
Lebanese American University

The present study aims to quantify acrylamide and metals in potato and corn chips and to determine their carcinogenic and neurotoxic risks. Gas chromatography mass spectrometry analysis revealed that the average acrylamide level in potato and corn chips (1756 mg/kg) was 3500-fold higher than the permissible limit for acrylamide in drinking water (0.5 mg/kg). Potato-based chips and baked chips were found to contain 23% and 18% more acrylamide than corn-based chips and fried chips, respectively. The daily consumption of acrylamide from potato and corn chips was found to be 7–40-fold higher than the risk intake for carcinogenesis set by World Health Organization (WHO) but was below the neurotoxic risk threshold. Energy dispersive X-ray fluorescence and thermal atomic absorption analysis revealed that the mean concentrations of zinc, lead and cadmium in corn chips were approximately 1.5-, 1.7- and 2.4-fold higher than the permissible limits set by Food and Agriculture Organization/WHO, respectively. However, the daily intake of these metals was lower than the oral reference dose and the upper tolerable daily intake set by the US Food and Drug Administration. The cancer risk for the Lebanese population from acrylamide exposure estimations appears to be significant, highlighting the need to conduct further epidemiological studies and ensure monitoring of acrylamide levels in food products.

## **Assessment of Gluten in Labeled Gluten-Free Foods Sold in Lebanon**

H. Hassan, J. Elaridi and M. Bassil<sup>1</sup>

<sup>1</sup>Nutrition Program, School of Arts and Sciences, Lebanese American University, Beirut, Lebanon

Many gluten-free (GF) food choices are now available in the Lebanese supermarkets and the presence of gluten in these foods poses a serious health risk to wheat-allergic and celiac patients. The aim of the study was to evaluate gluten contamination in labeled GF food products sold in Lebanon, by an enzyme linked immunosorbent assay (ELISA) kit, as there is no publicly available data. Over a two-year period (2014–2015), a total of 173 food samples collected from 135 products were analyzed. 50 (37%) products were locally manufactured, while 85 (63%) were imported. 95 (70%) were tested once, either in 2014 or 2015, and 40 (30%) were tested twice, in both 2014 and 2015. Gliadin, a marker of gluten contamination, was detected in 32 of 173 (18.5%) samples, and its content ranged between 2.5 and >80 parts per million (mg of gluten/kg). In 10 of the 173 samples (6%), the quantity of gliadin exceeded 20 parts per million, currently accepted in the Codex Alimentarius, the European Union, and the US Food and Drug Administration as the upper limit for GF food, while 163 (94%) had GF labelling compliance. 8 (80%) of those 10 contaminated products were locally manufactured. 8 (80%) of them were wheat starches or wheat-starch-based and 2 (20%) were rice-based processed foods. 15 (38%) of the 40 products tested twice in 2014 and 2015 showed different gliadin content between two years.

# Determinants of Glycemic Control in Type II Diabetes

Farran N., Afify T., Al Bakhour D., El Kaakour F., Al Sibai L., Haider Reda J., Mourad R., Bassil M.

Department of Natural Sciences, School of Arts and Sciences, Lebanese American University, Beirut, Lebanon

**Introduction:** Tight glycemic control reduces the risk of developing vascular complications in patients with type II diabetes (Points & ADVANCE Collaborative Group, 2008). Nevertheless, extensive variability exists in this populations' adherence to proper habits needed for diabetes management (Lane et al. 2000). The reasons for poor glycemic control in this chronic condition are complex (Khattab, Khader, Al Khawaldeh, & Ajlouni, 2010), and understanding inter-individual differences contributing to limited compliance could advance behaviour modification strategies (Seides, 2012; Skinner, Bruce, Davis, & Davis, 2013). The present study investigated the interrelationship between behavioural, cognitive, as well as personality factors and glycemic control in patients with type II diabetes.

**Methods:** A convenient sample of 193 patients with type II diabetes from Lebanon was recruited (mean age  $57 \pm 13.9$  years; 46.6 % male). Demographics characteristics, as well as self-reported weight, height, diabetes complications and HbA<sub>1c</sub> were collected. Participants' diabetes related healthy behaviour were furthermore assessed using the revised version of the Summary of Diabetes Self-Care Activities Measure (Toobert, Hampson, & Glasgow, 2000). Disordered eating behaviours; Restraint Eating, Emotional Eating, and External Eating, were determined using the Dutch Eating Behaviour Questionnaire (Wardle, 1987), while the five personality factors; Agreeableness, Neuroticism, Extraversion, Openness to Experience, and Conscientiousness were assessed using the NEO Five-Factor Inventory-3 (Costa & McCrae, 1992). Moreover, the Diabetes Fatalism Scale (Egede & Ellis, 2010) was used to determine fatalistic attitudes towards type II diabetes. Pearson correlations were conducted to assess the associations between these variables. Stepwise linear regression and multiple regression were used to determine predictors and mediators of HbA<sub>1c</sub>. The Sobel test was conducted thereafter to test the significance of a possible mediating effect.

**Results:** The mean HbA<sub>1c</sub> was  $7.87 \pm 1.79$ . Significant associations were mainly present between External Eating and Neuroticism ( $r = .171$ ,  $p = .018$ ), in addition to Extraversion ( $r = .188$ ,  $p = .010$ ). Neuroticism was furthermore correlated with the Emotional Distress subscale of Fatalism ( $r = .244$ ,  $p = .001$ ), whereas openness negatively correlated with the other two Fatalism subscales which are Religious Spirituality Coping ( $r = -.202$ ,  $p = .006$ ) and Perceived Self Efficacy ( $r = -.208$ ,  $p = .004$ ). Fatalism mediated the relationship between External Eating and HbA<sub>1c</sub> ( $F(33.1, 569.6) = 5.2$ ,  $R^2 = .055$ ,  $p = .006$ ) with the mediating effect having a one-tailed significance of  $p = .040$ .

**Conclusions:** The relationship between External Eating behaviour and HbA<sub>1c</sub> levels was mediated by Fatalism in patients with type II diabetes from Lebanon. Additional studies on larger samples are needed to investigate the direct and indirect effects of other constructs on glycemic control. Subsequently, assessments of eating behaviours, cognitive beliefs, and personality traits may help in individualizing the nature and complexity of treatment regimes in such populations and aid in better diabetes management.

## **Integrating Interprofessional Education into Dietetics: Findings from a longitudinal study**

Zeeni N1, Zeenny R2, Hasbini T3, Asmar N4, Bassil M1, Nasser S2, Milane A2, Farra A4,  
Habre M3, Khazen G5, Hoffart N3

1 Lebanese American University, School of Arts and Sciences, Department of Natural Sciences, PO Box 36, Byblos, Lebanon;

2 Lebanese American University, School of Pharmacy, PO Box 36, Byblos, Lebanon;

3Lebanese American University, Alice Ramez Chagoury School of Nursing, PO Box 36, Byblos, Lebanon,

4Lebanese American University, Gilbert and Rose-Marie Chagoury School of Medicine, PO Box 36, Byblos, Lebanon, 5Lebanese American University, School of Arts and Sciences, Department of Computer Science and Mathematics, PO Box 36, Byblos, Lebanon.

The “Lebanese American University Interprofessional Education Steps” (LAU IPE Steps) framework consists of a five-step workshop-based series that is offered throughout the curriculum of health and social care students (nutrition, pharmacy, medicine, nursing and social work). The aim of this presentation is to report change in nutrition students’ perceptions of readiness for interprofessional learning before (spring 2012) and after (spring 2014) completing the IPE Steps, evaluation of interprofessional learning outcomes, and satisfaction with the learning experience. A longitudinal survey design was used: questionnaires were completed by students before IPE exposure and after each Step. Before IPE exposure nutrition students’ perceptions of their readiness for interprofessional learning was generally favorable (mean scores:  $43.95 \pm 4.21$  for Teamwork and Collaboration,  $19 \pm 1.98$  for Professional Identity and  $23.22 \pm 2.03$  for Patient Centeredness). Moreover, they had higher Teamwork and Collaboration scores compared to medicine and nursing students ( $p=0.05$ ). After participation in the IPE steps, nutrition students showed enhanced readiness for interprofessional learning. Also, a gradual increase in teamwork and collaboration scores was found across the IPE Steps, with an overall 10% increase between baseline and Step 5. Participants were satisfied with the learning experience and evaluation scores showed that all IPE learning outcomes were met. These findings show that the LAU IPE Steps framework is associated with an increase in nutrition student readiness for interprofessionalism. Consequently, other nutrition and interprofessional education program developers may find the framework of value for their own efforts. Additional study is needed to further assess learning outcomes.