



**NUTRITION AND FOOD RESEARCH
DAY**
Trends and Challenges in the Middle East

BOOK OF ABSTRACTS

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Nutrition Related Research

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Nutrition Related Research

Association between Infant Feeding Practices and Nutritional Status in a Sample of Lebanese Newborns

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Background: Infant feeding practices and its association with infancy nutritional status is well recognized in the literature and malnutrition in early infancy is a matter of serious concern. The extent of the problem in developing countries, particularly Lebanon, remains not well elucidated. **Objective:** To provide a description of infant feeding practices in Lebanon and identify potential associations with subsequent infancy nutritional problems. **Participants:** A sample of 200 couples mother/infant meeting inclusion criteria were conveniently selected from different hospitals and private pediatricians' clinics in the region of Byblos, Lebanon. The infants were 6-23 months of age, free of congenital anomalies, born at term and weighed between 2500-4000 g. A consent form was signed by each infant's mother. **Design:** Cross-sectional, descriptive study. **Methods:** Infant feeding practices were measured via a questionnaire previously validated in Lebanon. Weight at birth was reported, and actual weight and height were measured by a trained dietician. The following scores were calculated and compared to WHO standards: Weight for height z-score (WHZ) as an indicator of stunting and BMI for age z-score as an indicator of overweight. Socio demographic variables were obtained by a questionnaire. Descriptive statistics were used for infant feeding practices and nutritional status. Linear regression controlling for socio-demographics was used to determine the association between infant feeding practices with WHZ and between infant feeding practices and BMI for age z-score. **Results:** 71.5% (N=143) of the mothers initiated breastfeeding, however only 7.5% (N=15) practiced exclusive breastfeeding for more than 6 months and 59.5% (N=119) had introduced solid foods between 4 and 6 months. Regression analyses showed that there was no significant association ($p>0.05$) between infant feeding practices and nutritional status for both the BMI for age z-score and WHZ. Results showed that infants who were exclusively breastfed (N=57) had a lower BMI for age-z score than formula fed infants (N=57) (0.59 ± 1.76 vs. 1.01 ± 1.67) however this association did not reach statistical significance. Infants who were offered solid foods at the age 6 months (N=119) had a lower BMI for age z-score compared to those offered solid foods at the age of 4 months (N=81) (0.85 ± 1.90 vs. 0.94 ± 1.74); this association did not reach statistical significance. **Conclusion:** In our sample, there was no significant association between infant feeding practices and nutritional status in Byblos, Lebanon. Our results, however, do not recommend discarding proper infant feeding practices. Longitudinal studies and larger samples are needed to shed more light on our findings.

Attitude of Lebanese University Students Concerning Caffeine

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OBJECTIVE : Since caffeine is a chemical substance found in common beverages that university students consume, in Lebanon. The objectives are to quantify the dose of caffeine consumed as coffee, tea or soft drinks consumed by students of different faculties, and analyze knowledge, attitude and consumption of caffeine by Lebanese university students.

METHOD: a questionnaire has been filled by the inquisitor interviewing 360 students from different faculties (public health and science).

RESULTS: statistics showed that there is a high prevalence of students consuming caffeinated beverages (96%), the average consumption being of 370mg of caffeine per day. Students conceive these beverages as stimulants, and the negative effects are dose dependent. Drinking beverages containing caffeine is affected by factors like environment and habit.

DISCUSSION: Students, who consume caffeine before 30minutes of waking-up, tend to consume more total caffeine then people who consume caffeine after 30minutes of waking-up. People who smoke tend to consume more caffeine then non smokers. Students who drink alcohol with caffeine consume more than people who consume nothing with it. And students searching for the intellectual concentration effect consume more than people consuming for other reasons. Withdrawal symptoms appear in consumers of caffeine; these results may determine the addictive dimension of caffeine.

CONCLUSION: More studies should be done on the subject of caffeine, to determine the factors that influence the behavior of people, the reasons of consumption, and the undesirable side effects. The awareness of caffeine content beverages should be enhanced in a world where soft drinks are booming.

Key words: caffeine, consumption, students, knowledge.

Body Mass Index, Waist-to-Height Ratio, Percent Body Fat, and Conicity Index Cut-off Values to Predict Metabolic Syndrome in Lebanese Children and Adolescents

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Childhood obesity is a growing public health concern given its association with cardiometabolic risk factors and the metabolic syndrome. Although several anthropometric indicators have been proposed to assess adiposity and the risk for metabolic abnormalities in the pediatric population, recent studies have highlighted the need for ethnic-specific cut-off values for these anthropometric indicators. Research tackling Middle-Eastern youth and identifying population-specific cut-off values for adiposity indicators are lacking. This study aims at determining optimal cut-off values for body mass index (BMI), percent body fat (%BF), waist-to-height ratio (WHtR), and conicity index (CI) to predict increased risk of metabolic syndrome (MetS) in Lebanese children and adolescents.

A cross sectional study was conducted on 490 children and adolescents aged between 7 and 19 years old. Data collection included anthropometric measurements (weight, height, waist circumference (WC), and percent body fat), blood pressure and biochemical assessment of fasting serum glucose, HDL-C, TG, LDL-C, and total cholesterol. Individual metabolic abnormalities and metabolic syndrome were identified using the NCEP-ATPIII criteria. Cut-off values were determined using receiver operating characteristic (ROC) curves.

The optimal cut-off values for predicting MetS in boys and girls were, respectively, BMI Z score above +2.35 and +2.29, %BF above 32.2% and 36.45%, WHtR above 0.58 and 0.54, and CI above 1.58 and 1.45.

The best predictors of MetS were BMI and WHtR: BMI (AUC: 0.86, Sensitivity: 88.9%, Specificity: 80.7% in males; AUC: 0.86, Sensitivity: 81.8%, Specificity: 78.9% in females) and WHtR (AUC: 0.87, Sensitivity: 88.0%, Specificity: 80.2% in males; AUC: 0.81, Sensitivity: 81.8%, Specificity: 71.8% in females). These predictors were followed by %BF (AUC: 0.82, Sensitivity: 84.0%, Specificity: 71.1% in males; AUC: 0.75, Sensitivity: 78.8%, Specificity: 62.9% in females). CI was found to be the weakest predictor of MetS (AUC: 0.89, Sensitivity: 76.0%, Specificity: 71.1% in males; AUC: 0.75, Sensitivity: 72.7%, Specificity: 61.6% in females).

This study is the first to determine cut-off values for four anthropometric indicators (BMI, %BF, WHtR, and CI) to predict increased risk of the metabolic syndrome in a sample of Middle-Eastern children and adolescents. These cut-off values should assist in the screening and identification of increased cardiometabolic risk in youth.

Characteristics of Nonalcoholic Fatty Liver Disease Induced in Wistar Rats Following Four Different Diets

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Background and objective: Nonalcoholic fatty liver disease (NAFLD) is well known to be induced by high fat and high carbohydrates diet. The objective of this study is to establish, in sixteen weeks, a model of nonalcoholic fatty liver disease in Wistar pathogen-free rats following four types of diet.

Methods: 40 healthy Wistar male rats, a month and a half old, weighing 150g on average, were randomly divided into 4 groups of 10. Each group was assigned a diet with the same quantity (15g/rat/day), but with different composition. The moderate fat (MF) group was fed a moderate fat diet (18.5 % proteins, 31.2% fat and 50.3% carbohydrates), the high fat (HF) group was fed a fat-rich diet (51.5%) while the high sucrose group (HS) and the high fructose group (HFr) were fed a carbohydrate-rich diet (60%), of which 60% were sucrose and fructose respectively.

Results: At week 16, the HF group had the highest percentage of cells enriched in fat (40%) with micro and macrovacuolar patterns of steatosis accompanied with mild necro inflammation ($p < 0.05$). This group had also the highest weight and liver weight ($p < 0.05$).

The HFr group had the highest liver weight (g) /100g body weight, a macrovacuolar steatosis and an increase in plasma triglycerides, ALT and adiponectin as compared to week 1 ($p < 0.05$). This group had a significant higher plasma TNF- α than MF group ($p < 0.05$).

Conclusion: 15g/rat/day diet as compared to 25-30g/rat/day usually required, and composed of 51.5% fat or 60% carbohydrates enriched mainly in fructose is capable of inducing characteristics of nonalcoholic fatty liver disease in rats.

Keywords: Nonalcoholic fatty liver disease, Wistar rats, macrovacuolar steatosis, necro inflammation.

Dedicated Renal Dietitian in the Hemodialysis Unit Controls Serum Phosphorus and Malnutrition, Lebanon

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Nutritional education has shown to have a positive impact on hyperphosphatemia management in hemodialysis (HD) patients. In most third world countries, the existing practice is for the general hospital dietitian (GHD) to find time for the HD patient consults within the other clinical, administrative and food service duties. This study explored whether having a dedicated renal dietitian (DRD) offering nutritional education on hyperphosphatemia management to HD patients - as practiced in developed countries - can significantly improve HD-related patient outcomes compared with the existing practice in Lebanon.

Three HD units were randomly recruited from different Lebanese regions (117 patients). The study was a self-controlled trial where patients were first educated for 6 months by the GHD on phosphorus (P) management upon the availability of the dietitians and, after 6 months of no intervention, the same patients were educated for another 6 months by the externally recruited DRD as per the study protocol which included a 20-minute weekly individualized dietary education on P management using the Transtheoretical model of behavioral change. Both GHD and DRD were trained by the study principle investigator on KDOQI renal nutrition guidelines.

Outcome variables included serum P (mg/dL), dietary P/protein ratio (mg/g/day) using 24 hour recall and malnutrition inflammation score (MIS) where the lower score indicated better nutritional status. Paired Sample t-test was used to compare the 2 phases using SPSS 16.

The DRD protocol was the only one that resulted in significant improvement in study outcome parameters: serum P (5.04 ± 1.58 to 4.49 ± 1.29 mg/dL); P/protein ratio (15.79 ± 2.30 to 14.49 ± 1.12 mg/g/day) and MIS (7.50 ± 3.40 to 5.65 ± 2.49). Results revealed the significant impact on patient clinical outcomes when a dedicated dietitian provided individualized education in the HD unit.

Determining the Effect of Different Doses of Phosphorus Preloads on Subsequent Food Intake.

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Background: The present study is based on accumulating evidence in animals supporting an inverse relationship between eating behavior and hepatic Adenosine TriPhosphate (ATP) levels, that are known to be dependent on Phosphorous availability. In line with that, an inverse relationship between plasma phosphorus and body weight has been reported. Furthermore, common foods typically associated with weight gain, such as refined cereals, sweeteners, and oils, are low in phosphorus.

Objective: We hypothesized that increasing doses of phosphorus, would proportionally influence satiety, and subsequent food intake in overweight/ obese subjects.

Design: This was a randomized crossover study. Healthy overweight/ obese women (n=12) with a BMI of 31 ± 1.3 (mean \pm SEM) and a mean age of 29.75 ± 2.36 (mean \pm SEM) participated in this study. Subjects consumed different phosphorus doses with 0mg, 125mg, 250mg, 375mg, or 500mg randomly on different test days for 5 weeks with a washout out period of 1 week between test days. Visual analog scales rated hunger and satiety for 0min, 15min, 30min, 45min, 60min, 75min, and food intake was measured at an ad libitum lunch of pizza and water 80 minutes after consuming the supplements.

Results: Responses to satiety-related questions did not differ among treatments. Food intake was also indistinguishable among doses.

Conclusion: Satiety and food intake did not change in a dose-dependent manner after subjects consumed 0, 125, 250, 375, and 500 mg of phosphorus.

Determining the Medium- Term (3 months) Effect of Phosphorus Premeal on Reducing Energy Intake and Body Weight.

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Background: The present study is based on preliminary data, that a dose of 500 mg Phosphorus (P) was able to reduce subsequent food intake by about 27-33%. Assuming that using the highest dose of P (500 mg), three-times-daily ingestion of 500 mg P doses (before each meal: breakfast, lunch, and dinner) would increase daily phosphorus intake by 1.5 g, so intake from supplement plus food would be in the range of about 3 g, which would be 25% lower than the upper limit of intake for phosphorus (4 g/day). It is well accepted that changes in body weight require about 3 months. Using body weight as the outcome, which is the ultimate outcome of weight loss approaches, would provide robust information on the role of phosphorus.

Objective: We will investigate the effect of chronic phosphorus supplementation of 375mg with each main meal (breakfast, lunch, and dinner) on reducing food intake to the extent that body weight will be reduced. The effect of 3 months phosphorus supplementation with meal intake (breakfast, lunch and dinner) on body weight in overweight and obese subjects was examined. Primary outcome variables will be body weight, BMI, waist circumference, HbA1c, insulin and GLP-1. We hypothesize that meal phosphorus supplementation of 375mg will decrease GLP-1 and subsequent food intake and lead to a reduction in body weight, waist circumference, HbA1c, and improve insulin sensitivity of overweight and obese subjects. Such reduction would be expected to reduce morbidity and mortality of the subjects.

Design: This was a double-blind, randomized, placebo-controlled study. Overweight and obese subjects (n=50) (18 men and 32 women) with a BMI of 31 ± 1.3 and a mean age of 29.75 ± 2.36 (mean \pm SEM) participated in this study. Subjects were randomized to receive placebo (cellulose) or potassium phosphate (375mg) tablets at a specified time with each main meal (breakfast, lunch, and dinner) for a period of 3 months. Body weight, BMI, waist circumference, HbA1c, insulin and GLP-1 were collected at baseline and after 3 months of supplementation.

Results: After 3 months P supplementation, the change in weight (-0.44 ± 0.53 kg), BMI (0.16 ± 0.18 kg/m²) and WC (-3.48 ± 0.60 cm) was significantly ($p < 0.05$) lower compared with placebo (1.13 ± 0.45 kg, 0.42 ± 0.18 kg/m² and 0.38 ± 0.4 kg/m², respectively). The change in insulin, GLP-1 and HbA1C did not differ between groups

Conclusion: Phosphorous supplementation over a period of 3 months was significantly associated with decreased body weight, BMI, and waist circumference. However, there was no significant effect on insulin concentration and GLP-1.

Dietetic Practices in Adult Hemodialysis Units Compared to K/DOQI Guidelines, Lebanon

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Background: In Lebanon, hemodialysis (HD) units are exclusively hospital based, and most hospitals have only one dietitian performing all nutrition related activities in the hospital. This study investigated current dietetic practices and their conformity with Kidney Disease Quality Outcomes Initiative (KDOQI) nutrition guidelines in HD units, Lebanon.

Methods: National cross-sectional survey, using an anonymous 36 item, self-administered questionnaire, collected from all dietary departments of hospital based HD units in Lebanon (n=55). The questionnaire included: 1) demographics and professional characteristics; 2) knowledge of KDOQI nutrition guidelines; 3) level of implementation of KDOQI guidelines in assessing and estimating nutritional needs. Descriptive statistics was used.

Results: The response rate was 71%, 97% were female, 82% were within the age of 21-34, 67% were full timers in the hospitals and 85% worked ≤ 10 hours per week in HD units. Minimum educational level was Bachelor of Science yet none had a specialty. Almost 50% had < five years experience in general clinical or renal practice setting. Half of the dietitians worked in hospitals where their clinical workload ranged from 100 to 200 patients, including HD patients. Overall, dietitian knowledge of KDOQI nutrition guidelines was $35.45\% \pm 16.9\%$. Most dietitians (97%) implemented at least 1 guideline, and only 5% applied all guidelines.

Conclusions: The study identified a low conformity with KDOQI guidelines among dietitians managing HD patients in Lebanon. HD units in Lebanon can possibly improve their patients' outcomes by providing dietitians with sufficient time, knowledge, empowerment and training based on the KDOQI nutrition guidelines.

Eating Disorder Outpatients in Lebanon: a Descriptive Cross-Sectional Study

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Research in the field of eating disorders (ED) remains limited in the Middle East. Although it was declared by several studies that there is an increase in some of the risk factors associated with ED in Lebanese students, no study has previously been conducted on Lebanese patients who were clinically diagnosed with ED. The aim of the present study was to profile ED patients seeking help at outpatient clinics across Lebanon. This was accomplished by health care practitioners who were asked to fill one questionnaire per ED patient. Collected information included demographics, medical history, anthropometrics, therapy characteristics and its outcome. Bulimia nervosa was the most prevalent ED (44.6%) followed by anorexia nervosa (30.1%) and binge eating (24.3%). The emerging socio-demographic profile of the Lebanese ED patient was that of a single female young adult of middle to high socio-economic status with severe ED symptoms (amenorrhea and/or multiple purging behaviors) often accompanied by depression (73.4 %). In addition, distorted body image was a major characteristics of ED patients ,with the AN group having the highest prevalence (96.7%). Regarding the outcome of the therapy, it was not different between disorders, however it was positively correlated with the number of consultations ($r=0.441$, $p=0.01$). The current study emphasizes the compelling need for a public health approach to ED awareness and could help in developing remedial and preventive educational programs targeting youth in Lebanon and the Middle East. Moreover, there is a clear need for specialized multidisciplinary clinics dedicated to ED therapy in the region.

Effect of Fermentable Carbohydrate on Arterial Hypertension in Nephrectomized Rats: Comparison with Angiotensin-Converting Enzyme Inhibitors

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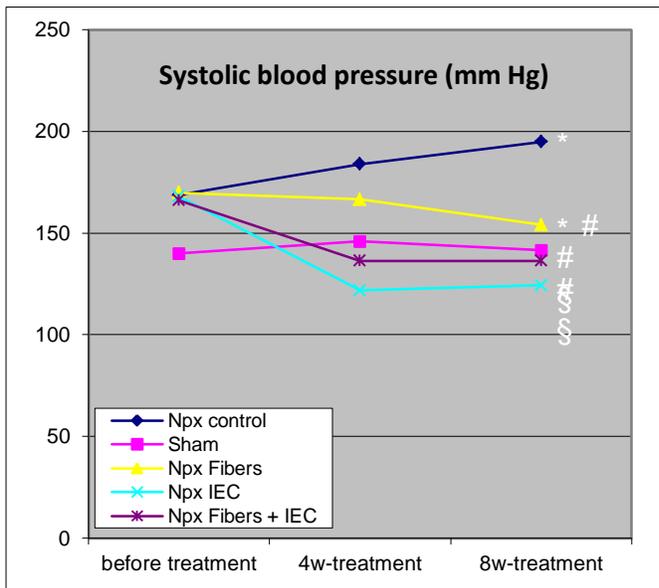
Several works reported beneficial effects of fermentable carbohydrate (FC) consumption on the prevention of digestive and metabolic disorders, particularly on hypercholesterolemia, diabetes and uremia. In uremic nephrectomized (Npx) rats and in chronic renal failure (CRF) patients, we have shown that feeding FC stimulated the nitrogen excretion by the digestive route via the stimulation of urea enterohepatic cycle and reduced the urinary N excretion with a concomitant decrease in the plasma urea concentration. However, the question about the effect of FC on arterial hypertension (HT) had not been studied. The aims of this work were (i) to study the impact of FC enriched-diets on HT and (ii) to compare this effect with that obtained with the angiotensin-converting enzyme (ACE) inhibitors and by consequence, its beneficial effects to slow down the progression of CRF.

The influence of FC on HT was investigated for 12 weeks in 50 Npx rats, distributed in 5 groups of 10 rats each : sham, Npx control, Npx rats enriched in FC, Npx rats treated with ACE inhibitors and the last group receiving FC + ACE inhibitors. After nephrectomy, all rats were observed for 4 weeks without treatment. Then, they received treatment (FC or ACE inhibitors or both) for 8 weeks. The systolic blood pressure was measured before treatment, after 4w-treatment and 8w-treatment.

We have shown that feeding FC significantly decreased the HT after 8w-treatment, compared to the Npx control group (from 195 to 154 mm Hg). As waited, the ACE inhibitors significantly decreased HT (from 195 to 124 mm Hg). But, this hypotensive effect of ACE inhibitors was less in the presence of fibers. In the same time, we have shown that feeding FC prevented the increase of plasma creatinin after 8w-treatment, compared to the Npx control group (from 122 to 81 $\mu\text{mol/l}$), as effective as ACE inhibitors (from 122 to 78 $\mu\text{mol/l}$).

In conclusion, FC feeding in Npx rats is as effective as ACE inhibitors in decreasing HT and prevents plasma creatinin increase. These results raise an important question: does FC have a nephro-protector effect similar to that of ACE inhibitors?

Moreover, it was been observed that when FC and ACE inhibitors are associated in diet, the effect of ACE inhibitors on blood pressure is reduced, but it remains significant. The question that arises is whether the status of good and poor responders to IEC is not related to the high-fiber diet?



* P < 0.05, different from sham-operated rats after two-way ANOVA.

P < 0.05, different from NPX control rats after two-way ANOVA

Effect of Movie Violence, on Mood, Stress, Appetite Perception and Food Preferences in a Random Population

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Introduction: Violence exposure has been shown to have effects at a psychological level, such as change in attitude toward aggression and making people prone to violent acts, and in developing addictive behaviors in children and adolescents (2, 3). However, violence in media also impacts acutely the body at a somatic level. In fact, media violence increases heart rate (4), blood pressure (5) and affects cardiovascular health at a more general level (6). Although extensive work has been done on the effect of media violence on attitudes, behaviors, and cardio-vascular health, very little is known about media violence and its effect on appetite, eating behavior and attitude toward foods specifically. Can media violence directly trigger food consumption upon exposure to it as well as influence social norms relating to food consumption? Would watching violent scenes affect our appetite control system, making it more “impulsive” and shifting our food preferences? The complexity of the mechanisms by which media violence affects our body and mind and probably our appetite, means that research is very valuable to help us understand and highlight the mechanisms behind this effect, thus allowing us to intervene and implement strategies to decrease the impact of media violence on attitudes and behaviors.

The present study aimed at investigating the immediate acute effect of violence in movies, on mood, stress, and appetite perception and food preferences.

Methods: Protocol: 447 subjects (F= 202; M= 239) completed a validated visual analogue scales questionnaire (VAS) to record their subjective feelings of hunger, satiety, and desire to eat immediately at their way out of a movie. Movies were divided into 3 categories: horror n=96 (Mama, The Conjuring), romance or comedy n=188 (Safe Haven, Scary Movie, Pitch Perfect, We're the Miller, Turbo, Smurf, Planes) and drama or action n=163 (Lonely place to die, Jack the Giant, Olympus has fallen, GI Joe, Snitch, Pearsy Jackson, Two guns). The sample population was randomly chosen, before getting into any of the movies and was asked if they would agree to answer our questionnaire straight after the end of the movie. Movie theaters were located in Beirut, Lebanon. Body weight and height and the time of last meal were also recorded.

The statistical analysis was done on SPSS v.17. Descriptive statistics were first conducted, followed by One-way ANOVA to test for differences between different movie categories. Pearson's correlations were used to determine the relationship between variables. We chose to analyze only 9 of the questions that are relevant to the research question in order to avoid possible results due to excessive statistical analysis. Significance was set at $p < 0.05$.

Results: Average age was 21.7 y (SD=5.0) and average BMI was 23.4 Kg/m² (SD=3.9). There was a significant difference between the 3 movie categories for the Tensed feeling (p=0.003; Action>Horror>Romance), The Anxious feeling (p=0.021; Horror>Action>Romance), The sleepy feeling (p=0.000; Romance>Action>Horror) and a preference to eat something Sweet (p=0.019; Romance>Action>Horror).

No significant difference was seen for hunger or for other food preferences.

The Hunger feeling was highly correlated with a high preference to eat something sweet, fatty, salty or savory (p=0.000 for all). But did not correlated with any of the tensed, stressed or anxious feelings or even the time of the last meal. However the time of last meal positively correlated (p=0.000) with the question: How much do you think you can eat? The Sleepy feeling correlated with a preference for Sweet (p=0.014) and Fatty foods (p=0.000).

Conclusion: The type of movie e.g. horror impacts the subject by making him feel more tensed and anxious, however romance makes him feel sleepier. Movie types didn't seem to affect hunger or appetite (through stress or anxiety) but rather triggers some food preferences, such as a preference for sweet after a romance movie, which is the opposite for a horror movie.

This is a first of a kind pilot study that elucidates the acute effect of violence and its consequent stress, on food intake and preferences. It allowed us to have a first vision on the impact of receiving violence passively through watching a movie for 2 hours on our eating behavior and stress level. The study is very basic in its design, and its results lead to the need of a more complex investigation in which adjustments for eating during the movie will be done. However the strength of the design is that it is integrated in real life situation and it is not an imitation of the reality in a lab.

Environmental enrichment and cafeteria diet synergistically modify the response to chronic variable stress in rats.

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Stress is known to lead to metabolic and behavioral changes. Evidence shows that exposure to environmental enrichment (EE) or to a highly palatable diet can reduce the response to chronic stress in rats. To further explore the relationships between EE, dietary intake and stress, male Sprague-Dawley rats were fed one of two diets for 5 weeks: high carbohydrate (HC) or “Cafeteria” (CAF) (offering a choice of highly palatable cafeteria foods). Also, they were housed in cages with or without EE. After the first two weeks, half of the animals from each group were stressed daily using a chronic variable stress (CVS) paradigm, while the other half were kept undisturbed until the end of the experiment. The effects of stress, EE and diet on animal adiposity, serum lipids, and stress hormones were analyzed. Results showed increases in liver weight and intra-abdominal fat associated with the CAF diet and an increase in bodyweight gain associated with both the CAF diet and EE. Stressed animals showed increased serum corticosterone (CORT) levels compared to non-stressed animals ($P < 0.001$). In addition, there was an interaction effect of diet and EE ($P = 0.02$) on serum CORT levels: the CVS-induced increase in CORT was attenuated in the presence of EE and the CAF diet. Our study thus provides evidence that the availability of a positive rearing environment combined with highly palatable food renders rats more resilient to the effects of CVS.

Evaluation of Dietary Habits among 100 Type 2 Lebanese Diabetic Patients

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Type 2 diabetes is a well characterized but inadequately controlled disease. Optimal glycemic control can reduce the incidence of its complications. Adequate nutrition has a crucial role in the management of this disease. Lack of understanding of the beneficial effects of dietary choices and exercise in the regulation of type 2 diabetes, may lead to inappropriate treatment methods. This study evaluates the dietary habits of a sample of 100 Lebanese, adult and stable type 2 diabetic patients.

Validated questionnaires were distributed in 3 clinics in 2 Lebanese regions.

Descriptive statistics were used via SPSS 16.0.

Fifty five per cent of the sample consumes sweetened drinks more than once per day, 23% consumed more than 3 fruits per day. Forty two per cent consumed refined bread and 38% surpassed the recommended intake of pastry per week. Sixty three per cent consumed legumes less than 3 times per week and 33% consumed less than 2 exchanges vegetables per day. Six percent surpassed the alcohol consumption guidelines and 62% drank less than 1.5L of water per day. Sixty four per cent had an irregular meal schedule and consumed less than 5 meals per day, 69% had a sedentary lifestyle and 42 % were regular smokers 58 % of the non smokers were passive smokers.

This study pioneers in revealing poor dietary habits in Lebanese diabetic patients, suggesting the necessity of a public health educational program targeting this issue.

Key words: type 2 diabetes, dietary habits, dietetic management.

Extraction and Analysis of the Most Important Active Ingredients (Volatile Oil and Polysaccharides) and Determination of its Importance in Medicine, Pharmacy and Nutrition

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Laurus nobilis L. also known as sweet bay, bay laurel, Grecian laurel and bay tree, is either an evergreen shrub or a small tree and belongs to the family of *Lauraceae* comprised of numerous aromatic and medicinal plants. Its height ranges from 6 to 10 meters. It is cultivated in many warm regions of the world, particularly in southern Europe and around the shores of the Mediterranean Sea, including Lebanon. It has been in this country since the ancient times. Lebanese local population uses the fruit in manufacturing but the leaves and fruit's volatile oil, although they have a lot of medical benefits, are underexploited. The dried leaves are mainly used in cooking, and the essential oil is one of the main products from bay trees that are used in food, spice, flavouring and cosmetic industries.

Given the scarcity of local studies on Laurel which is widespread in Lebanon, little has been reported to this date. The aim of the present study was to determine and compare leaves, fruits essential oil and the fatty acids of *Laurus nobilis* L. collected from three different geographic and climatic areas. Phytochemical tests on different extracts prepared from dried leaves, using solvents of different polarities such as water, Ethanol, Methanol, Chloroform, Petroleum ether and diethyl ether, determined the concentration of certain constituents like Alkaloids, Flavonoids, Tannins, Anthraquinones and Coumarins. Moreover, additional analytical experiments on samples taken from towns of Kfarnabrakh, Deir-El-Qamar and Semkani determined *Laurus*' composition in trace elements and showed that it was rich in K, Ca and Si. The highest percentages have been found in Deir-El-Qamar. The determination of fatty acids showed a high concentration in stearic, oleic, vaccenic and palmitic acids. Following the phytochemistry, tests were able to extract for the first time many types of polysaccharides such as alginate and fucoidane, confirming their chemical structure by ¹H NMR and IR spectroscopy and determining their effects as antioxidant and anticoagulant agents. Furthermore, we studied the genetic difference between the three samples of *Laurus* by ISSR technique and determined *Laurus* types in Lebanon.

Keywords:

Laurus nobilis L., trace elements, Essential oil, Fatty acids, polysaccharides, Antioxidant, Anticoagulant, Alginate, Fucoidane.

Factors associated with poor nutritional status among community dwelling Lebanese elderly subjects living in rural areas: results of the AMEL study

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Objectives: This study aimed to assess the nutritional status, measured by MNA, and its association with socio-demographic indicators and health related characteristics of a representative sample of community dwelling elderly subjects.

Design: Cross-sectional study

Setting: Community dwelling elderly individuals living in rural communities in Lebanon

Participants: 1200 elderly individuals aged 65 years or more

Measurements: Socio-demographic indicators and health related characteristics were recorded during a standardized interview. Nutritional status was assessed through Mini Nutritional Assessment (MNA). The 5-item GDS score was used to assess mood, whereas Mini Mental Status (MMS) was applied to evaluate cognitive status.

Results: The prevalence of malnutrition and risk of malnutrition was 8.0% respective 29.1% of the study sample. Malnutrition was significantly more frequent in elderly subjects aged more than 85 years, in females, widowed and illiterate people. Moreover, participants who reported lower financial status were more often malnourished or at risk of malnutrition. Regarding health status, poor nutritional status was more common among those reporting more than three chronic diseases, taking more than three drugs daily, suffering from chronic pain and those who had worse oral health status. Also, depressive disorders and cognitive dysfunction were significantly related to malnutrition. After multivariate analysis following variables remained independently associated to malnutrition: living in the governorate of Nabatieh (ORa 2.30, 95% CI 1.35 -3.93), reporting lower income (ORa 0.77, 95% CI 0.61-0.97), higher number of comorbidities (ORa 1.22, 95% CI 1.12-1.32), higher drug intake (ORa 1.72, 95% CI 1.24-2.39), and depressive disorders (ORa 1.663, 95% CI 1.467-1.885). On the other hand, better cognitive functioning was strongly associated with decreased nutritional risk (ORa 0.274, 95% CI 0.172-0.435).

Conclusion: Our results highlighted the close relationship between numerous health status and malnutrition. The identification of potential predictive factors may allow better prevention and management of malnutrition in elderly people.

Key words: Malnutrition, Elderly, MNA

Health Mobile Application “HEMA”

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Overweight and obesity (defined as body mass index of 25-29.9kg/m² and body mass index equal or greater than 30 kg/m², respectively) have become an epidemic affecting large population worldwide. According to the WHO, in 2005 about 1.6 billion adults were overweight of whom at least 400 million were obese (WHO, 2010). At least 2.8 million people die each year as a result of being overweight or obese, and it is estimated that 35.8 million (2.3%) of global DALYs (disability- adjusted life years) are caused by overweight or obesity (WHO, n.d).

We designed “HEMA”; Health Mobile Application in an attempt to combat obesity; reach out to a wider section of the population and provide an alternative to the traditional health/obesity public health campaigns. The application covers areas of nutrition, health awareness, behavioral change, tailor made for UAE nationals based on their food choices, habits, physical activity routines and their health related conditions. The application is considered to be educational. It also helps people track their nutritional status, and provides recommendations on calorie intake and physical activity based on their nutritional and health status. Additionally, the application includes a cook book that contains healthy versions of local meals, meals for special conditions, such as diabetes, high blood pressure, and cholesterol, and healthy meals for children. The recipes will contain nutritional information: calorie, fat and sugar content.

Maintenance of Weight Loss One Year since a Diet vs. Exercise-Based Successful Interventions, among Lebanese Adult Overweight/Obese Women

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OBJECTIVE: To evaluate maintenance of weight loss, among women who followed a diet or a physical exercise program, since at least one year at the time of the survey (one year after the intervention), and determine factors associated with weight loss maintenance.

METHODS: Observational, retrospective study on a sample of 60 women who successfully lost weight after following a diet (n=30) or exercise (n=30) one year later. Random sample of women were interviewed in 5 different sports and diet centers. A scale and a stadiometer were used to take the measurements of height and weight of women, in the interview a 24h recall of food eaten, an IPAQ (International Physical Activity Questionnaire), and FFQ (Food Frequency Questionnaire), were used to collect data.

RESULTS: The percentage of overweight or obese women; who maintained their weight loss for at least one year after a diet or sports exercise is 18.3% (10% in diet group and 26.7% in sport's group with a significant difference between groups). Factors associated with weight loss maintenance are: following a Mediterranean diet, a high fiber consumption; a diet with a lower percentage of saturated fatty acids, a high percentage of protein in actual diet, and higher ratio of Mono-Unsaturated Fatty Acids/ Saturated Fatty Acids in maintainers versus non maintainers ($p < 0.005$). There is an inverse association between the fact of skipping meals and weight loss maintenance. Moreover, a longer duration of follow-up, and practicing more minutes of exercise per week, are also associated to weight maintenance. After correction for confounders, the most influential factor for weight maintenance is the duration of follow-up, this factor was more in play in maintenance of weight for at least one year regardless of the group women belongs to.

CONCLUSION: In this sample of women, adopting healthier eating habits, and exercising enough are keys to success in weight loss maintenance one year after a weight loss intervention regardless of the kind of method used.

Key words: diet, physical activity, maintenance, body weight.

Nutrition policies at schools: Opportunities & challenges in Lebanon.

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Background: Because youth's eating and lifestyle patterns are influenced by a range of social and physical environment factors, it is important to develop policies that target the different levels at which these influences occur. Programs and policies of health promotion at schools should not be based solely on the evidence of scientific research but also on other evidence such as inclusion of personal experiences, perceptions and preferences, attitudes, values, legislation and resources. Thus, the qualitative information gained in the context in which health promotion activities will take place is of great importance and can lead to formative assessment and understanding of the specific context in which an innovation is going to develop.

Objective: To explore the facilitators and the barriers to the SSH* project implementation by studying stakeholders' perceptions of an eventual national nutrition policy in Lebanese schools.

Methodology: An integrated conceptual framework was proposed to explore stakeholders and youth perceptions toward school nutrition policy implementation from different perspectives where various levels of action, namely community, individual and organizational variables, are presented. These levels of action integrate concepts stemming from theories and models based on the social marketing approach to guide the planning and evaluation of programs.

Setting: Social marketing suggests targeting schools and the community. This could be individuals who are recognized leaders in their environment, networks that promote program support, and coordinating agencies which maintain the programs. The target population of this study consists of 32 multidisciplinary stakeholders who are active in Lebanese communities and 35 adults (directors, food services managers, parents and teachers) and 48 youth (ages 10-14) from 8 schools (rural and urban, public and private). All participants were willing to express their perspectives to explore the determinants of deploying a national school nutrition policy in the Lebanese context.

Data collection: Directed and semi-structured individual interviews with key stakeholders, students, directors and food services managers were conducted. For teachers and parents, focus groups were conducted with 6 to 8 participants including both profiles. During the interviews, adults and youth participants were asked to answer a questionnaire of 25 and 30 open-ended questions respectively. Both questionnaires are related to the variables of the integrated conceptual framework of this study, which are grouped under individual, community, organizational and other variables.

Analysis strategy: Data from this research have been submitted to a thematic qualitative analysis. The first stage of this analysis involved the production of major findings for each interview. They were then grouped and reduced into common themes under the four categories of variables of the conceptual framework. The synthesis was iterative. Whenever new themes emerged, they were retained to be considered as facilitating factors or barriers to school nutrition policy development.

Next, the major findings were synthesized per respondent group (stakeholders, directors, food services managers, parents/teachers, and youth) to identify similarities or differences in their perspectives according to the school profile, namely the geographic area (urban, rural) and the socioeconomic school profile (private, public).

Finally, the themes and synthesis of this study were thoroughly interpreted leading to a final exhaustive and complementary perspective from different interviewees.

Results: Data generated from our exploratory qualitative study using the integrated conceptual framework suggest that the following considerations may ensure school nutrition policy deployment and sustainability: 1. It is built on theories that can be overturned or confirmed; hence, it helps to improve knowledge in health promotion; 2. It is designed progressively so that interventions are appropriate for the stage of development of children and adolescents; 3. It seeks to tailor each intervention to the specific socioeconomic and cultural characteristics of the community members; 4. It emphasizes active participation of the community and incorporates ongoing consultation as an essential activity to identifying the real issues and challenges encountered in the community; 5. It focuses on the time commitment for success and good relationships between partners to facilitate activities in the community; 6. It uses multichannel communications, resources and services in place in schools to promote the concepts of ownership and belonging to the community; and 7. It reduces the overly heavy emphasis on school-centric approaches.

Conclusion: The exploratory qualitative research can help to better define a problem, to suggest hypotheses to be tested later and to gather perceptions of new concepts. Particularly in this study, the innovative integrated theoretical framework allowed enrichment of knowledge about the barriers and facilitating factors envisaged in the deployment of school nutrition policy in Lebanon as they are perceived by adults and youth stakeholders. These predisposing, enabling and reinforcing factors help the stakeholders and the decision makers in their promotion and communication practices during planning, developing, implementing and evaluating an eventual national school nutrition policy.

Nutritional profile of Lebanese NAFLD patients: A case-control study

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Objectives: The aim of this study is to evaluate the nutritional profile of Lebanese non-alcoholic fatty liver disease (NAFLD) patients (cases) and compare it with controls.

Methods: From November 2010 to June 2013, 255 NAFLD Lebanese patients; 197 men (mean age: 44±12.4), 58 women (mean age: 40.3±7.9) and 108 controls; 39 men (mean age 42±14.5) and 69 women (mean age 36.7±12.8) were recruited at the outpatient clinic of the department of Gastroenterology of a university hospital. A valid food frequency questionnaire (Harvard, Nurses' Health Study, 2010) and a 24 hours recall were administered. Anthropometric measures, blood pressure and biological markers were also taken in both groups.

Results: Mean body mass index of NAFLD patients (cases) was (31.6±5 kg/m²) as compared to (24.8±4kg/m²) for controls (p<0.0001). According to IDF classification (International Diabetes Federation, 2005), 67.8% of cases versus 14.6% controls had more than 3 parameters of metabolic syndrome and 48.5% of them versus 18.8% for controls had a homeostasis model assessment (HOMA-IR) ≥3 (p<0.0001). On multiple logistic regression analysis, HOMA-IR, intake of fructose (g) and absence of physical activity were significantly associated with a increase risk for NAFLD; HOMA-IR (odd ratio 5.17, 95% confidence interval, 1.52-17.59), p=0.009, fructose (odd ratio 1.03, 95% confidence interval, 1.01-1.06), p=0.027 and presence of physical activity (odd ratio 0.44, 95% confidence interval, 0.20-0.99), p=0.047, after adjustment for gender, calorie intake/day, BMI, medical and family medical history.

Conclusion: High HOMA-IR, high fructose intake and lack of physical activity were the main potential risk factors for NAFLD Lebanese patients

Keywords: Nonalcoholic fatty liver disease, HOMA-IR, fructose, metabolic syndrome, physical activity

Socioeconomic status and obesity in Lebanese children and adolescents aged between 11 and 18 years

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The global overweight and obesity prevalence has increased dramatically over the past decade. Childhood obesity, in particular, has become a global public health crisis. This global phenomenon is affecting all socio-economic groups, irrespective of age, sex or ethnicity but its prevalence varies across socioeconomic strata.

This cross-sectional pilot study describes the association between obesity and socio-economic status (SES) in Lebanese children and adolescents. The sample consisted of 359 Lebanese girls and boys, 11 to 18 years of age, randomly selected from public and private schools. The study was conducted in 2013 at elementary and secondary schools in Beirut, Tripoli, Zahle, Jbeil, Keserwan, Baskinta and Tyr.

The questionnaire included a series of questions aiming to assess the children's SES. The latter was estimated considering whether the child was registered in a public or a private school, parental work activities, household demographic factors, number of rooms per household, having help in the household, house ownership and number of cars owned by family members. The children's anthropometric measurements were obtained and the BMI was calculated.

One way ANOVA and Duncan Post hoc tests were carried out for statistical comparisons. The Statistical Package for the Social Sciences (SPSS) was used and a p-value <0.05 was considered significant.

In our study, the majority of adolescents were found to belong to a low socioeconomic background with a percentage of 55.4%, while 10.3% had a high SES and 34.3% had a middle SES.

The BMI differed significantly across the three groups with a p value of 0.006. In fact, the BMI of adolescents with high SES was significantly higher than the BMI of adolescents coming from both low and middle socioeconomic background. On the other hand, there was no significant difference between BMI of adolescents with a low and middle SES, at a p value <0.05, but the prevalence of undernourished students was found to be the highest in the low SES group.

We also found a statistically significant relationship between the BMI and the type of school attended. A high rate of obesity and overweight were observed in students attending private schools and a wider spread of under nutrition was observed in public schools.

This study supported the view that obesity in the developing world would be essentially a disease of the socioeconomic elite. It showed that there are multiple nutritional problems emerging in the Lebanese society ranging from under-nutrition to overweight and obesity all affected by the socioeconomic status. The major red flag is the increased percentage of poorly nourished adolescents in less fortunate families and the increased percentage of overweight and obese adolescents in the richer society.

Study for assessment of traditional food intake in Lebanon

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All emerging countries are now subjected to a dietary transition accompanied by a development of degenerative pathologies related to human diet.

Our research is aimed at investigating the current Lebanese food typology under the following theme: have Lebanon been able to preserve its local traditional diet or have it been affected by the exposure to western diet?

A pre-survey administered in Lebanon in 2003, showed that the existence of the traditional dishes in the Lebanese diet remain important till date. However, the absence of reliable and precise tools to conduct surveys aiming to describe food consumptions gave us an incentive to develop such tools. The main purpose of the exercise is to determine the contribution of the traditional Lebanese food to the relative overall intake and to evaluate its contribution in covering the various nutritional needs.

For this reason, we developed and validated a photographic atlas of food portions, a food frequency questionnaire and a table of food composition corresponding to the traditional Lebanese dishes. Using these tools, the daily intake of traditional dishes was quantified in a representative population sample of 566 Lebanese adults, aged 20–85 years, selected in 5 areas of Lebanon.

This cross-sectional study suggested that the modern Lebanese population preserved an important place for the traditional food: 57 % of the Lebanese population consumes more than 9 traditional dishes per week, which means 2 dishes per day.

This diet is characterized, as in most of the Mediterranean regions, by a dominating contribution of fruits and vegetables (42 %), cereals (34 %: bread 14 %; pastries 5 %) and legumes (7 %) in the daily food ration.

The Lebanese population, through the consumption of the only traditional dishes of which the energy intake exceeds the 75 %, has mean energy intake of 2047 kcal/day. The breakdown shows a statistical mean of carbohydrates ranging up to 46 %; 11% of proteins; 43% of lipids; 10 % of SFA, 20 % of MUFA and 10 % of PUFA. The Lebanese population covers almost all their needs in vitamins and minerals.

The Lebanese daily food ration presents a strong trend today to evolve towards diets rich in lipids on the detriment of carbohydrates. Carbohydrates keep however a place that is relatively important in the ration but with a changed pattern: consumed in the form of wholegrain cereal in the past, they are now replaced by refined and transformed cereal.

The results demonstrate that the validated food photography booklet is a useful tool to achieve acceptable quantification of consumption levels of traditional Mediterranean dishes. A validation of the nutritional composition will make it possible to derive the nutrient intake from the traditional diet.

In conclusion, Lebanon seems to be the place of coexistence between the tradition and the modernity. A valorization of the still very present traditional diet in the food habits should allow to slow down the nutritional transition and to improve the health of the population.

The Prevalence of Breakfast Skipping and its Association with BMI z-score in 11-15 year-old Adolescents from Selected Lebanese Regions

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Background: Breakfast skipping is relatively common among adolescents. Breakfast skipping has been associated with poor nutritional status mainly weight gain in some but not all studies; this might be due to the difference in definitions of breakfast which may vary according to various study settings. **Objective:** Determine the prevalence of breakfast skipping and its association with BMI for age among adolescents living in Lebanon. **Participants:** 404 adolescents (203 males and 201 females), aged 11-15 years, located in 3 Lebanese districts (Metn, Kesrouan and Jbeil) were selected from 203 private and public middle schools. Sample selection took into consideration the different proportions of private and public schools, the different sizes of schools in terms of students' enrollment and the difference between each district. 2% of the adolescent's population in these regions has been used except for the Metn District where only 1.3% has been used due to logistical constraints. A consent form was signed by each adolescent. **Design:** cross sectional observational. **Methods:** As there is no standard definition for breakfast skipping, we assessed it using six main questions found in the literature. Total energy intake was estimated by one 24-hour recall. Weight and height were measured by a trained dietician using standardized techniques and calibrated equipment. BMI for age z-score was calculated using WHO standards. Lifestyle and demographic factors were assessed using a questionnaire. Descriptive statistics were used for breakfast skipping, BMI for age z-score, and lifestyle factors. Linear regression controlling for covariates was used to determine the association between skipping breakfast and BMI for age z-score. **Results:** According to the WHO 2007 cutoff points, the prevalence of overweight and obesity in this study was 25% (N=101) and 20% (N=77) respectively. While, in the absence of standardized definition, six questions for breakfast skipping were used and the prevalence varied between 8.4% (N=34) and 42.8% (N= 173). There was no significant association between breakfast skipping and BMI for age z-score even after adjustment for energy intake and demographic factors ($p>0.05$). However, descriptive statistics such as crosstabs revealed that only 9 (5.2%) of all breakfast skippers based on our definitions had an energy intake equal to zero before 12 a.m. on the 24-hour diet recall. **Conclusion:** Our findings could not confirm an association between breakfast skipping and BMI for age among adolescents. However, we found that the questions used in the literature for breakfast skipping do not reflect lack of eating in the morning as only 9 out of 173 breakfast skippers did not consume anything before 12 a.m. This might be the reason of the lack of association between both variables of interest in our study. Our results show the need of a standardized definition for breakfast skipping.

Trends of Overweight and Obesity and its Associated Risk Factors among Adolescent School Students in Tripoli

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Background: Adolescence is a vulnerable period for the development of obesity and also appears to be a critical period for establishing risk factors for some chronic diseases in adulthood. The proportion of adolescents who are overweight or obese is rapidly increasing worldwide. Available statistics indicate that an alarming proportion of people in most Arab countries suffer from obesity. Studies have revealed that the prevalence of overweight and obesity among adolescents in Arab countries ranges from 18% to 44%.

Objective:. To investigate the current overweight and obesity trends and its associated risk factors in adolescent school students in Tripoli.

Design and setting: Through a cross sectional study approach a sample of about 400 students from 4 mixed schools which were divided into 2 public and 2 private schools, were assessed. Data were collected using an interview questionnaire, anthropometric, and dietary tools. BMI was determined using the CDC BMI- for- age growth charts.

Main outcome measures: Overweight and obesity trends, physical activity levels, sedentary behaviors, lifestyle and dietary factors of adolescent school students.

Results: The results showed that the overall prevalence of overweight and obesity among the whole studied sample was 32 % with a statistically significant difference between males (40%) & females (28%). A significantly higher proportion of public school students (91%) compared to private school adolescent students (72%) had low physical activity levels. Also public school adolescent students showed a significantly higher disturbed meal pattern (44% compared to 34% in private school students). In addition the whole studied sample (62%) reported low weekly intake of fruits and vegetables.

Conclusion: The alarming overall high prevalence of low physical activity levels, disturbed meal pattern and unhealthy dietary intake indicates the necessity of formulation of policies and nutritional strategies to stop the rise of overweight and obesity among adolescent students in Tripoli, Lebanon.

Using cell phone camera pictures to record food intake and promote healthy eating

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Recording food intake may contribute to weight loss by promoting changes in eating behavior. The current spread of mobile phone embedded cameras offers new opportunities for recording food intake. Moreover, the act of taking pictures of food consumed may further increase chances of achieving dietary goals by enhancing visual consciousness of portion size and nutrient content. The present study tested the effect of using cell phone pictures to prompt memory on energy intake and food choice in college students. Participants (n=76) were randomly assigned to two groups. The first group was asked to enter their food intake online during three days based on their memory while the second group was asked to record intake using cell phone pictures for a memory prompt. Participants then crossed over to complete 3 more days of diet recording using the alternate method. Results revealed a decrease in energy intake (p=0.03) during cell phone-based recall (1334 ± 54.2 kcal/day) compared to memory-based recall alone (1446.4 ± 53 kcal/day). More precisely, cell-phone based recall was associated with a decrease in consumption of meat (p=0.008) and vegetable (p=0.021) exchanges. In conclusion, mobile phone pictures may be an easy and effective way to record diet when aiming at weight loss. The combination of cell phone-based dietary recording with healthy eating education may lead to greater improvement.

Food Related Research

Adding Whey Protein to the Milk in Shanklish Processing

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To improve the processing and the productivity of the Shanklish, one of the rarely affined and mold cheese derived from the coagulation of yogurt and native of the Middle East, whey protein (WP) was added to the milk. Three lot of Shanklish was processed following a standard diagram of manufacture. The first lot T is the control without adding anything to the milk, the second lot WP-1 when milk was fortified by 1% WP and the lot three WP-2 where 2% of WP was added to the milk. Shanklish-yielding capacity was expressed as actual yield (grams of shanklish per 100 g of milk). The physicochemical properties of the shanklish were monitored. Results showed that the cheese yield increase significantly with the addition of the WP and as WP addition was increased from 1 to 2%. The yield of the lot T, WP-1 and WP-2 was respectively 19% 25% and 32%. However water retention increase proportionally with the WP level. This enrichment led to a final product with improved functional and nutritional properties and will prevent defects such as poor texture of the gel firmness, and syneresis.

Keywords: Shanklish, whey protein, yield, texture, functional properties, nutritional properties.

Caraway (*Carumcarvi*) essential and fixed oils characterization

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Caraway (*Carumcarvi*L.) is one of the most appreciate culinary spices. It is not only cultivated for its seed essential oil richness but also for its biologically active compounds. Furthermore, its seeds are source of a fixed oil. The aim of the present work was to ascertain the composition of Tunisian caraway essential oil and seed oil.

For essential oil extraction, *Carumcarvi* seeds were *submitted* to hydrodistillation for 3 h using a Clevenger apparatus. The oil was decanted and dried over anhydrous sodium sulphate. Essential oil composition was analyzed by coupled gas chromatography-mass spectrometry (GC-MS). *Carumcarvi* seeds were crushed and Soxhlet-extracted with hexane. Oil was vacuum concentrated with a rotavapor and the last traces of solvent removed under nitrogen. Before analysis by gas chromatography, fatty acids were transformed into their corresponding methyl esters according to the method described by Cecchi et al. (1985) using sodium methylate. Methyl heptadecanoate was used as an internal standard for quantification purposes. Fatty acid methyl esters composition was done by GC.

The main results showed thatthe major compounds were carvone and Limonene in *Carumcarvi* essential oil. The other compounds were detected as traces. Concerning *Carumcarvi* seed oil, we noted the predominance of oleic acid (C18: 1) with an amount of 52.28%. This fatty acid was followed by linoleic acid (C18: 2) which accounted for 30.84%. *Carumcarvi* essential oil was characterized by the predominance of oxygenated monoterpenes (79.79%) Furthermore, *Carumcarvi* seed oil was characterized by its richness in C18: 1 which is reputed for its nutritional virtues and is involved in protection against cardiovascular diseases. It is also rich in C18: 2 which is an essential fatty acid. So, it could be recommended for human consumption.

Key words: Caraway (*Carumcarvi*), seed oil, essential oil, fatty acids, carvone, limonene

Chemical and Microbiological Safety of Vegetables Grown in the Upper Litani Basin

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A potential health hazard is revealed due to the degradation in the Litani river water quality which is of major concern to the agricultural production in the Bekaa region. Hence, the study objectives are to (a) identify the microbiological and chemical hazards in soils and main vegetables grown and irrigated with the Litani river water, (b) compare the levels of chemical and microbiological contaminants in irrigation water, soils and vegetables to determine the levels of contaminants and identify factors impacting the translocation and accumulation of these contaminants in grown products, (c) evaluate the magnitude of the health hazards by comparing levels of chemical and microbiological contaminants to national and international standards, and (d) determine the antibiotic resistance patterns of detected pathogenic bacteria for proper foodborne disease management. A total of 48 composite samples of soils and vegetables (lettuce, parsley and potato) from three different experimental sites (Bar Elias, Dalhamieh and Zahle) and from control agricultural area from the same region irrigated with groundwater were analyzed. The microbiological and chemical quality of the vegetables and soil was determined and evaluated. Further, the antibiotic resistant pattern was determined for the four commonly prescribed antibiotics (Ciprofloxacin, Cefotaxime, Gentamicin, and Erythromycin).

Results indicate that the irrigation with Litani River water is leading to the accumulation of microbiological (*E. coli*, *E. cloacae*, *E. aerogenes*, *K. pneumonia*, *K. oxytoca*, *S. marcescens*, *C. freundii*, *Sh. sonnei*, *C. diversus*, *Listeria spp* and *P. aeruginosa*) and chemical contaminants (barium, arsenic, lead, cadmium, chromium, zinc, iron, nickel, copper, manganese and Molybdenum) in vegetables (lettuce, parsley and potato) and soils. And, the levels in leafy vegetable are higher than in tubular crops (potato). Moreover, the results of the study showed that the exposure to the polluted irrigation water through sprinkling irrigation is the main important factor impacting the safety of the grown crops. Furthermore, all isolated pathogens showed 100% resistance to Erythromycin, 98% resistance to Gentamicin and 93% resistant to both Ciprofloxacin and Cefotaxime.

As such, the consumption of vegetables irrigated with the Litani river water poses a major public health concern, and accordingly, it is recommended to operate the existing wastewater treatment plants and follow up on the construction of planned ones, substitute sprinkler irrigation by drip irrigation to reduce exposure to contaminants, disseminate awareness on appropriate household practices to reduce the levels of contaminants in the consumed crops, and implement integrated river basin management for proper risk assessment and risk management. Additional studies are also recommended to evaluate human exposure to the identified chemical and microbiological hazards.

Does The Orange Blossom Smell as Blue in Lebanon as in France? A Lebanese-French Cross-Cultural Study

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Many cross-modal correspondences involving colors have been documented in non-synesthetes. Among these cross-modal associations, a small number of studies have attempted to investigate the relationship between odors and colors (see Gilbert *et al.*, 1996; Schifferstein and Tanudjaja, 2004; Demattè *et al.*, 2006; Piqueras-Fiszman and Spence, 2011). Consistent associations between specific colors and odors mainly related to food have been confirmed recently (Maric&Jacquot, 2013). It is well known that culture-specific experiences with odors may influence different aspects of odor perception such as intensity, pleasantness or edibility. Although the cross-modal linkage between the olfactory and visual senses is seldom mentioned in the literature, it has been proved to be not only consistent but also stable with time (Gilbert, Martin, & Kemp, 1996). Interestingly, the latest research suggests that neuropsychological factors may also impact on the expression of crossmodal correspondences (Spence, 2011). As compared to visual stimuli, odors are modulating neuronal responses within the amygdala more strongly (Royet *et al.*, 2000). This preferential neuronal processing of odors in emotion generating brain areas can be explained by the strong overlap between olfactory cortex and limbic brain structures. Relationships between inner features of both olfaction and vision have been demonstrated (including odor intensity, familiarity, pleasantness and edibility). In addition the effect of culture does play an important role through this inter-modal correspondence: Japanese perceive differently odors than Germans (Ayabe-Kanamura *et al.*, 1998).

To further investigate the influence of experience on odor-color correspondences, the responses of 155 French and 96 Lebanese subjects to the same odorants were compared. In each country, untrained subjects were first presented with 16 food and flower natural odorants and asked to select among 24 colours the one that best matched each given olfactory stimulus. Secondly, they rated each odor according to four descriptors (intensity, familiarity, pleasantness and edibility).

Both populations matched olfactory stimuli with colors in a non-random manner. Indeed, significant color characterizations were found for all tested odors. For 12 odors, no significant differences were found between French and Lebanese subjects in all the matched colors. For 3 odors, no clear differences between the two populations were found in the mainly associated color. Somewhat unexpectedly, significant differences in colors association were only found for

one odorant: orange blossom. Furthermore, a significant difference was found between the two populations in edibility ratings for this odor. This difference could therefore arise from cultural differences in the odor function.

Our results confirm the existence of robust odor-color correspondences among both populations and raise important questions about the representation of odors. This underlines the need for further studies to understand the mechanisms underlying these cross-modal correspondences and the influence of cultural background and experience on them.

Effect of drought on safflower natural dyes

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This research evaluated the effect of drought on total phenol, flavonoids, and proanthocyanidin composition of two *Carthamustinctorius* varieties (Jawhara and 104) flowers. Plants were treated with different levels of water deficit: control (C), moderate water deficit (MWD) and severe water deficit (SWD). Results indicated that water stress treatment greatly limited plant growth by affecting dry biomass.

In this study, quantitative differences in different classes of polyphenols, flavonoids and proanthocyanidins of *C. tinctorius* flowers under water stress have been observed. In fact, total polyphenol content imposed a significant increase ($p < 0.05$) of about 52.39 % (104) and 51.69 % (Jawhara) under 50 %. Similarly, flavonoid content declined by about 10.31 % (104) and 15.68 % (Jawhara) under 25 % with respect to 100 %.

Keywords: *Carthamustinctorius* flower, Drought, Plant growth, Phenolic composition,

Effect of Incorporating Selected Herbal Extracts Native of Lebanon on the Chemical Characteristics of Virgin Olive Oil during Static Heating

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Improving the heating characteristics of olive oil is of economic and commercial importance. In this study, the effects of separately adding 18 extracts of plants native of Lebanon (*Helian racemosum*, *Pistacia palaestina*, *Fritaria libanotta*, *Cetaurium limbellotum*, *Cistus creticus*, *Scutellaria brevibracteata*, *Verbascum sinwatom*, *Origanum syriacum*, *Thymbra spicata*, *Salvia sclarea*, *Salvia judaica*, *Notobasis syriaca*, *Cytisopsis dorycniiifolia*, *Scutellaria heterophylla*, *Aspodelus microcarpus*, *Stachys cretica*, *Orchis papilionacea* and *Ophrys Israelitica*) on the chemical changes of virgin olive oil when subjected to heating were studied and compared to the effects of adding synthetic antioxidants, BHA and BHT. Oil samples with 0.00, 0.04 and 0.08% of the plant extract or synthetic antioxidant were statically heated at three temperatures (160, 180 and 200 ± 3°C) and held for 30 min. Free fatty acid (FFA), peroxide value (PV) and iodine value (IV) were determined using AOAC methods. When herbal extracts were added, FFA% reduction compared to the control ranged between 1.5% (*Cistus creticus*) and 49.7% (*Salvia judaica*), with 23.3 and 17.7% when BHA and BHT were added, respectively. In terms of PV reduction, the % ranged between 0% (*Scutellaria brevibracteata*) and 70.7% (*Salvia judaica*), compared to 55.5 and 66.1% when BHA and BHT were added, respectively. In terms of IV increase, the % ranged between 0.4% (*Stachys cretica*) and 15.8% (*Notobasis syriaca*), compared to 4.1 and 4.3% when BHA and BHT were added, respectively. Our results showed that some herbal extracts can outperform the synthetic antioxidants, yet further investigations on their effects on the organoleptic quality of the oil must be performed.

Effects of olive drying on aroma, chlorophyll and fatty acids composition of olive oil

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The olive agrifood chain is one of the main agrifood sector in Mediterranean countries. Olive products, mainly table olive and extra virgin olive oil, have been processed as a plant food since prehistoric times. A large increase in demand for high-quality olive oil and table olive during the past few years can be attributed not only to its potential health benefits but also to its organoleptic properties. In this sense, a new technological procedure, involving drying of olive (fruit), has been developed.

The purpose of this work was to ascertain the effect of drying on FA and total volatile compound composition and also on total chlorophyll amount. Samples were obtained from homogeneous olive fruits belonging to four Tunisian cultivars: "Chemlali", "Chetoui", "Oueslati" and "Picholine". Olives were submitted to air drying, oven drying (40°) and infra red drying (40°). Oils were extracted using the continuous soxhlet method. Fatty acids were converted into fatty acid methyl esters (FAMES) and their composition was analyzed by capillary gas chromatography (CGC). Total chlorophylls content was measured by The AOCS method. Furthermore, volatile compounds were stripped by dynamic headspace and their composition was performed with the same capillary column used for FA analysis.

The main results showed that, by comparison with oil extracted from non dried olives, the drying didn't affect FA composition whereas a significant decrease in pigment contents was found when fruits were dried by infrared radiation and oven dried. Air drying gave the most pigmented oil. In all our oils, aroma compounds were represented by C6 aldehydes, alcohols and esters. We noticed a decrease of aldehydes against an increase of alcohols and esters after oven drying at 40°C. Aldehydes amount was more important in oils extracted from olives submitted to drying by infra-red radiations.

Keywords: olive, olive oil, drying, fatty acids, volatiles, chlorophylls

Essential and Toxic Metals in Canned Food in Lebanon: Impact of Metal Cans

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Canned food is popular food sources all around the world, because they are inexpensive and affordable. For most people, the main route of exposure to toxic elements is through the diet. Food safety is a worldwide major public concern, and the increasing worry about food safety stimulated research regarding the risk associated with the consumption of food contaminated by heavy metals. The ingestion of fresh or canned food is an obvious cause to exposure to metals, not only because many metals are natural components of food stuffs, but also due to environmental contamination and contamination related to food packaging and processing. Trace metals are significant in nutrition either for their essential nature or their toxicity. Iron, copper and zinc are essential micronutrients consumed in adequate amounts, but these same essential metals become toxic when consumed excessively. In contrast Cd, Pb, and Hg are toxic metals. They are harmful at low concentration and they are not easily biodegradable. Metallic cans are generally composed of tinplate and/or aluminum. The use of tinplate will ultimately result in some tin dissolving in food. Aluminum is also widely used in food contact material such as cans and can ends. Additionally, other metals like Fe, Cr, Cu and Zn might leach into food especially in non-lacquering steel containers. Lead might exist in canned food stuff due the leaching from the soldering materials. The objective of this study is to assess metal content of different canned food types local and imported sold in Lebanese market and the impact of metal cans on food quality. Forty five samples of canned food of different types, brands, and different manufacturing countries were purchased from local supermarkets. The metals in cans were determined by ED-XRF technique, while metals in food were analyzed after digestion and consequent metal analysis (Fe, Cr, Cd, Cu, Zn, Pb by Thermal AAS technique; Al, Sn, As, Hg by ICP-MS). The statistical analysis of the data was performed using SigmaStat statistical package software. Results indicated that Fe has the highest percentage of metals in cans, some cans the % of Al was comparable to Fe and 50% of cans had Sn up to 12%. The analysis of variance (ANOVA) of each metal indicated statistically significant difference of metal levels in the different food categories, except for Cr. In food Fe, Zn, Cu, Al, and Sn levels were below the international permissible levels. But in some canned vegetables Sn levels were close to EU permissible limit. Furthermore, a correlation existed between levels of Sn and Al in cans and respective food indicating leaching of Sn and Al from metal cans into food. The concentrations of Pb and Hg (toxic metals) in canned food were below PTWI levels. While, 31 % of canned vegetables and legumes samples (40 % of these manufactured in Lebanon), and 45% of canned fish samples had Cd concentration levels above the EU permissible (0.1 µg/g). This finding necessitates continuous monitoring of Cd levels in canned food for providing citizens with safe food.

Food Safety and Handling Knowledge and Practices of Lebanese University Students

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The aim of this study was to assess the level of food safety handling knowledge and practices among 1172 Lebanese university students (mean age 20.0±1.6 SD) and to explore the association between their knowledge/practices and the socio-demographic and academic characteristics. Participants were undergraduates enrolled in the Lebanese American University from different majors and years of study, different areas of residence, living alone or with others, and having working or non-working mothers. They completed a questionnaire of 16 food handling practices and 14 food safety knowledge questions related to preparation, cross contamination, storage and hygiene. On average, the students scored 53.6±15.8% and 44.7±14.3% on the knowledge and practices parts, respectively. Female students scored higher on both practices and knowledge questions than male students; however, the difference was significant ($P<0.001$) for the practices part only. Health-related majors scored significantly ($P\leq 0.001$) better on both practices and knowledge questions. Senior students scored highest on the knowledge questions compared to younger ones and the difference was borderline significant ($P=0.07$). The area of residence had a significant ($P=0.006$) effect on the food safety practices questions. Students living with parents scored higher in both parts than those living alone or with roommates; however, the difference was significant ($P=0.009$) in the knowledge part only. Students who cook all the time showed a significant ($P=0.001$) lower difference in terms of their food safety knowledge compared to those who cook less frequently. Food handling practices and food safety knowledge scores were significantly ($P<0.001$) related with a weak-to-moderate correlation coefficient ($R=0.231$).

Food safety knowledge, attitudes and practices of food handlers in SME's, Beirut, Lebanon

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In Lebanon's food service sector availability of data on food safety and performance indicators is very limited. Production practices such as the use of untreated waste water for irrigating crops causes concern, particularly when dealing with leafy vegetables to be eaten raw. Contaminated irrigation water has been implicated as a vector of enteric pathogens in fresh vegetables, and has led to growing public health concerns with reported cases of foodborne illnesses.

As food moves along the farm-to-fork continuum, it is subjected to conditions which could allow the pathogen contamination, survival and growth, posing a risk in catering operations. The aim was to identify factors that may contribute to pathogens growth and attachment on the surface of vegetables while exploring handling practices and hygienic conditions, and potential control opportunities along the food supply chain.

For this purpose, a survey was conducted in Beirut to evaluate the knowledge, attitudes and practices related to food safety issues of food handlers (n=80) in food service establishments (n=50) by administering questionnaires and observational survey assessment in the course of vegetables preparation. In general, the respondents demonstrated moderate awareness in food safety with a mean food safety knowledge score of 56.6 ± 21.00 . The results showed also a general trend towards a positive attitude regarding hygienic practices in the kitchen. Almost all surveyed food handlers considered that they serve consumers safe food, and that training in food safety is essential to their work.

At the same time the visual assessment results show inadequate premises and hygienic design of the food service establishments. Almost half (54%) of the food premises do not fulfil the basic hygienic requirements for clean floors, equipment and food contact surfaces. Lack of chips-free and clean color-coded cutting boards poses cross-contamination risks in 48% of the surveyed food outlets.

The Chi-Square cross tabulation results showed a significant relation between the type of management that operates the food outlets and the adequate hygienic and structural standards that are essential for the production of safe food. Resources and lack of space, among others, were reported as barriers against the implementation of a food safety system.

Current work aims to assess the presence of pathogens in fresh produce from farms and post-harvest and means of decontamination. One of the expected outcomes is the development of applicable mitigating strategies for risk reduction of contaminated produce reaching the small and medium sized food service establishments.

Gill histological and oxidative stress evaluation in the *Oreochromis niloticus* exposed to Red 195 Dye

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Abstract:

In this work, we study the relation between biochemical and histological changes in gill exposed to red 195 dye in tilapia *Oreochromis niloticus*. Tilapia were fed and exposed to different concentrations (0.05; 0.1 and 0.2 mg/L) of the dye for three weeks (7, 14, and 21 days). During each week, we performed the dissection of 12 fishes after measuring their weight, their lengths and determined their sexes. The gills of each fish were removed. A portion of the gills were crushed and homogenized in phosphate buffer (KH₂PO₄, pH 7, 4) and then centrifuged at 16000 g for 20 min at 4°C. The supernatant used for the enzymatic assays (CAT, GST and GR). CAT activity was measured with a Clark-type oxygen electrode (Hansatech®, Del Rio et al., 1977). GST and GR activity were determined by the spectrophotometer (Variant-Cary®50, Carlberg and Mannerviek, 1985). The other part of the gills are placed in cassettes and after in formaldehyde for histological section.

In gills, the results showed that CAT activity decreased at the highest dose after 14 and 21 days of exposure compared to the control. Although, GST activity was increased at the highest dose after 14 and 21 days of exposure, but GR activity was increased slightly after 7 and 21 days of exposure, compared to the control. Furthermore, the observation of histological changes of gill showed severe lesions, such as lamellar fusion and necrosis.

Keywords: Red 195 dye, Tilapia, Antioxidant Enzymes, Gill, Histological, oxidative stress

Metal Concentration in Commonly Used Medicinal Herbs and Infusion by Lebanese Population: Health Impact

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The use of plants as medicine predates recorded history despite medical and pharmaceutical advancements. The use of medicinal plants in primary healthcare intervention is more common in developing countries, where commercial drugs are mostly unaffordable or unavailable. The effectiveness of medicinal plants for therapeutic purposes is often accounted for by their chemical constituents. Minerals and trace metals are partially responsible for their medicinal and nutritional properties, as well as their toxic ones. The levels of essential elements in plants vary according to the geographical region, geochemical soil characteristics, and the ability of plants to selectively accumulate some of these elements. Some metals are essential nutrients (zinc, iron, copper, and chromium), yet become toxic at high concentrations, while others (lead, mercury, arsenic and cadmium) have no known beneficial properties and are toxic. Accumulation of heavy metals in plants is one of the most serious environmental concerns because they transfer heavy metal pollutants from soil into the food chain, and cause adverse health effects in humans. There are a number of factors which contribute to heavy metal contamination in agricultural soils including waste and industrial water discharge, irrigation with contaminated water, fertilizers and pesticides. In Lebanon, research on medicinal plants has mainly focused³ on the identification and characterization of their essential oils and pharmacologically important secondary metabolites. However, no studies on metal levels in commonly used medicinal herbs in Lebanon have been conducted yet. Therefore, the objective of this study is to assess the major and toxic metal levels in sixteen commonly used medicinal herbs, local and imported, and their infusions by the Lebanese population. In this study we used the common practice of herb infusions, and were prepared by either boiling the herb with boiling water or soaking the herb in boiled water to simulate its traditional usage. Sixteen medicinal herbs or blends were purchased from one of the oldest and major herbalists in Beirut. The concentrations of metals (Ca, K, Fe, Mn, Zn, Cu, Co, Ni, Cr, Pb, Cd, As) in the dried herbs was determined using EDXRF. Two types of herbal infusions were prepared based on the common methods used by Lebanese (boiling the herbs with water or by soaking the herbs in hot water). The concentration of metals in infusion (boiled and soaked) was determined by using thermal AAS. Statistical analyses were performed using SPSS, and SigmaStat statistical packages. Results revealed the order of metal contents in the herbs was found to be: K (6990-19850 µg/g) > Ca(1630-14450 µg/g) > Fe(80-3650 µg/g) > Mn (28-458 µg/g) > Zn (23-108 µg/g) > Cu (5-71 µg/g) > Cr (3.1-55 µg/g) Pb > (1.1-10.3 µg/g) > As (nd-10.8 µg/g) > Cd (nd-1.7 µg/g). The mean levels of toxic metals in herbs Pb, As and Cd were below WHO permissible levels. Cluster analysis indicated metals are most probably in plants due to wastes disposal and irrigation with contaminated wastes and/or from atmospheric waste particulates. The levels of Mn, Cr, Pb and As in herbal infusions were found to be higher in soaked than boiled preparations and correlated with Fe, while Zn and Cu levels were higher in

boiled infusions. The highest weekly intake from herbal infusions of toxic metals Cr (492.8 μ g), As (77.0 μ g), Pb (291.2 μ g) and Cd (19.0 μ g) were below the recommended permissible tolerable weekly intake respectively 1260 μ g, 900 μ g, 1500 μ g, and 150 μ g. Therefore, the consumption of these traditional medicinal herbs does not pose any health risk provided full compliance with recommended daily doses.

Protecting Consumers in Lebanon: The Need for Effective Food Safety System

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Background: Food safety has a major impact on the health of the Lebanese population and economy. Pathogenic microorganisms are being detected in Lebanese foods, food poisoning outbreaks are being reported, and some Lebanese food product exports are being rejected while no changes have been made in the food safety practices. Little is known about what happened after the spoiled meat incident in March 2012 which provoked major public and political interest in the food safety practices. There is lack of clarity on who is responsible for food safety governance and control in Lebanon and how this system can be enhanced. This K2P Briefing Note aims to shed light on the current situation in terms of the food safety system and practices in Lebanon, clarify problems and offer a recommendation.

Methods: To effectively inform and advise decision makers about this pressing public health issue, the knowledge translation tool “K2P Briefing Note” was selected and prepared. The selection of this tool was based on predetermined criteria. The development of the K2P briefing note involved combining the explicit knowledge from the literature with the tacit knowledge of policymakers, content experts and relevant stakeholders through interviews. Available local, regional and global evidence on food safety governance mechanisms was collected through an assessment of the databases and identification of literature, screening, extraction and synthesis. This evidence was then contextualized through key stakeholder interviews and recommendations were developed.

Findings: To date, there is no food safety law in Lebanon, there are only decrees from the 1960s and 1970s which are outdated. There are nine agencies in Lebanon that govern food safety with overlapping functions, duplication of activities, gaps in the food control chain, and lack of accountability. Lebanese food safety practices do not conform to international standards and do not ensure the safety of Lebanese consumers. The current draft food safety law suggests a centralized approach to the food safety system coordinated by an independent food safety board and authority. There is a world-wide trend for governments to adopt stricter and more rigorous food safety control systems. The Briefing Note reports on food safety system models implemented in different countries, including their advantages and disadvantages and case studies of how some countries restructured their food safety systems.

Recommendations: The development of a national food safety law to uphold an effective food control system is essential for protecting consumers in Lebanon. Based on evidence synthesized in the K2P Briefing Note, the new food safety law should be context-specific, taking into consideration local applicability, implementation barriers, and political influences. This law should be accompanied by appropriate legislative decrees addressing implementation such as inspection, import/export, licensing etc. This law could be developed by conducting thorough assessment of the background of the food safety practices in Lebanon, analyses of the problem

and underlying factors and identifying and appraising options for strengthening the food safety system. Such analysis should be the basis for holding deliberative policy dialogues.

Sensory and quality parameters of raw and processed Chicory-Hindbeh, a commonly consumed dark leafy green in Lebanon (*Cichoriumintybus L.*) during frozen storage

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This work aimed at assessing the effect of heat treatment and frozen storage on the sensory and chemical properties of chicory with the goal of optimizing the heat pretreatment-storage condition to best preserve the chemical and sensory properties of chicory. Raw, boiled (10 min), blanched (90°C for 60 s) and steamed (for 20 s) chicory samples were produced and stored at -6°C, -12°C or -18°C for 4 months. Chemical analyses (moisture, ash, vitamin C, peroxidase activity, chlorophyll and color) and sensory evaluation (QDA and hedonic evaluation) were conducted. Treatment significantly influenced all chemical variables ($p < 0.001$), except for moisture; and so did freezing temperatures for a-value ($p < 0.001$), chlorophyll-a, peroxidase activity, vitamin C and ash ($p < 0.01$), total chlorophyll, moisture and b-value ($p < 0.05$). Differences were obtained for age for all chemical variables ($p < 0.001$). Treatments affected consumers' acceptability of chicory and QDA showed that boiled chicory was significantly more tender, less chewy and crunchy and needed less time to disintegrate than other samples. PCA showed that PC1 and PC2 separated attributes based on type and intensity of treatments, respectively. It is recommended to use blanching at 90°C for 60 s and freezing at -12°C or -18°C to best preserve the quality of chicory.

Keywords: Chicory, leafy vegetables, blanching, quality, POD, vitamin C, frozen storage.

Study of Culinary Sayings in Traditional Lebanese Recipes by Means of Molecular Gastronomy

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Molecular gastronomy was first introduced in 2011 in Lebanon through a series of lectures addressed to various publics. Since then, actions followed to assure the perpetuity of this initiative, including the creation of a Lebanese group of molecular gastronomy. A project funded by the Agence Universitaire de la Francophonie (AUF) is currently undertaken by an academic team in Lebanon under the theme “Preservation and development of Lebanese culinary heritage through molecular gastronomy”, in order to better understand scientifically the particularity of Lebanon’s traditional recipes.

Actions undertaken for this project include the organization of monthly seminars of molecular gastronomy. At these monthly meetings, cooks, scientists, teachers, engineers, food writers are considering open questions on culinary transformations. Results of these monthly seminars will be shown. Among the famous Lebanese dishes, differences between home-made and industrial *hommoss* were analyzed by the study of the emulsion formed after dissolution with *tahine*. Microscopic, viscosity and texture measurements were done in order to better explain the relation between the microstructure and the macrostructure of formulations. Analytical exploration of elementary steps in *hommoss* production is thus highlighted.

Another part of this project included visits to different rural regions in Lebanon in order to work with women’s associations on traditional recipes. Scientific exploration followed in order to study the scientific validity of culinary sayings in traditional recipes in Lebanon.

In particular, collaboration took place with women's associations as part of agricultural cooperatives in Tannourine and Deir El-Ahmar regions. Traditional recipes from the regions of Tannourine and Deir El-Ahmar were explored in the same way. Some culinary sayings were justified by analytical measurements while others were not validated.

A specific Unit of Molecular Gastronomy is built in Lebanon with major scientific findings shared in the scope of this communication, with a main academic core interacting with main partners in the field: universities, cooks, school students, industries, restaurants and research centers. In order to innovate, one must better learn about culinary traditions and precisions. A balance is sought through this project between the meaning of traditional cooking and innovation through the knowledge gained by food science.

Survey of Internal Temperatures of Lebanese Domestic Refrigerators and Analysis of Factors Affecting Them

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Lebanon is currently suffering the worst electrical power crisis in its history, which is negatively affecting the internal temperatures in domestic refrigerators and putting the Lebanese population at a higher risk of food poisoning. A survey was carried out from February to November 2013 and internal temperatures were recorded at the middle of refrigerator compartment using a data logger. In addition, socio-economic status of the households, conditions of the refrigerators and the power supply were analyzed. A short questionnaire was administered to participants, enabling the following information to be obtained: characteristics of the family, characteristics of the power supply, characteristics of the refrigerator and the use conditions. One hundred and forty-seven domestic refrigerators were surveyed in the three main cities (Beirut, Tripoli and Saida) every 5 min over a period of 72 hours. The age of 30% of the surveyed fridges exceeded 13 years, 26% were fully loaded, 16% had bad door seals, 100% did not have an internal thermometer, 20% had a heat source less than one meter close and 79% of participants reported that their refrigerator is not always connected to power. The temperatures of the surveyed refrigerators were: average 8.0°C, minimum -5.9°C and maximum 37.0°C. A significant proportion (71%) of the refrigerators had a mean temperature >6°C. Statistical analysis showed that there was no significant ($P > 0.05$) difference between mean temperatures in refrigerators in the three locations. The socio-economic status of the households (income and number of family members), the refrigerator status (age, brand name, load level and seal status) and the power supply characteristics (frequency of governmental power cuts and availability of alternative power) had a significant ($P < 0.05$) effect on internal temperature distribution of the refrigerators. The temperature data collected by this survey can indicate the amount of time that refrigerators have an internal temperature above a minimum bacterial growth temperature. In addition, these data can assist with food safety promotion and act as an input into food safety risk assessments.