EATING DISORDERS AND DIETARY PATTERNS:
A CROSS-SECTIONAL STUDY AMONG
STUDENTS OF A LEBANESE PRIVATE UNIVERSITY

A Thesis

presented to

the Faculty of Nursing and Health Sciences

at Notre Dame University-Louaize

In Partial Fulfillment

of the Requirements for the Degree

Master of Science in Human Nutrition

---

by

ROMY CHAMMAS

JUNE 2017

Department of Nursing & Health Sciences
Faculty of Nursing & Health Sciences
MS Thesis Proposal & Committee

Student's Name: Romy Chammas ID#: 20081394
Department: Nursing & Health Sciences
Degree sought: MS Human Nutrition

Thesis Proposal Title *(should clearly reflect the study main aim)*
Prevalence of Eating Disorders among University Students in Lebanon, and its Correlation with Specific Dietary Patterns.

Thesis Proposal Abstract (about 250 words): *should be attached to this form.*

Thesis Committee
The Master's thesis committee should be composed of at least three members recommended by the department and approved by the faculty graduate committee. ***The proposal of the thesis topic, the selection of the advisor, and the members of the thesis committee should have been approved by the faculty graduate committee*** *at least four months before the student defends the thesis. It is advisable that the thesis committee includes one external member. This member may be from an institution other than NDU. All committee members should hold professorial ranks. The thesis committee approves the thesis topic and research program and conducts the thesis defense examination. (NDU Catalog 2014-2015, p91)*

MS Thesis Committee

Name	Title/ Faculty	Signature
1. Antoine Aoun , **Thesis advisor**	Assistant Professor	
2. Christelle Bou Mitri	Assistant Professor	on Behalf of Dr. Christelle Bou Mitri
3. Jocelyne Bou Mosleh , **Thesis advisor**	Assistant Professor	

MS Thesis Committee Chair: Antoine AOUN *(Full Name)* Date: 8/11/2016

Approved by: Faculty Graduate Committee

Name	Title	Signature
1. Jocelyne Matar Boumosleh	Assistant Prof	
2. Maya ABOU JAOUDE	Lecturer - Acting chair	
3. Antoine Feghali	Associate Prof - Dean	
4. Dany Tcaciuk	Associate Professor	

Date: 11/8/2016

Original copy: Thesis Advisor; One copy: Academic Advisor, Department, & Student

Thesis Release Form

□ I ……..... , authorize Notre Dame University-Louaize to supply copies of my thesis to libraries or individuals on request.

□ I Romy Samir Chammas do not authorize Notre Dame University-Louaize to supply copies of my thesis to libraries or individuals on request before publishing this work.

…….

Signature

……..

Date

Acknowledgment

First and foremost, I thank and praise God for giving me this opportunity to grow, to confront obstacles and to appreciate challenges.

I would like to thank Notre Dame University, particularly the Faculty of Nursing and Health Science and all its members who stood by me during all the academic years.

I would like to thank my thesis advisor Dr. Antoine Aoun. The door of his office was always open whenever I ran into a trouble or had a question about my research or writing. He consistently allowed this paper to be my own work, but steered me in the right direction whenever he thought I needed it.

I would also like to thank Dr. Jocelyne Bou Mosleh who was involved in all the stages of this research project. Without her participation and input, the survey could not have been successfully conducted.

I would also like to acknowledge Dr. Doris Jaalouk and Dr. Christelle Bou Mitri for their precious help and support. I am gratefully indebted for their very valuable comments on this thesis.

I would like to thank deeply my family and my friends for their great support all over my academic years.

Table of Contents

I. ABSTRACT

Background: Eating disorders (EDs) and related risk factors have become an area of interest for researchers, and a challenge to manage for health care practitioners. EDs were considered mainly as western culture disorders; however recent studies showed a comparable raise of EDs in the Middle Eastern countries.

Objective: The purpose of this study was to estimate the proportion of Notre Dame University students (NDU) who are at risk of developing EDs, and examine the association of ED's risk with socio-demographic, lifestyle, dietary factors and dietary patterns.

Methods: This was a cross-sectional study, conducted on a sample of 457 NDU students of both genders. Informed consent form was obtained prior to participation from study applicants. Data on socio-demographic and lifestyle factors were collected using a background questionnaire, along with data on physical activity collected using the International Physical Activity Questionnaire (IPAQ) - short form. Dietary intake of participants was assessed using a 61-item food frequency questionnaire (FFQ-61 item). The risk of developing EDs was assessed using the SCOFF questionnaire (The *Sick, Control, One stone, Fat, Food*). Anthropometric, body composition and blood pressure measurements of all subjects were obtained, using standard protocols and bioelectrical impedance analysis, respectively.

Statistical Analysis: Quantitative and qualitative measurements were summarized as mean ± standard deviation/Median (Interquartile range) and n (%). Comparisons of continuous and categorical variables were performed using independent two-sample T-

Test/ Mann Whitney- U Test/ analysis of variance and the chi square test/ Fisher's exact test respectively. Dietary patterns were identified by exploratory factor analysis. Spearman's correlation coefficients were calculated between dietary patterns and energy adjusted nutrient intakes. Multiple linear regression was used to assess socio-demographic and lifestyle determinants of the various dietary patterns. Multivariate linear regressions were used to assess associations between each of the identified dietary patterns and being at risk of EDs, after controlling for confounders. Statistical analyses were performed using Statistical Package for Social Sciences (SPSS) version 22 for Windows. A p-value < 0.05 will be considered statistically significant.

Results: The mean age of the sample was 21.3±1.9 years (63% males). Five dietary patterns were identified: 'Traditional Lebanese', 'Western fast food', 'Dairy', 'Lebanese fast food' and 'Fruits'. Using the SCOFF questionnaire, 146 (32.4%) students were found to be at high risk of developing EDs with a significantly higher proportion of females than males (F: 40% vs. M: 28.1%, P<0.05). Significant associations were observed between high risk of EDs and: frequency of eating meals while watching television/ week (often (37%), occasionally (25%) , rarely (36%)), physical activity level (low level 39%, moderate 24% and high 37%), family history of mental illness (positive: 52% vs. negative: 31%,), higher depression score (42% vs 28%., P=0.014), risky waist circumference (49% vs. 31%, P=0.038), higher percentage of body fat (26.3 vs. 19.6, P=0.004), higher BMI (Obese: 49%, Overweight: 41%, Normal: 28%, Underweight: 4%, P=0.000), risky waist to height (44% vs. 26%, P= 0.000), chronic morbidity (Yes: 46%; No: 31%, P= 0.046), unhealthy eating behavior for the past 3 months (Yes:48%; No: 30%, P= 0.008), lower energy intake (4172.5 vs. 4860.1, P=0.004) and higher dietary

intake of: potassium (14324 vs. 1313 mg, P=0.000), magnesium (151.5 vs. 143.0 mg, P=0.007), fiber (9.1 vs. 8.6 g, P= 0.015), copper (0.67 vs. 0.65 mg, P= 0.026), fluoride (1259 vs. 1037 mcg, P= 0.036), phosphorous (649 vs. 630 mg, P= 0.044), Vitamin C (53 vs. 48 mg, P= 0.043), B5 (1.95 vs. 1.81 mg, P= 0.008), B6 (0.87 vs. 0.81 mg, P= 0.011) and B7 (11.09 vs. 10.36 mcg, P= 0.046). Students at high risk of EDs had a 0.111 lower score from the "Dairy" pattern (P= 0.035), with no association with the other dietary patterns.

Conclusion: Early detection and treatment of EDs may be improved by routinely evaluation of several specific risk factors in adolescence.

Keywords: Eating Disorders, Risk Factors, Dietary Patterns, University Students, SCOFF, DSM V

II. LITERATURE REVIEW

Introduction:

People have been using food as a coping mechanism to deal with uncomfortable or extreme emotions or to help them feel more in control when feelings or situations are over-whelming. Thus, eating disorders (EDs) have increasingly become an area of interest for researchers and a challenge to manage for health care practitioners (Fairburn and Harrison, 2003). They represent an aggregate of medical conditions including psychiatric disorders with diagnostic criteria based on psychological attitudes and behaviors related to weight, food and physiological issues. If left untreated, they may result in health threatening conditions and mortality for both females and males (Elmer, 1996). EDs are somehow underestimated among the general population and patients tend to deny or hide their illness and reject profession help or intervention (Elmer, 1996).

The worldwide prevalence of EDs among adolescents is around 10%, most commonly affecting females aged between 15 and 19 year old. It has been predicted that 0.3–2.2% and 1–2% of young females in urbanized countries suffer from anorexia nervosa (AN) and bulimia nervosa (BN), respectively. Deaths from AN have been estimated to be as elevated as 5.0%. EDs were considered mainly as western culture disorders; however recent studies showed a comparable raise of unhealthy eating behaviors/EDs in less developed countries, including Middle Eastern countries, too (Aoun et al., 2015; Elmer, 1996; Fairburn and Harrison, 2003; Lahteenmaki et al., 2009a; Smink et al., 2012; Stice et al., 2013; Musaiger et al., 2013; Zeeni et al., 2017). EDs are highly prevalent among university students in Lebanon as in France (Tavolacci et al., 2015). In a study conducted

among university students from greater Beirut, risky weight control measures were detected among 6.5% of students in private universities and 5.6 % of students in public universities. Extreme practices for weight loss were also found to be followed, mostly by females, by 122 out of 2013 students with 63%, 40%, and 53% reporting to have used weight loss pills, laxatives and induced vomiting, respectively (Tamim et al., 2006). Moreover, a recent research study indicated that 21.2% of students in a Lebanese university were vulnerable to develop EDs and that 11.4% have been diagnosed by health care professionals with EDs, with BN being the most prevalent (46.1%) followed by AN (39.4%) and binge eating disorder (BED) (14.4%) (Zeeni et al., 2013).

The classification of EDs and their diagnostic criteria are based on the Diagnostic and Statistical Manual of Mental Disorders (DSM). The DSM IV identifies two EDs, anorexia nervosa (AN) and bulimia nervosa (BN), with a residual category known as the "eating disorders not otherwise specified" (EDNOS) (Fairburn and Cooper, 2011; Fairburn and Harrison, 2003; American Psychiatric Association, 2015). The need of developing a DSM V rose from the realization that a considerable number of patients with EDs did not fit in the DSM IV categories of AN and BN, but rather in the EDNOS category (Fairburn and Cooper, 2011; Fairburn and Harrison, 2003). After 14 years of revision process, the fifth edition was published in May 2013 with substantial changes from the DSM IV characterized by the inclusion of new EDs in order to allow for more precise classification of patients who fit in the EDNOS and therefore appropriate clinical management (American Psychiatric Association, 2015). Specifically, the changes were the following: First, binge eating disorder (BED) has been recognized as a separate category. Second, amenorrhea criterion was removed from AN diagnostic criteria

because it is not applicable to males, pre-menarche females, females taking oral contraceptives and post-menopausal women. Third, the rate of recurrence of binge eating and compensatory behavior, as one criterion in the diagnostic criteria for BN and BED, was decreased from twice to once per week for 3 months. Fourth, DSM V referred to EDNOS as FEDNEC or other specified feeding or eating disorder (OSFED) Finally, pica, rumination and avoidant/ restrictive food intake disorders were included (Fairburn and Copper, 2011; American Psychiatric Association, 2015; Rodríguez-Testal et al., 2014).

As a result of the changes introduced into the DSM-V, the distribution of EDs diagnosis varied widely between the DSM IV and the DSM V. According to specific ratings on the eating disorder examination interview version 16 which was applied to 167 consecutive adult patients (body mass index >15.0 kg/m^2) seen in an EDs British clinic, a significant increase/decrease in proportion of interviewees with AN and EDNOS was observed. (8.4-28.7 and 52.7 - 25.1, respectively). In addition, 7.2% of the interviewees were found to fall in the newly created category in the DSM V (BED) (Fairburn and Cooper, 2011; Fairburn et al., 2007).

Anorexia Nervosa

AN is more common in females with a lifetime prevalence of 0.8% among American adolescent girls and young women (Fairburn and Harrison, 2003; American Psychiatric Association, 2015; Smink et al., 2012; Stice et al., 2013). People with AN suffer from a distorted body image, belief that they are overweight/obese even though their body weight is way below normal (BMI $\leq$ 18.5 Kg/m^2), an overvaluation of the shape and weight and strict weight loss achieved by severe or selective food restriction, extreme

dieting, fasting and excessive exercising (restricting type) or by binge eating accompanied by a compensatory behavior (abuse of laxatives, diuretics, weight loss drugs and self-induced vomiting) (binge eating/purging type) (Elmer, 1996; Fairburn and Harrison, 2003). AN is associated with serious physical and psychological problems such as cessation of the menstrual cycle in women not taking oral contraceptives, potentially resulting in osteoporosis, heart abnormalities and arrhythmias that increase their risk of sudden death, depression… All psychological and physiological problems can be reversed if appropriate weight gain is achieved (Fairburn and Harrison, 2003).

Bulimia Nervosa

BN shares common features with AN with a lifetime prevalence of 2.6% among American adolescent girls and young women (Smink et al., 2012; Stice et al., 2013). Bulimics are also highly concerned about their body weight and shape and their self-evaluation is based on physical characteristics (Fairburn and Harrison, 2003). However, they frequently experience episodes of binge eating, recurrent eating of large uncontrolled quantities of food (1000-2000 Kcal per episode), in a very short period of time even when not feeling hungry (Elmer, 1996; Fairburn and Harrison, 2003; American Psychiatric Association, 2015). Subsequently, a feeling of guilt follows, driving them to punish themselves or compensate by inappropriate behavior such as abuse of laxatives, diuretics or even self-induced vomiting (purging type), or fasting / excessive exercise (non- purging type) to relieve guilt, compensate for binges and control their body weight (Elmer, 1996; Fairburn and Harrison, 2003). Bulimics, unlike anorexics, maintain a normal or slightly elevated body weight (Elmer, 1996). BN is also

associated with serious psychological and physical problems such as, repeated vomiting causes erosion of stomach and esophagus, dehydration and mineral imbalances, heart arrhythmias and occasionally sudden death, depression, anger, low self-esteem, irritability, mood swings, social isolation and reduced sexual appeal.

Binge Eating disorder

BED has a lifetime prevalence of 3.0% among American adolescent girls and young women (Smink et al., 2012; Stice et al., 2013). It is similar to BN in terms of consumption of an abnormally large amount of food in a relatively short time. However, binge eaters do not engage in compensatory behavior (induce vomiting/ use laxatives, exercise) and as result they get fatter and become overweight or obese (Elmer, 1996; Fairburn and Harrison, 2003; American Psychiatric Association, 2015). During most of the binge-eating episodes, patients eat much more rapid than usual, until feeling uncomfortably full, when not feeling physically hungry, and alone because they feel ashamed of eating in public (American Psychiatric Association, 2015). BN is more prevalent in men as compared to AN and BN which are more common in women (Elmer, 1996; Fairburn and Harrison, 2003).

Feeding or Eating disorders not otherwise classified

FEDNEC, also known as atypical EDs, include those who have feeding disturbances presenting clinical features as severe as other EDs but do not meet their diagnostic criteria (Fairburn and Harrison, 2003). They are the most common among other EDs with a lifetime prevalence of 11.5% among American adolescent girls and young women.

Examples include: atypical anorexia, purging disorder, night eating syndrome (Stice et al., 2013).

Screening tools

Early detection of EDs is important in order to improve the prognosis and management (Lahteenmaki et al., 2009; Morgan et al., 1999). Among many others, the habitually used screening tools; Eating Attitudes Test (EAT), Eating Disorders Inventory (EDI), Eating Disorder Examination Questionnaire (EDE-Q) and Bulimic Inventory Test Edinburgh (BITE) are often long and time-consuming. They need to be correctly validated in primary care settings and are difficult to understand requiring data analysis by a specialist (Cotton et al., 2003; Lahteenmaki et al., 2009a).

The use of an effective, short and simple screening tool for EDs is thus needed for rapid detection and intervention. Recently, a new screening tool, the *Sick, Control, One stone, Fat, Food* (SCOFF) questionnaire, was introduced and shown to be an effective valid screening tool in its British (Morgan et al., 1999), Spanish (Garcia-Campayo et al., 2005), American (Parker et al., 2005), Italian (Siervo et al., 2005), Catalan (Muro-Sans et al., 2008), Finnish (Lähteenmäki et al., 2009a) , French (Garcia et al., 2011) and the Arabic version (Aoun et al., 2015). The SCOFF questionnaire is a simple, brief and easy to memorize questionnaire. It consists of 5 short questions: 1) Do you make yourself **S**ick because you feel uncomfortably full? 2) Do you worry that you have lost **C**ontrol over how much you eat? 3) Have you recently lost more than **O**ne stone (6.5kg) in a 3-month period? 4) Do you believe yourself to be **F**at when others say you are too thin? 5) Would you say that **F**ood dominates your life? A yes answer to each of the 5 questions is equal

to one point and a total of at least 2 points indicates that the person is at high risk of developing EDs (Morgan et al., 1999). The sensitivity and specificity of the SCOFF questionnaire, in its original British form, were found to be 84.6% and 89.6% respectively (Morgan et al., 1999).

Risk Factors

Researchers are still learning about the fundamental causes of EDs. However, these emotionally and physically damaging conditions are believed to be complex conditions arising from interactions among **1) socio-demographic (**such as age, gender, ethnicity, educational level and major (Fairburn and Harrison, 2003; Maxwell et al., 2011)**) 2) socio-cultural (**such as family support or pressure, relationships, media exposure, stressful life events including war exposure and physical/sexual abuse (Andreea-Elena, 2015a; Aoun et al. 2015; Fortesa and Ajete, 2014; Karsli and Karsli, 2015; Levická et al., 2014; Samnaliev et al., 2015; Taylor et al., 2006)**) 3) biological (**predisposing genes, hereditary traits and role of some hormones controlling appetite and mood (Fairburn and Harrison, 2003; Shinohara et al., 2004)**) 4) psychological (**such as mental health problems (depression and anxiety), personality traits (perfectionism) and perception of body image (muscularity and thin concept and effect of cosmetic surgery) **5) dietary and lifestyle (**such as wrong beliefs about diet and food, food addiction and exercise (Andreea-Elena, 2015a; Goldschmidt et al., 2010; Wilson et al., 2009; Di Mattei et al., 2015)**) 6) dietary patterns (**such as energy and nutrient intake, meal frequencies and food choices (Neumark-Sztainer et al., 2004; Huse and Lucas, 1984)**)**.

Socio - demographic factors:

Although EDs can occur at any age, including childhood, teenage years and older adulthood, they are much more common during the teens and early adulthood (16-28 years of age) (Call et al., 2013). Teenage girls and young adult women are more likely than teenage boys and young men to have AN or BN, but males can still have EDs mainly BED if they are having troubles in losing weight (Fairburn and Harrison, 2003; Sukariyah and Sidani, 2014). 10-15% of EDs occur in males and that male sufferers are similar to female sufferers in terms of age of onset, dissatisfaction with current body shape and weight control methods.

Several authors have examined attitudes towards weight among individuals of different ethnic groups. Rosen et al. (1991) found that African-American women were more satisfied with their body weight than were Caucasian-American women. Similarly, in the United Kingdom, Ahmad et al. (1994) found that Asian schoolgirls were more satisfied with their weight than their Caucasian counterparts. Caucasians appear in most studies to be more concerned about weight than other ethnic groups. According to Altabe and Thompson (1996), when compared with African-Americans, Caucasian-Americans had more negative body cognitions and evaluations of general physical appearance. Caucasians and Hispanics showed the most disturbances toward weight-related body image, whereas African and Asian-Americans the least. For the general appearance body image, African- Americans had the most positive self-view. Asian-Americans placed the least importance on physical appearance. Thus, ethnic differences occurred for both weight and non-weight dimensions of body image. However, the pattern of ethnic differences was different for these two dimensions of body image (Altabe and Thompson, 1996). Also, the type of community (modernized vs. rural) was found to be a risk factor

for EDs with higher prevalence of EDs among individuals living in modernized communities than among those living in rural areas (Karsli and Karsli, 2015). The eastern adolescents try always to mimic westerns in their eating attitudes and beliefs, considering it as modernization, while the false marketed thin, ideal, attractive concepts are the leaders to develop inappropriate eating practices leading to EDs (Andreea-Elena, 2015b). Generally, women with EDs are less educated. Lower education level has also been associated with longer duration of illness and younger age of onset. AN students were found to be largely attracted by the love of achieving, expressing and having a higher IQ scores than normal people (Maxwell et al., 2011). Substantial concern on physical appearance and eating attitudes were found to be more common among university students majoring in Nutrition and dietetics, Physical education and Sports (Nergiz-Unal et al., 2014).

Socio-cultural factors:

People who try to lose weight often engage in unhealthy weight loss behaviors. These behaviors are often reinforced by positive comments by others to encourage them to attain their ideal body weight. This, however, may cause some people to take dieting too far, leading to development of an ED; this is especially true for those who live in a weight obsessed culture where there is social pressure to be thin (Joja et al., 2015). Parental or sibling criticism of weight, shape, size, eating behavior is positively associated with body weight status in adolescents, increased emotional neglect, and lower self-esteem therefore higher risk for EDs (Taylor et al., 2006). Adolescents who are born and raised in a familial environment that highly values the bodily appearance and evaluates the person primarily according to his/ her body image develop increased interest in body and shape

evaluation themselves. The different cultural context differs from a family to another and this explains the variability among individuals in how they express these negative thoughts in their eating behavior and whether they would develop psychological and mental health problems (Fortesa & Ajete, 2014; Zeeni et al., 2013). Lack of life fulfillment, social support from friends, family, or partner, emotional solitude in dating relationships, along with the great importance of physical appearance that our society imposes, were found to cause social-physique anxiety and perturbation in adolescents wellbeing and therefore they are remarkably related to the development of EDs among adolescents (Çekiç et al., 2014).

Differences in relationships exist among patients with EDs and are differentially associated with various eating disorder symptoms and characteristics (Wilson and Sysko, 2009). Women with EDs showed same desire for romantic relationships and for childbirth as healthy patients, however women with restricting and purging AN, experience more a loss of sex appeal than women with BN and EDNOS. This emotional, psychological and mental instability threatens marriage and commitment (Maxwell et al., 2011). Homosexuality appears to be a unique risk factor for eating pathology in men (Russell and Keel., 2002; Beren et al., 1996; French et al., 1996; Heffernan, 1994; Williamson, 1999). One prominent explanation for the high prevalence of EDs among gay and bisexual men can be referred to as the socio-cultural perspective which implicates social and cultural values and norms that advance notions of an ideal body image that are unobtainable by many, which can influence self-esteem and attitudes towards eating and food. Thus, the perspective posits that gay and bisexual men are affected by social norms and values that guide cultural notions of beauty. Therefore, gay

and bisexual men are subject to similar pressures and demands as heterosexual women (Feldmen and Meyer, 2007).

Adolescence is a very sensitive phase in which individuals focus a lot on how they look, and how others look at them. The media effect and the marketing of the thin/muscular body image as being the ideal body image by using celebrities, athletes and idols as role models, pushes vulnerable individuals to engage in extreme activities (extreme dieting and excessive exercising), leading eventually to development of EDs (Karsli and Karsli, 2015). University students in Lebanon, for example, were found to engage in emotional eating and their body image was impacted to a larger extent by socio-cultural agents including media influences than Cypriot university students (N. Zeeni et al., 2013).

Traumatic life events are considered important risk factors for EDs. Childhood trauma, abuse (physical and sexual), loss of close relatives, experiencing war may lead to melancholy, nervousness and post-traumatic stress disorders which can aggravate the psychological wellbeing and lead to inadequate eating behavior in civilians. Prenatal and postnatal life stress due to unexpected death of close relative has been associated with an increased overall risk of EDs in adolescent girls and young women (Su et al., 2016). During war, disruption of food supply, unstructured meal plan, forced dieting along with many stressful events such as inhibition of daily life practices, witnessing serious injuries, familial shock due to death, lack of employment, damaged civil infrastructure and dislocation of many individuals all add up to increase the tendency of EDs to happen (Aoun et al., 2013).

Biological factors:

Attempts to understand the neurochemical basis of EDs are underway but yet too far to be fully unveiling the bio-molecular causes of these disorders. Dopamine activity in human brain is well known to play a key role in satiety, sexual activity and behavior in reward or reinforcement (Wise, 2006). Attempts have been taken to try to link deregulation in the dopaminergic system to eating behavior. It has been shown that affected dopamine reuptake is strongly linked to binge eating behavior in patients with EDs (Shinohara et al., 2004).

A dopamine transporter gene called DAT1 has VNTR polymorphism in 3' un-translated region. Some people have short allele polymorphism, some have long allele polymorphism. Binge eaters have been found to have significantly a higher frequency of short allele polymorphism than the control group (Shinohara et al., 2004). Previous advanced imaging studies have shown that short allele polymorphism is associated with lower transcriptional activity, therefore lower activity of dopamine transportation. This is a very important finding potentially linking disrupted dopamine reuptake to binge eating behavior in patients with EDs (Fairburn and Harrison, 2003; Shinohara et al., 2004). Patients with binge eating do not all have this polymorphism, and many people with short allele polymorphism in DAT1 gene do not have eating behavior problems, so this finding did not offer genetic testing as a diagnostic tool for EDs, but it surely did underline the role of dopaminergic deregulations in eating behavior, hence, showing that there is a role of genetics and molecular biology in the complex multifactorial etiology of EDs (Shinohara et al., 2004).

Psychological Factors:

EDs are closely related to psychological disorders. For example, bulimics are more likely to have anxiety disorder and substance abuse disorders such as alcohol; about 65-90% of patients with AN have at least one episode of major depression in their lifetime (Álvarez-Malé et al., 2015). Therefore, individuals with mental illnesses (depression, anxiety), together with environmental and genetic risk factors, are considered to be at increased risk of developing EDs (Álvarez-Malé et al., 2015; Casper, 1998; Tavolacci et al., 2015). Severe emotional stress, especially when accompanied with lack of good handling of this stress by the family, is a significant risk factor for developing EDs in adolescence and adulthood (Vajda and Láng, 2014). Emotional abuse addressed to children alone and/or accompanied with physical and/or sexual abuse during childhood are considered psychological traumas; inducing the feeling of helplessness and low self-esteem, which halts the emergence of psychopathology in adulthood to compensate this emotional gap and help the subject regain control of his/her own body image. Previous data showed a high prevalence of EDs in these subjects. Neglect was more associated with BED, and emotional abuse was more associated with avoidance and restrictive attitude of patients resulting more in AN than BN, especially when confronted with lack of good handling of this stress by the family (Vajda and Láng, 2014).

Perfectionism and Obsessive Compulsive Disorder (OCD) have each been closely linked to restrictive eating behavior (Bulik et al., 2003). A clear causative link was shown between perfectionist behavior and restrictive eating behavior, where nearly half of the "high-standards" group of perfectionists behave naturally by restricting high-calorie food, and the amount of food, whereas the "low-standards" group tend to have shyness in

eating and experience some “regret” feeling after eating (Shafran et al., 2006). Impulsiveness, on the other hand, has been highly linked to BED. The relationship between personality disorders and EDs is beyond being merely a risk factor, but rather a causative agent and hence treating personality disorders is an important preventive step against EDs (Sansone et al., 2004).

In many studies, females of normal height and weight for age reported that they like to be slimmer, with an overvaluation of the body weight and shape (Goldschmidt et al., 2010; Jones et al., 2001). A significant increase in the drive for thinness, body dissatisfaction, persistence to achieve drastic weight loss, purging, following unhealthy weight loss programs and skipping meals was found in young schoolgirls who were dieting compared to those who were not. These increases were even more remarkable in girls with higher BMIs (Jones et al., 2001). The perception of body image was also affected by the time trend, which caused the increase in incidence among the high risk groups, with a doubled incidence in 90’s as compared to 80’s (Joja et al., 2015). Body image and one’s diet habits are predicting factors for EDs development. Also, elevated correlation between adiposity, corporal satisfaction, the pressure to be thin and the depressive symptoms, creating a sequential process leading to the development of EDs (Andrea-Elena, 2015b).

Distorted body image in people opting to undergo cosmetic surgery, a psychological aspect partially influenced by mass media. Individuals with a cluster B personality disorder (narcissistic PD, histrionic PD and borderline PD) are dissatisfied with their bodies, seek cosmetic surgeries and therefore are at increased risk of developing EDs (Di Mattei et al., 2015). An association between improvement in patients’ own body image and satisfaction post liposuction surgery and a net decrease in their risk of developing

EDs was found in a Finnish study done on patients, at high risk of developing EDs, who underwent liposuction surgeries. Liposuction does indeed boost self-esteem and improve body image, and might "protect" against developing EDs, however, further investigations are needed to examine whether liposuction could ever "treat" or help decrease symptoms of patients already diagnosed with an ED. (Saariniemi et al., 2015). On the other hand, liposuction could predispose individuals to develop inappropriate eating behavior in order to maintain the post-operative shape and avoid later weight gain. This may increase the likelihood of developing EDs (Di Mattei et al., 2015; Saariniemi et al., 2015).

Dietary and lifestyle factors:

Studies have shown statistically significant positive correlations between BMI and the risk of EDs development. Overweight/obese teenagers and chronic dieters have higher risk of developing EDs than normal weight adolescents controlling for other factors such as low self-esteem, depression and anxiety (Álvarez-Malé et al., 2015; Sukariyah and Sidani, 2014). People may have wrong beliefs about food and diet such as: "extreme diets are efficient way to cut binge eating" and "considering food an addiction, in which specific toxic food triggers binge eating episodes". These individuals may wrongly interpret their EDs and consider it as a simple addictive food problem and not a serious disorder. Therefore, they think that binge eating is not a major problem to seek medical treatment (Wilson et al., 2009).

Exercise has been reported to have positive association with physical and mental wellbeing. Children and adolescents exercise routinely develop a positive self-body image and master self-development and therefore reduce their risk of developing EDs

(Penedo et al., 2005). Studies showed that regular exercise was practiced more by males than females, by those with high attraction towards exercise and those with fewer unhealthy dieting behaviors. Regular exercisers showed better psychological functioning, less social physique anxiety, better self-esteem and were far from developing EDs. Adolescents who exercise occasionally, scored higher on the shape and weight concern subscale and therefore had higher prevalence of developing EDs than adolescents who exercised regularly (Álvarez-Malé et al., 2015; Gomes et al., 2015). EDs are also encountered among athletes with excessive training. Studies among athletes aged between 18 and 26 years showed that 21.2% of male athletes and 14.5 % female athletes had EDs behaviors, with 2.04% and 5.52% of males and females respectively exhibiting compensatory behaviors on a weekly basis (Pope et al., 2015). However such practices may threaten their athletic performance through reducing physical strength, causing rapid fatigue, lack of concentration and mental focus and may even endanger their overall health since such practices may cause severe endocrine, cardiovascular, reproductive, central nervous systems, gastrointestinal and kidney problems and sometimes irreversible complications (Byrne and McLean 2001). The "thin ideal" society's obsession and the aesthetic ideally slim female body are factors that push female athletes to undergo unhealthy weight control practices to lose weight. On the other hand, male athletes struggle to reduce adiposity and increase lean body mass, influenced by the muscular shape of most attractive and fit society deems predisposes them to do unhealthy practices to look like them even if they are not convinced and conscious of its harmful effect on their endurance and overall sport performance (Beals and Manore, 2002). Competitive sports athletes also undergo perturbation in eating practices due to the

stress they face before their participation in any competition. As an example, weight-restricted sports, negative comments from coaches and teammates have a great impact on their eating behavior (Pope et al., 2015).

Dietary Patterns:

Dietary patterns are defined as the quantities, proportions, variety or combinations of different foods and beverages in diets, and the frequency with which they are habitually consumed. It can be characterized in three main ways; the first is through the use of a priori index that is based on a list of dietary recommendations for a healthy dietary pattern resulting from scientific consensus or proposed by investigators using an evidence based approach. The index/score is obtained by comparing and quantifying the individual's adherence to the standard food and/ or nutrient component of the index and then summed up over all components. Examples of dietary quality scores include: The Healthy Eating Index (HEI) - 2005 and 2010, The Alternate HEI (AHEI) and updated AHEI- 2010, The Recommended Food Score (RFS), The Dietary Approach to Stop Hypertension (DASH) score, The Mediterranean Diet Score (MDS), and the Alternate Mediterranean Diet Score (aMed).

The second way is through data –driven approaches, such as cluster analysis (that addresses the question : " Using the self- reported food and beverage intake data are there groups of people with distinct dietary patterns?") and factor analysis (that addresses the question : " Which components of the diet track together to explain variations in food or beverage intake across diet pasterns?"). These data driven approaches are outcome – independent; that is the relationships between the dietary patterns and intermediate or

longer- term health outcomes are examined once the patterns themselves are defined. Other data driven approaches are outcome – dependent, such as reduced rank regression (which addresses the question, "What combination of foods explains the most variation in one or more intermediate health markers?").

The third method examines individual's food and beverages intake preferences as they are commonly defined by foods included or eliminated. In cohort studies, this pattern are usually based upon qualitative self- reported behaviors rather than detailed questionnaires. Vegetarianism and its various forms (Ovo-lacto vegetarianism) are examples of this type of dietary pattern (Cespedes & Hu, 2015).

Associations between dietary patterns and several health outcomes have been examined thoroughly, but little research studied the association between dietary patterns and EDs (Fedoroff, 1996; Huse and Lucas, 1984). It was thought that patients with AN have similar dietary patterns characterized by calorie restriction, avoidance of fatty food and eating limited variety of foods (Affenito et al., 2002; Schebendach et al., 2008). AN patients eat chiefly fruits and vegetables, do not eat foods high in fat and drastically reduce carbohydrate intake. However, it was shown that the average daily source of energy was assumed to be 33% from carbohydrates, 49 % from fat and 18 % from proteins (Huse and Lucas, 1984). However, studies found that despite the generalization of calorie restriction, there is great variability in the diet patterns.

A study reviewed medical records of 96 patients diagnosed with AN, and for which diet history was taken (Huse and Lucas, 1984) showed that the mean caloric intake was 900 Kcal/day. Among participants, 25 patients ate high quality meals regularly but simply

restricted calories, 11 maintained a high quality diet but ate at irregular intervals and 6 had episodes of binge eating and vomiting or fasting. However, studies that rely on recall and interviews may not always be accurate, because patients with AN are known to be less honest about their eating behavior. Also in a more recent study, 55 females with EDs (cases) and 15 females without EDs (controls) reported their liking of and desire to eat 50 common foods. All cases rated their desire to eat high calorie foods/ high fat foods less than their desire to eat low calorie foods/low fat foods. Correlations between ratings of liking and desire to eat were shown to be more similar for all the food categories among the controls rather than cases (Fedoroff, 1996). A prospective cohort study compared the macronutrient intake of 14 and 140 female adolescents with and without history of AN respectively at three different times. Findings revealed that anorexic adolescents reported significantly lower total energy intake (less by ~ 20%) and fat intake during the first year of illness with higher protein intake as compared to healthy controls. This significant reduction in energy intake was already evident one year before the diagnosis of clinical AN (Affenito et al., 2002). In a case control study, the nutrient intake of 39 community anorexic resident girls was compared to that of 39 healthy adolescent girls through a four day food record. The anorexic group consumed significantly fewer calories from fat ($p < 0.0001$) and more calories from carbohydrates ($p = 0.0009$) and proteins ($p< 0.0001$) with higher dietary fiber intake than controls. No significant difference between the two groups in their dietary intakes of Calcium, Zinc and Iron was observed, but the total mineral intake was greater among AN group due to the supplement use. Also, the anorexic group had significantly higher intakes of vitamins A, D, K and most of B vitamins with many anorexic girls meeting the Dietary Reference Intake of vitamin D and

Calcium from supplements. The resting energy expenditure was significantly lower and the leisure activity levels were higher among girls with AN (Misra et al., 2006).

An evaluation of the association between individual and family eating pattern during childhood and the likelihood of developing EDs was performed among 261 patients with EDs. Eating excessive sweets and snacks and consuming food specially prepared for the respondents during childhood and early adolescence were found to be linked to development of EDs later in life. In contrast, regular breakfast consumption was found to be protective against EDs. Patients with EDs reported unfavorable eating patterns early in life, with importance given to food by the individual and the family increasing the likelihood for developing subsequent EDs. The family should be informed about the importance of structuring meal times with shared meals particularly breakfast and increasing the accessibility and promotion of healthy snacks. Maintaining structured family meals might encourage healthier diets in children and adolescents and could also allow the family to gain a better understanding of the child's food choices (Fernández-Aranda et al., 2007). In addition, another study included 4746 ethnically diverse adolescents showed that those who reported more frequent family meals, high priority for family meals with positive atmosphere at family meals and a more structured family meal environment were less likely to have disordered eating since family meals play an important role in the prevention of unhealthy weight control behaviors among youth (Neumark-Sztainer et al., 2004).

A study evaluated temporal patterns of food selection during binges in obese subjects with BED and whether it differs from obese patients with BN. While being recorded via a camera, 10 women with BED and 10 others without BED were instructed to binge on a

multiple item meal. Individuals with BED consumed significantly more meat than those without BED, but the food choices and time spent eating each of the foods were similar among subjects with BED and without BED and normal weight controls. Whereas, bulimics ate dessert foods earlier in the meals while non-bulimics ate meat at the beginning of their meals and kept the dessert foods till the end. The study concluded that food selection patterns during binges in subjects with BED are more similar to eating patterns of subjects without EDs than to patterns seen among patients with BN (Cooke et al., 1997). Patterns of food selection were also described in another study that compared bulimic and non-bulimic patients' eating behavior. Findings supported the previous ones, that during a binge meal, bulimics spent more time eating dessert and snacks than did non bulimics, cases distributed their meat consumption more evenly across the meal whereas controls ate meat predominantly early in the meals. Therefore, the eating disturbances in bulimic patients are not confined only to episodes of binge eating (Hadigan et al., 1989) .

Conclusion of the Literature Review

EDs are associated with multiple factors. Its onset, prognosis, regression and treatment vary from an individual to another. The prevalence of EDs is increasing in the middle-eastern courtiers, resulting in the need for more research studies to identify the underlying causes and therefore better prevent their development. Adolescents and young adult women are considered at high risk population. A screening tool was developed, SCOFF questionnaire, simple, and memorable in order to screen high risk population in a primary care unit since other tools were time consuming and specific for inpatients. Many risk factors influence adolescents leading to deterioration in eating practices. Not only genetic predisposition, but also general socio-demographic factors such as age, gender, and

educational level showed that young females with low educational level are prone to develop EDs more than males, and females with high educational background. Other factors include nutritional issues and false beliefs related to food, over valuation of shape and body weight, with a significant relation between high body mass index (BMI) and BED. Lifestyle of adolescents can be highly influenced by media marketing for the thin ideal body image pushing them to practice unhealthy eating behaviors which may be too extreme such as purging, vigorous exercise, calorie restriction even if that was on the count of their health, tempting to mimic the artistic body of models, or even seeking plastic surgeries to achieve this goal. Stressful life events and environmental factors affect significantly the attitudes, when stress, war experience, lack of social support along with psychological disorders including depression, perfectionism and obsessive compulsive disorder aggravate the distorted body image and the likelihood to develop EDs. No research studies examined the association between dietary patterns, as a risk factor, and EDs among university students.

III. RATIONAL

These findings lead us to an important question: Could certain dietary patterns adopted by the Lebanese population play a role in prevention of EDs or attenuation of EDs symptoms? Examining this association is worthy because of the huge burden of EDs, therefore changing dietary habits or patterns, found to associate with increased risk for EDs, can be a cost-effective stand-alone/complementary intervention against EDs and is a measure that can be easily implemented with adequate professional supervision and support from family. Some studies done is Lebanon assessed the associations of different dietary patterns identified and health outcomes such as, BMI, WC, metabolic syndrome,

obesity… but they fail to address the associations of dietary patterns adopted in the Lebanese population and risk of EDs. Our study is the first, to our knowledge, in Lebanon that aims to assess the link between identified dietary patterns and risk of EDs among a sample of Notre Dame University (NDU) students.

IV. STUDY OBJECTIVES

Research Questions:

What proportion of Notre Dame University (NDU) students are at high risk of EDs? What dietary patterns identified among NDU students prevent against EDs/predispose to developing EDs?

Objectives:

1. Determine the proportion of students at high risk of EDs development among NDU students
2. Examine the associations between socio-demographic, lifestyle factors, and stressful life events and risk of EDs among NDU students
3. Identify the different dietary patterns among a sample of NDU students
4. Examine the association between risk of EDs and each of the identified dietary patterns, independent of effects of confounding variables among the sample of NDU students

V. METHODS

Study design and recruitment methods

The study is a cross-sectional survey that was conducted among NDU undergraduate students. Subjects were recruited by targeting GER courses. GER courses include a relatively random sample of students from each of NDU's faculties. After obtaining the approval of the concerned dean, the chairperson and instructors of each course, researchers visited the classrooms, as per date and time set by the course instructor, to recruit subjects and perform data collection.

Data collection

During class visit (about 50 minutes), researchers briefly informed students about the study objectives and procedure, and obtained consent of students who wanted to participate. Researchers were present to answer any questions students have had about the study or the consent form. Data collection entailed completion of four questionnaires (Food Frequency Questionnaire (FFQ), Background questionnaire, SCOFF questionnaire (original English version) and the International Physical Activity Questionnaire (IPAQ) - Short Form. Trained dietitians assisted participating students in completing the Food Frequency Questionnaire (FFQ). The remaining three questionnaires were given to students for completion at home and then submission to the research staff within a period of two weeks in a sealed envelope. Students were asked to come in person to the nutrition research laboratory (FNHS, HA318, third floor, pink building), on Mondays and Wednesdays from 12 to 1 pm, or Tuesdays and Thursdays from 12:30 to 1:30 pm, for

weight and height, waist circumference, body composition and blood pressure measurements (3 measurements in 10-minute interval each).

Collection of data took place during a 2-month interval. Data was collected in an anonymous manner (Example: no names, student identification number (ID), or any other personal identifier were requested) to avoid participants' attempt to hide sensitive information. All data forms were maintained in a locked cabinet in the nutrition research laboratory, and access was strictly limited to study investigators. Likewise, computerized data was stored on a password protected computer in a locked office of the research team.

Assessment of Study variables

Dietary Patterns

Dietary patterns were identified through administering the semi-quantitative FFQ. The FFQ employed was comprised of 74 items pooled into 9 groups. For each food item listed on the FFQ, participants were asked to mark their frequency of intake of a designated serving/ portion size in days, weeks, months or rarely/never during the past year. The FFQ included Lebanese items, composite dishes (e.g. Chawarma, Falafel, Labneh…), full-fat/low-fat dairy products and regular/diet beverages. The FFQ-74 was adjusted and modified similarly to the one used and developed at the American University of Beirut and had been deployed in multiple pertinent studies including one that targeted a nationally representative sample of Lebanese adults (Naja et al., 2013; Naja et al., 2011).

Dietary Intake

Estimates of macro/micro-nutrient intake and energy intake of each participant were generated using the Nutritionist Pro-Diet Analysis software developed by Axxya systems. Lebanese dishes and recipes were composed and entered using this software according to food composition tables for use in the Middle East by Pellet and Shadarevian (Pellet and Shadarevian, 2013).

Socio-Demographic and Lifestyle Factors

The Background questionnaire included questions on socio-demographics, lifestyle characteristics and stressful life events as well as questions that determine eligibility of a participant. (i) socio-demographic: Age? Do you currently have a job in addition to your studies? Where are you staying at present time? (ii) Lifestyle factors: How many meals do you have per day? Do you drink alcohol? How often do you have your meals while watching TV during a week? (iii) Stressful life events: Have you had experienced any of the following stressful life events during the past year? This questionnaire also included questions on anthropometric and blood pressure (BP) measurements. Researchers also measured body weight, height, waist circumference (WC) and BP of all participants. Body weight was measured to the nearest 0.1 kg using an electronic portable scale with subjects dressed in minimal clothing and without shoes; Height was measured to the nearest 0.1 cm using a portable stadiometer according to the following protocol: no shoes and heels with the head touching the ruler with line aligned horizontally. BMI was calculated as: Weight (kg)/ Height (m^2). BMI categories were classified as (1)

underweight (UNDWT): BMI <18.5 kg/m^2, (2) normal weight (NW): 18.5 kg/m^2 <BMI<24.9 kg/m^2, (3) OVWT: 25.0 kg/m^2 <BMI< 29.9 kg/m^2, and (4) obese (OB): BMI≥ 30.0 kg/m^2 (WHO, 2004). Blood pressure protocol: Patient was seated comfortably, with back supported, legs uncrossed, and upper arm bared. Patient's arm was supported at heart level. Cuff bladder encircled 80 percent or more of the patient's arm circumference. Mercury column was deflated at 2 to3 mm per second. The first and last audible sounds were recorded as systolic and diastolic pressure, respectively. Measurements were given to the nearest 2 mm Hg. Neither the patient nor the person taking the measurement was allowed to talk during the procedure (AHA, 2005). Blood pressure in adults was classified according to the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC7) as: (1) normal: systolic blood pressure (SBP) < 120 mmHg and diastolic blood pressure (DBP) < 80 mmHg, (2) pre-hypertension (pre-HTN): SBP between 120–139 mmHg and/or DBP between 80–89 mmHg, (3) stage 1 hypertension (HTN): SBP between 140-159 mmHg and/or DBP between 90-99 mmHg, (4) stage 2 HTN: ≥ 160 SBP and/or ≥ 100 DBP mmHg) (JNC7, 2003). WC values were classified according to the National Heart, Lung, and Blood Institute Guidelines, whereby a WC > 102 cm in men, or > 88 cm in women, is considered an indicator of increased cardio-metabolic disease risk (CDC, 2007).

Physical Activity Levels

The International Physical Activity Questionnaire (IPAQ) - Short Form, a 7-item self-administered questionnaire, tested for use in assessing physical activity (PA) among adults, was used to assess PA level of our study participants. IPAQ asks about three

specific types of activity: walking, moderate and vigorous physical activities and time spent by an individual (Booth, 2000). The items were structured to provide separate scores on each of these activities. Using the following values, Walking = 3.3 METs, Moderate PA = 4.0 METs and Vigorous PA = 8.0 METs (*Med Sci Sports Med* 2000), four continuous scores were calculated:

- Walking MET-minutes/week = 3.3 * walking minutes * walking days
- Moderate MET-minutes/week = 4.0 * moderate-intensity activity minutes * moderate-intensity days
- Vigorous MET-minutes/week = 8.0 * vigorous-intensity activity minutes * vigorous-intensity days
- Total physical activity MET-minutes/week = sum of Walking + Moderate + Vigorous MET-minutes/ week scores

Low-level, moderate-level and high-level PA were defined by scores of less than 600 MET-minutes per week, between 600 to less than 3000 MET-minutes per week, and of 3000 or more MET-minutes per week, respectively.

Risk for developing EDs

The *Sick, Control, One stone, Fat, Food* (SCOFF) questionnaire, a valid and reliable screening tool, in its British, Catalan, Finnish, French, Italian, Spanish and American versions with the first Arabic version validated on March 2015 (Aoun et al., 2015), was used to identify subjects at high risk of developing EDS in our study sample. The sensitivity and specificity of the SCOFF questionnaire in it Arabic version were found to be 80.0% and 72.7% respectively (Morgan et al., 1999; Aoun et al., 2015). SCOFF is a

simple self-administered questionnaire consisting of five questions: 1) Do you make yourself **S**ick because you feel uncomfortably full? 2) Do you worry that you have lost **C**ontrol over how much you eat? 3) Have you recently lost more than **O**ne stone (6.5kg) in a 3-month period? 4) Do you believe yourself to be **F**at when others say you are too thin? 5) Would you say that **F**ood dominates your life? A Yes answer is equivalent to 1 point with a total of two or more points indicating the subject to be at high risk of developing EDs (Morgan et al., 1999).

Pilot testing

The questionnaires were pre-tested during the month of May 2015. The draft questionnaires were tried out on a random sample of 45 NDU students (~ 14% of the calculated sample size) that is similar in makeup to the one that ultimately was sampled (i.e., from the targeted GER courses in our study). Pilot testing was performed to measure how much time it takes to complete each questionnaire, analyze the information provided to clarify directions, question wording, or response categories where necessary and then revise as needed. Revision and corrections were done before launching of the study. This sample was not included in data analyses.

VI. SAMPLE SIZE AND STATISTICAL ANALYSES

Using the "Raosoft online sample size calculator", and assuming that the margin of error is equal to 0.05; type I error (α) =0.05, power = 80%, population size at NDU main campus is around 7000 students, the sample size was calculated and found to be 365 subjects.

All filled-out questionnaires were reviewed for completion immediately after collecting them from the students. Data were entered, and checked to ensure that errors in the data file are corrected. Quantitative and qualitative measurements were summarized as mean ± standard deviation//Median (Interquartile range) and n (%), respectively. Comparisons of continuous and categorical variables were performed using independent two-sample T Test/ Mann-Whitney-U-test/Analysis of variance and the chi square test /Fisher's exact test, respectively.

In order to identify dietary patterns, exploratory factor analysis based on the inter-correlation among the FFQ food items was used. As a first step, a spherical representation of the correlation matrix was plotted to visualize any apparent correlation of the 61 items, then a scree plot was generated in order to estimate possible number of factors. An exploratory factor analysis with varimax rotation was performed. The number of factors retained (five) was based on: (i) plotted Eigen values and their corresponding inflection points in the scree plot and (ii) interpretability of factors. The derived patterns were labeled on the basis of food groups having a rotated factor loading larger than 0.4. Factor scores were produced by calculating the weighted average of the items comprising each factor/pattern, using factor loadings as weight. A pair wise correlation matrix was then produced to test the correlation among the factor scores of the five emerging patterns.

To study the association between dietary patterns and nutrient intake, Spearman's correlation coefficients were calculated between the factor scores of each of the identified dietary patterns and energy-adjusted nutrient intakes. The adjustment of the nutrient intakes was performed by multiplying the dietary intake of the nutrient by 1000 kilocalories and then dividing it over the total energy intake of each student. Multiple

linear regression analysis was used to assess the associations of the identified dietary patterns, with factor scores of each as the dependent variable and socio-demographic and lifestyle factors and stressful life event as independent variables. The associations between increased risk of developing EDs (independent variable) and dietary patterns (dependent variable) were evaluated using multivariate linear regression analyses adjusted for the common confounders (gender, BMI, chronic morbidity, depression status and physical activity level) for each of the five dietary patterns in addition to other specific confounders for each dietary pattern ("Traditional Lebanese diet": frequency of breakfast, smoking habits and number of meals/day; " Western Fast Food": number of snacks/day and frequency of breakfast; " Dairy": smoking habits, hypertension status and alcohol drinking; "Lebanese Fast Food": frequency of meals while watching TV and for the "Fruits": number of meals/ day and smoking habits) were forced into the model. The other covariates that were found to be associated with high risk of developing EDs in bivariate analyses ($P<0.05$) were entered using the stepwise method. Normality of the variables was assessed and transformations were performed when needed.

The correlation between each of the independent variables included in the regression models and tolerance/VIF values were examined to pick up problems with multi-collinearity (Tolerance < 0.1, VIF > 10). Normality of the residuals was assessed by inspecting the normal probability plot of the regression standardized residual and the residuals scatter plot. Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS) version 22 for Windows. A p-value less than 0.05 were considered statistically significant.

VII. Results

Sample characteristics

The sample consisted of 457 NDU undergraduate students (62.8% males and 37.2% females) with a mean age of 21.28 ± 1.91 years. The majority of the study participants reported to be single (~ 99%), live with parents (~ 82%), unemployed (~ 62%), not physically disabled (~ 98%), senior students (~45%) and belong to the business administration and economics faculty (~ 29%) with a trend to follow a dairy based dietary pattern. With regard to disease risk, a substantial percentage of the surveyed participants were found to have no risk factors for diseases, normal BMI (~ 55%); normal waist circumference (~ 91%); moderate to high physical activity levels (~77%); non-smokers (~ 60%); occasional alcohol drinkers (~ 47%); often consume 3 meals and 2 snacks per day (~ 49% and ~ 47%) respectively; have breakfast daily (~ 46%); follow special diet (~ 85%); not taking dietary supplementation (~ 83%), with about (~ 67%) not being at risk of EDs and (~ 89%), more than the two thirds having healthy eating behaviors in the past 3 months (~ 87%) and having no chronic morbidity at all (88.9%). However, about (~24.1%) of the students had moderate to severe symptoms of depression (PHQ-9 score ≥10) (Table 1).

Dietary patterns analysis

Principal component analysis revealed five different dietary patterns, which together explained 50.0% of the variance in dietary intake. Factor loadings of the five patterns are shown in Table 2. The patterns were named according to the food groups loading highest on the respective dietary pattern. Therefore, the patterns obtained were classified as

follows: (I) the 'Traditional Lebanese' pattern, which was positively associated with Lebanese traditional/typical food such as bulgur, wheat, low fat dairy products like cheeses and Labneh, fruits mainly bananas and apples, vegetables like celery, spinach and tomatoes, legumes, broccoli, potatoes, proteins, eggs and olive oil; (II) the 'Western Fast food' pattern was positively associated with sweetened fruit drinks, energy drinks, mayonnaise, cake, cookies, donuts, ice cream, chocolate, burgers, pizza, Manaeesh and French fries; (III) the 'Dairy' pattern was associated with bread, rice, whole-fat dairy products and ice cream; (IV) the 'Lebanese fast food' pattern was associated with Lebanese foods that are mainly high in fat/junk such as nuts and seeds, organ meats, sausages and Makanek, Falafel and Chawarma sandwiches; (V) the 'Fruits' pattern was only associated with fruits, dried fruits and fresh juices.

The associations of the factor scores of various dietary patterns with energy and energy-adjusted nutrient intakes were described in Table 3. Scores of the "Traditional Lebanese diet" pattern had the strongest positive significant associations with energy (r = 0.56), protein (r = 0.27), total fat (r = 0.20), cholesterol (r = 0.19), Trans fat (r = 0.11), MUFA (Monounsaturated Fatty Acids) (r = 0.20), PUFA (Polyunsaturated Fatty Acids) (r = 0.26) and total fiber (r = 0.18) and significantly negatively correlated with carbohydrates (r = -0.27), alcohol (r = -0.10) and caffeine (r = -0.27). Scores of the "Western fast food" pattern had the strongest positive significant associations with energy (r = 0.69), total fat (r = 0.22), saturated fat (r = 0.42) and MUFA (r = 0.15) and significantly negatively correlated with protein (r = -0.33) and total fiber (r = -0.37). Scores of the "Dairy" pattern had the strongest positive significant associations with energy (r = 0.53), carbohydrates (r = 0.24), total fat (r =0.20) and saturated fat (r = 0.33) and significantly negatively

correlated with total fiber (r = -0.28) and caffeine (r = -0.11). Scores of the "Lebanese fast food" pattern had the strongest positive significant associations with energy (r = 0.68), total fat (r = 0.52), saturated fat (r = 0.09), Trans fat (r = 0.0.18), MUFA (r = 0.49) and PUFA (r = 0.63) and significantly negatively correlated with protein (r = -0.16), carbohydrates (r = -0.40), total fiber (r = -0.14) and caffeine (r = -0.10). Scores of the "Fruits" pattern had the strongest positive significant associations with energy (r = 0.30), carbohydrates (r = 0.17) and total fiber (r = 0.36) and significantly negatively correlated with total fat (r = -0.17), saturated fat (r = -0.21) and caffeine (r = - 0.14).

Associations of socio-demographic, anthropometric and lifestyle characteristics with risk of EDs (SCOFF+, SCOFF-)

The risk of having EDs was found to be significantly associated with: Female gender (40.0%, p = 0.012), being overweight (40.6%) and obese (48.9%, p = 0.000), risky waist circumference (48.7%, p = 0.038), risky waist to height ratio (43.9%, p = 0.000), higher body fat composition (SCOFF +: 26.27 ± 10.35, p = 0.004), meals often consumed while watching TV (36.7%, p = 0.036), having unhealthy eating behavior in the past 3 months (48.2%, p = 0.008), low (38.5%) or high (36.6%, p = 0.040) physical activity level, presence of chronic morbidity (46.0%, p = 0.046), depression status (41.9%, p = 0.014) and family history of depression or mental illness (51.7%, p = 0.037). Adopting more a "Lebanese Fast Food" pattern, was shown to be significantly protective against the risk of EDs (SCOFF-: 0.39 ± 0.38, p = 0.049). No significant associations were found between the risk of EDs and other socio-demographic and lifestyle characteristics (Table 4).

Associations between risk of EDs (SCOFF+, SCOFF-) with energy, adjusted nutrient and amino acids dietary intakes

The risk of having EDs was found to be significantly associated with lower energy intake (4172.53 ± 2088.88 Kcal, p = 0.04) and higher dietary intake of : total fiber (9.12 ± 3.08 g, p = 0.015), Caffeine (17.60 ± 19.75 mg, p = 0.037), Potassium (1424.02 ± 346.45 mg, p= 0.000), Magnesium (151.52 ± 40.97 mg, p = 0.007), Copper (0.67 ± 0.15 mg, p= 0.026), Fluoride (1259.30 ±1717.67 mcg, p = 0.036), Phosphorous (649.06 ± 120.52 mg, p = 0.044), Vitamin C (52.90 ± 33.05 mg, p = 0.043), Pantothenic Acid (B5) (1.95 ± 0.56 mg, p = 0.008), Pyridoxine (B6) (0.87 ± 0.29 mg, p = 0.011) and Biotin (B7) (11.09 ± 5.07 mcg, p= 0.046). No significant associations were found with other dietary intake of macro/ micro nutrients and amino acids (Table 5).

Multivariate linear regression analyses were applied for the five dietary patterns identified and the risk of EDs. A different association than the one detected before with the "Lebanese Fast Food" pattern was observed. Significant association was found between the risk of EDs and the scores of the Log "Dairy" pattern when controlling for these variables: the gender, BMI, chronic morbidity, depression status, physical activity level, smoking habits, hypertension status and alcohol drinking. A student at risk of EDs has a 0.111 lower score from the "Dairy" pattern than student not at risk of EDs (Table 6).

Table 1: Sample Characteristics (Socio-demographic, Anthropometric, Lifestyle factors) and Risk of EDs in the study population

	Total (n=457) Mean ± SD Or n (%)		**Total (n=457) Mean ± SD Or n (%)**
Age (years)	21.28 ± 1.91	**Meals while watching TV/ week**	
Gender		Often	131 (28.8)
Male	287 (62.8)	Occasionally	156 (34.3)
Female	170 (37.2)	Rarely	168 (36.9)
Residence		**Snacks/day**	
With parents	374 (82.2)	1	125 (27.7)
In dormitories	39 (8.6)	2	210 (46.6)
Own apartment	31 (6.8)	3	83 (18.4)
Others	11 (2.4)	4 or more	33 (7.3)
Marital status		**Following special diet**	
Single	448 (99.3)	No	70 (15.4)
Married	2 (0.5)	Yes	385 (84.6)
Divorced	1 (0.2)	**Intake of dietary supplement**	
Employment		Yes	79 (17.4)
No	284 (62.4)	No	376 (82.6)
Part time	127 (27.9)	**Unhealthy eating behaviors past 3 months**	
Full time	44 (9.7)	Yes	57 (12.7)
Class		No	392 (87.3)
Sophomore	102 (23.4)	**Smoking**	
Junior	136 (31.2)	Non Smoker	272 (59.9)
Senior	198 (45.4)	Previous Smoker	31 (6.8)
Faculty		Current Smoker	151 (33.3)
FAAD	85 (18.9)	**Alcohol drinking**	
FBAE	132 (29.4)	Occasionally	212 (47.1)
FE	126 (28.1)	1-2 drinks/week	195 (43.3)
FH	45 (10.0)	1-2 drinks/day	25 (5.6)
FLPS	10 (2.2)	>2 drinks/day	18 (4.0)
FNAS	35 (7.8)	**Physical activity level**	
FNHS	16 (3.6)	Low	79 (23.2)
BMI		Moderate	138 (40.6)
Underweight	26 (5.7)	High	123 (36.2)
Normal	252 (55.3)	**Severity of depressive symptoms**	
Overweight	129 (28.3)	None	143 (36.3)
Obese	49 (10.7)	Mild	156 (39.6)
WC		Moderate	68 (17.3)
Normal	412 (91.2)	Moderately severe	17 (4.3)
Risky	40 (8.8)	Severe	10 (2.5)
Meals /day		**Physical disability**	
1 meal	7 (1.5)	Yes	7 (1.5)
2 meals	114 (25)	No	447 (97.8)

3 meals	223 (48.9)	**Chronic morbidity**	
4 or more meals	112 (24.6)	Yes	50 (11.1)
Frequency of meals		No	399 (88.9)
Often	322 (71.6)	**Risk Of EDs**	
Occasionally	121 (26.9)	At Risk (SCOFF +)	146 (32.4)
Rarely	7 (1.6)	Not at Risk (SCOFF-)	304 (66.5)
Breakfast consumption		**Dietary pattern**	
Daily	208 (45.5)	Traditional Lebanese	0.60 ± 0.44
Occasionally	153 (33.5)	Western Fast Food	0.39 ± 0.37
Rarely	96 (21.0)	Dairy	0.68 ± 0.72
		Lebanese Fast Food	0.38 ±0.37
		Fruits	0.35 ± 0.41

FAAD: Faculty of Architecture Art and Design
FBAE: Faculty of Business Administration and Economics
FE: Faculty of Engineering
FH: Faculty of Humanities
FLPS: Faculty of Law and Political Science
FNAS: Faculty of Natural and Applied Sciences
FNHS: Faculty of Nursing and Health Sciences
BMI: Body mass Index
WC: Waist circumference

Table 2: Factor loading matrix for the five dietary patterns identified in the study population

Food items	Traditional Lebanese	Western fast food	Dairy	Lebanese fast food	Fruits
Eggs, whole, large	0.54				
Legumes: lentils, broad beans, chickpeas, etc., cooked	0.54				
Cauliflower/ Cabbage/ broccoli	0.54				
Others: Banana (medium)/ Apple, fresh (small)	0.52				0.42
Dark green or deep yellow vegetables (ex. spinach, Hindbeh, carrots , …)	0.51				
Poultry (3 oz = ½ chicken breast)	0.50				
Red Meat (3 oz = meat burger size)	0.49				
Fish, (including Tuna)	0.48				
Cheese, low fat, white	0.48				
Salad – green: lettuce, celery, green peppers, cucumber	0.46				
Wheat, whole, cooked / Bulgur	0.42				
Potato, baked / boiled / mashed	0.39				
Tomatoes, fresh, medium	0.39				
Squash, summer (Kussa), Eggplant /cooked	0.34				
Labneh, low fat	0.34				
Cheese, low fat, yellow	0.32		0.53		
Oil: corn / sunflower / soy/olive	0.32			0.31	
Fruit drinks: canned/ bottled , sugar – sweetened		0.64			
Burgers (Beef, chicken, fish)		0.62			
Energy drinks, sports drinks, regular		0.57			
French fries		0.56			
Hot chocolate or cocoa, with sugar		0.55			
Chocolate bar		0.54			
Mayonnaise		0.54			
Manaeesh, Zaatar, cheese		0.45			
Cake, cookies , donuts, muffin, croissant		0.40			
Pizza		0.35		0.32	
Ice cream		0.34	0.32		
Cheese, regular, yellow			0.64		
Labneh, regular			0.63		
Whole fat yogurt			0.63		
Cheese, regular, white			0.61		
Rice, white, cooked			0.32		
White bread			0.31		
Sausages, makanek, hot dogs				0.50	
Falafel sandwich, medium				0.46	
Organ Meats (liver, kidneys, brain)				0.45	
Chawarma sandwich, medium				0.44	
Nuts & seeds (peanuts, almonds, sunflower seeds, etc.), roasted				0.36	

Citrus Orange (1 item) / Grapefruit (1/2 item)					0.57
Deep Yellow or Orange (1 small peach, 2 plums, etc.)					0.51
Strawberry (12)					0.50
Grapes (15)					0.47
Dried fruits: raisins (2 Tablespoon), dates (2), apricots (4)					0.45
Fresh fruit juice					0.41

**Total variance explained by the 5 factors 0.50*
**Absolute values <0.3 were excluded from the table*

Table 3: Spearman's correlation coefficients of dietary pattern scores with total energy and adjusted nutrient intakes per 1000 Kcal in the study population

	Dietary Patterns				
Nutrient intake	**Traditional Lebanese diet**	**Western Fast Food**	**Dairy**	**Lebanese Fast food**	**Fruits**
Energy (Kcal)	0.559**	0.692**	0.525**	0.684**	0.301**
Protein (g)	0.273**	-0.334**	0.026	-0.163**	0.052
Carbohydrate (g)	-0.273**	-0.067	0.234**	-0.395**	0.169**
Total Fat (g)	0.197**	0.218**	0.202**	0.525**	-0.172**
Cholesterol (mg)	0.187**	-0.017	0.043	0.057	0.009
Saturated Fat (g)	-0.036	0.424**	0.334**	0.094*	-0.210**
Trans Fat (g)	0.107*	0.067	0.041	0.182**	-0.230
MUFA (g)	0.199**	0.153**	-0.034	0.486**	-0.037
PUFA (g)	0.257**	0.064	-0.040	0.633**	-0.091
Total Fiber (g)	0.177**	-0.374**	-0.277**	-0.138**	0.356**
Alcohol (g)	-0.100*	0.048	-0.010	0.000	-0.015
Caffeine (mg)	-0.271**	0.011	-0.109*	-0.103*	-0.137**

MUFA: Monounsaturated Fatty Acid; PUFA: Polyunsaturated Fatty Acid
*Correlation significant: * ($p \leq 0.05$) and ** ($p \leq 0.001$)*
Variables were log transformed
Adjustment for energy was carried out as nutrient intake per 1000 kcal/day for all nutrients

Table 4: Associations of socio-demographic, anthropometric, lifestyle characteristics and stressful life events with risk of EDs in the study population

	Mean ± SD Or n (%)		
	At Risk (SCOFF +)	**Not at Risk (SCOFF -)**	**P-value**
Age	21.05 ±1.76	21.40 ±1.98	0.131
Gender			
Male	80 (28.1)	205 (71.9)	**0.012**
Female	66 (40.0)	99 (60.0)	
Employment			
No	95 (34.1)	184 (65.9)	0.486
Part time	40 (32.0)	85 (68.0)	
Full time	11 (25.0)	33 (75.0)	
Place of living			
With parents	121 (32.9)	247 (67.1)	0.880
Without parents	25 (31.2)	55 (68.8)	
Do you have children			
No	144 (32.4)	301(67.6)	0.106
Yes	2 (100.0)	0 (0.0)	
Cumulative GPA	2.77 ± 0.49	2.74 ± 0.50	0.603
Faculty			
FAAD	27 (32.9)	55(67.1)	0.220
FBAE	53 (40.8)	77 (59.2)	
FE	36 (28.8)	89 (71.2)	
FH	15 (33.3)	30 (67.7)	
FLPS	1 (11.1)	8 (88.9)	
FNAS	4 (11.4)	31 (88.6)	
FNHS	7 (43.8)	9 (56.3)	
Class			
Sophomore	32 (32.0)	68 (68.0)	0.663
Junior	40 (29.6)	95 (70.4)	
Senior	67 (34.4)	128 (65.6)	
BMI			
Underweight	1 (4.0)	24 (96.0)	**0.000**
Normal	70 (28.1)	179 (71.9)	
Overweight	52 (40.6)	76 (59.4)	
Obese	23 (48.9)	24 (51.1)	
WC Risky			
Yes	19 (48.7)	20 (51.3)	**0.038**
No	126 (31.0)	280 (69.0)	
WHT ratio			
Normal	73 (26.1)	207 (73.9)	**0.000**
Risky	72 (43.9)	92 (46.9)	
Body Fat composition (%)	26.27 ± 10.35	19.59 ± 8.76	**0.004**
Number of Meals/day			
≥3 meals /day	115 (35.0)	214 (65.0)	0.087
<3 meals /day	31 (25.8)	89 (74.2)	
Frequency of meals			
Often	105 (33.0)	213 (67.0)	0.799

Occasionally + rarely	39 (31.2)	86 (68.8)	
Frequency of breakfast			
Daily	71 (34.6)	134 (65.4)	0.412
Occasionally	50 (32.9)	102 (67.1)	
Rarely	25 (26.9)	68 (73.1)	
Meals while watching TV/week			
Often	47 (36.7)	81 (63.3)	**0.036**
Occasionally	38 (24.5)	117 (75.5)	
Rarely	60 (36.4)	105 (63.6)	
Number of snacks/day			
1	30 (24.4)	93 (75.6)	0.122
2	69 (33.5)	137 (66.5)	
3	33 (39.8)	50 (60.2)	
≥4	11 (33.3)	22 (66.7)	
Special diet			
No	115 (30.3)	264 (69.7)	0.076
Yes	29 (42.0)	40 (58.0)	
Are you athlete following special diet			
No	122 (31.4)	266 (68.6)	0.274
Yes	23 (39.7)	35 (60.3)	
Unhealthy eating behavior past 3 month			
No	114 (29.5)	272 (70.5)	**0.008**
Yes	27 (48.2)	29 (51.8)	
Dietary Patterns			
Traditional Lebanese diet	0.59 ± 0.37	0.60 ± 0.47	0.774
Western Fast Food	0.37 ± 0.32	0.40 ± 0.39	0.271
Dairy	0.56 ± 0.43	0.73 ± 0.82	0.059
Lebanese Fast Food	0.35 ± 0.37	0.39 ± 0.38	**0.049**
Fruits	0.41 ± 0.50	0.33 ± 0.35	0.069
Smoking habits			
Non- smoker	91 (34.0)	177 (66.0)	0.131
Previous smoker	14 (45.2)	17 (54.8)	
Current smoker	41 (27.7)	107 (72.3)	
Alcohol drinking			
Occasionally	66 (31.9)	141 (68.1)	0.721
1-2 drinks/week	66 (34.0)	128 (66.0)	
≥1 drink/day	12 (27.9)	31 (72.1)	
Physical activity level			
Low	30 (38.5)	48 (61.5)	**0.040**
Moderate	33 (24.3)	103 (75.5)	
High	45 (36.6)	78 (63.4)	
Physical disability			
No	145 (33.0)	295 (67.0)	0.435
Yes	1 (14.3)	6 (85.7)	
Chronic morbidity			
Yes	23 (46.0)	27 (54.0)	**0.046**
No	123 (30.8)	276 (69.2)	
Taking medication			
No	132 (32.0)	281 (68.0)	0.734

Yes	9 (37.5)	15 (62.5)	
Dietary supplementation			
No	116 (31.4)	253 (68.6)	0.576
Yes	28 (35.4)	51 (64.6)	
Number of stressful life events			
0	72 (31.7)	155 (68.3)	0.384
1	33 (28.2)	84 (71.8)	
≥2	38 (36.9)	65 (63.9)	
Family history of depression or mental illness			
No	131 (31.1)	290 (68.9)	**0.037**
Yes	15 (51.7)	14 (48.3)	
Depression status			
No Depression	82 (27.7)	214 (72.3)	**0.014**
Depression	39 (41.9)	54 (58.1)	
Mental illness other than depression			
No	135 (31.8)	290 (68.2)	0.347
Yes	10 (43.5)	13 (56.5)	

GPA: *Grade point average*
FAAD: Faculty of Architecture Art and Design
FBAE: Faculty of Business Administration and Economics
FE: Faculty of Engineering
FH: Faculty of Humanities
FLPS: Faculty of Law and Political Science
FNAS: Faculty of Natural and Applied Sciences
FNHS: Faculty of Nursing and Health Sciences
BMI: Body mass Index
WC: Waist circumference
WHT: Waist to Height Ratio

Table 5: Associations between risk of EDs (SCOFF+ and -) and energy, adjusted nutrient and amino acids intake in the study population

	Mean ± SD		
Nutrient Intake	**SCOFF+**	**SCOFF-**	**P-value**
Energy (kcal)	4172.53 ± 2088.88	4860.11 ± 2880.71	**0.040**
Protein (g)	41.15 ± 9.84	41.14 ± 10.78	0.667
Carbohydrate (g)	103.71 ± 19.53	102.60 ± 21.96	0.603
Total Fat (g)	46.67 ± 8.05	47.36 ± 8.70	0.425
Cholesterol (mg)	170.74 ± 232.44	186.08 ± 225.64	0.215
Saturated Fat (g)	14.54 ± 3.00	14.65 ± 3.39	0.889
Trans Fat (g)	0.40 ± 0.57	0.40 ± 0.71	0.985
MUFA (g)	15.78 ± 4.44	16.10 ±4.70	0.367
PUFA (g)	8.81 ± 3.67	8.71 ± 3.52	0.999
Total Fiber (g)	9.12 ± 3.08	8.64 ± 3.45	**0.015**
Alcohol (g)	3.43 ± 5.18	2.83 ± 3.91	0.516
Caffeine (mg)	17.60 ± 19.75	15.13 ± 21.69	**0.037**
Sodium (mg)	975.78 ± 274.63	990.71 ± 246.46	0.382
Potassium (mg)	1424.02 ± 346.45	1313.29 ± 366.05	**0.000**
Magnesium (mg)	151.52 ± 40.97	143.01 ± 41.13	**0.007**
Zinc (mg)	4.65 ± 1.02	4.67 ± 1.21	0.943
Calcium (mg)	423.38 ± 115.27	408.51 ± 110.88	0.087
Chromium (mg)	0.032 ± 0.02	0.031 ± 0.02	0.323
Copper (mg)	0.67 ± 0.15	0.65 ± 0.18	**0.026**
Fluoride (mcg)	1259.30 ± 1717.67	1036.85 ± 1727.86	**0.036**
Iron (mg)	6.80 ± 1.44	6.83 ± 1.90	0.634
Manganese (mg)	1.36 ± 0.44	1.34 ± 0.48	0.231
Molybdenum (mcg)	17.91 ± 11.81	17.02 ± 13.29	0.093
Phosphorus (mg)	649.06 ± 120.52	630.15 ± 127.44	**0.044**
Selenium (mcg)	35.83 ± 13.30	35.25 ± 12.85	0.802
Vitamin D (IU)	30.27 ± 27.81	27.22 ± 22.76	0.470
Vitamin C (mg)	52.90 ± 33.05	48.07 ± 35.34	**0.043**
Vitamin E (mg)	0.26 ± 0.11	0.27 ± 0.15	0.668
Vitamin A (IU)	3002.60 ± 2591.36	3179.07 ± 3391.67	0.465
Vitamin K (mcg)	38.50 ± 15.11	38.71 ± 25.43	0.214
Cobalamin B12 (mcg)	2.18 ± 1.10	2.20 ± 1.09	0.695
Niacin B3 (mg)	9.36 ± 3.44	3.14 ± 3.48	0.500
Pantothenic Acid B5 (mg)	1.95 ± 0.56	1.81 ± 0.55	**0.008**
Pyridoxine B6 (mg)	0.87 ± 0.29	0.81 ± 0.28	**0.011**
Riboflavin B2 (mg)	0.87 ± 0.22	0.83 ± 0.21	0.115
Thiamine B1 (mg)	0.62 ± 0.12	0.61 ± 0.16	0.643
Biotin B7 (mcg)	11.09 ± 5.07	10.36 ± 5.37	**0.046**
Folate B9 (mcg)	166.14 ± 44.30	160.58 ± 55.41	0.083
Alanine (mg)	1647.47 ± 605.26	1659.76 ± 626.49	0.977
Arginine (mg)	2018.91 ± 671.54	2023.66 ± 665.66	0.986
Aspartic Acid (mg)	3208.10 ± 1014.87	3183.03 ± 1031.22	0.608
Cystine (mg)	451.26 ± 145.08	449.74 ± 152.31	0.634

Glutamic Acid (mg)	6947.54 ± 1831.58	7040.02 ± 1809.70	0.583
Glycine (mg)	1437.24 ± 543.47	1440.89 ± 550.57	0.958
Histidine (mg)	1011.49 ± 328.78	1020.66 ± 337.98	0.760
Isoleucine (mg)	1649.44 ± 542.43	1664.94 ± 568.06	0.874
Leucine (mg)	2790.69 ± 888.11	2822.73 ± 918.07	0.790
Lysine (mg)	2379.66 ± 898.78	2384.46 ± 943.20	0.925
Methionine (mg)	789.56 ± 295.36	796.57 ± 304.62	0.821
Phenylalanine (mg)	1612.67 ± 464.65	1626.14 ± 456.97	0.761
Proline (mg)	2467.22 ± 720.07	2512.06 ± 726.06	0.593
Serine (mg)	1604.90 ± 470.88	1622.57 ± 472.12	0.671
Threonine (mg)	1348.24 ± 456.62	1371.02 ± 497.26	0.799
Tryptophan (mg)	398.58 ± 118.07	407.31 ± 125.03	0.535
Tyrosine (mg)	1273.62 ± 407.41	1287.58 ± 411.07	0.673
Valine (mg)	1842.73 ± 577.31	1854.31 ± 586.77	0.936

MUFA: Monounsaturated Fatty Acid; PUFA: Polyunsaturated Fatty Acid

Table 6: Association of the risk of EDs with the scores of the five dietary patterns identified as assessed by multivariate linear regression

	β	Standard Error	Significance	95% CI	
				Lower	Upper
Traditional Lebanese diet					
Risk of EDs	-0.027	0.035	0.449	-0.096	0.043
Gender	-0.037	0.037	0.317	-0.110	0.036
BMI	0.001	0.004	0.733	-0.007	0.009
Chronic morbidity	0.095	0.052	0.071	-0.008	0.197
Depression status	0.025	0.037	0.498	-0.048	0.098
Physical activity level	0.035	0.021	0.099	-0.007	0.078
Frequency of breakfast	-0.048	0.022	**0.029**	-0.091	-0.005
Smoking habits	-0.041	0.018	**0.022**	-0.076	-0.006
Number of meals/ day	0.049	0.023	**0.034**	0.004	0.095
Western Fast Food					
Risk of EDs	-0.022	0.048	0.649	-0.115	0.072
Gender	-0.219	0.049	**0.000**	-0.316	-0.122
BMI	-0.007	0.005	0.218	-0.017	0.004
Chronic morbidity	0.000	0.069	0.995	-0.137	0.136
Depression status	0.140	0.050	**0.005**	0.042	0.238
Physical activity level	-0.034	0.029	0.235	-0.091	0.022
Number of snacks/ day	0.107	0.025	**0.000**	0.059	0.155
Frequency of breakfast	0.086	0.027	**0.002**	0.032	0.139
Dairy					
Risk of EDs	-0.111	0.053	**0.035**	-0.215	-0.008
Gender	-0.075	0.057	0.195	-0.187	0.038
BMI	-0.003	0.006	0.637	-0.016	0.010
Chronic morbidity	-0.083	0.077	0.281	-0.235	0.068
Depression status	0.11	0.056	**0.037**	0.007	0.226
Physical activity level	-0.018	0.032	0.583	-0.080	0.045
Smoking habits	-0.096	0.027	**0.000**	-0.149	-0.043
Hypertension status	0.141	0.063	**0.026**	0.017	0.266
Alcohol drinking	0.071	0.033	**0.036**	0.005	0.136
Lebanese Fast Food					
Risk of EDs	-0.073	0.047	0.121	-0.166	0.020
Gender	-0.080	0.049	0.108	-0.177	0.018
BMI	0.001	0.005	0.788	-0.009	0.012
Chronic morbidity	0.018	0.069	0.795	-0.118	0.154
Depression status	0.086	0.050	0.087	-0.013	0.184
Physical activity level	0.024	0.029	0.398	-0.032	0.081
Meals while watching TV/week	-0.052	0.026	**0.048**	-0.104	0.000
Fruits					
Risk of EDs	0.093	0.054	0.087	-0.014	0.199
Gender	-0.141	0.057	**0.013**	-0.253	-0.030
BMI	0.003	0.006	0.682	-0.010	0.015
Chronic morbidity	0.018	0.080	0.819	-0.139	0.175
Depression status	-0.026	0.057	0.643	-0.138	0.085

Physical activity level	0.010	0.033	0.750	-0.054	0.075
Number of meals/ day	0.103	0.033	**0.002**	0.037	0.169
Smoking habits	-0.064	0.027	**0.018**	-0.118	-0.011

VIII. Discussion

The primary aim of the study was to estimate the proportion NDU students who are at high risk of developing EDs, and examine the association of EDs high risk with socio-demographic, lifestyle and dietary factors.

Five dietary patterns were identified in our sample; "Traditional Lebanese", "Western Fast Food", "Dairy", "Lebanese Fast Food" and "Fruits" pattern. The "Traditional Lebanese" and "Western Fast Food" patterns identified in our sample were similar to the ones previously reported among a nationally representative sample (n= 2048) of Lebanese adults aged 20-55 years (Naja et al., 2011), another sample (n=174) of Lebanese adults aged 40-77 years (Naja et al., 2013), and among a large sample (n= 3307) of Lebanese university students (Salameh et al., 2014). Although the "Dairy", "Fruits" and "Lebanese Fast Food" patterns, emerged as distinct in our study, they were recognized as food items included in: the "Traditional Lebanese" and "Western Fast Food" patterns, respectively, as per findings of (Naja et al. 2011, Naja et al., 2013). Our findings on energy intake and energy-adjusted nutrient profile of "Traditional Lebanese" pattern were comparable to those reported in previous studies as far as high intake of energy, fat (primarily unsaturated), cholesterol and fiber. Nonetheless, they differed on intake of carbohydrate and protein: in our sample, "Traditional Lebanese" pattern showed an unexpected significant negative association with carbohydrate and protein consumption. Still, the "Western Fast Food" pattern correlated with high intake of energy

and fat (essentially saturated fat), low intake of carbohydrate, and very low intake of protein and fiber in our study, as well as in previously reported findings (Naja et al., 2011, Naja et al., 2013). Evidently, the "Western Fast Food" and "Lebanese Fast Food" patterns were similar with regard to high energy and total fat intake and low consumption of protein, carbohydrate and fiber. However, they diverged on the type of fat: predominantly unsaturated for the "Lebanese Fast Food" versus a predominant intake of saturated fat for "Western Fast Food". Of note our "Traditional Lebanese" pattern factor is similar to the mixed diet (a combination of plant foods, composite dishes, and bread) recognized in the study on Lebanese university students published by Salameh et al. (2014).

With the new classification and diagnosis of EDs according to DSMV, the lifetime prevalence of any of the ED by the age of 20 was shown to be 13.1% among adolescent girls (n=496) from an American city diagnosed using the Eating Disorder Diagnostic Interview (EDDI) (Stice et al., 2013). There is evidence from a variety of sources that EDs are pervasive in university students with a prevalence ranging from 8% to 17% (Tavolacci et al., 2015) and peaking around 30% in students with war stress in Lebanon (Aoun et al., 2013). The assumption of the risk of EDs among our sample was performed using the SCOFF screening tool which showed a proportion of 32.4% of students being at risk of EDs. Previous results of a Lebanese study (n= 949) conducted only on young female adults showed lower risk (21.2%) (Doumit et al., 2017). The high proportion of EDs among our sample as compared to other previous Lebanese studies could be justified by the emergence and spread of EDs across the globe over time (Pike et al., 2014). The trend of EDs was also studied in seven different Arab countries on secondary students

aged between 15 and 18 years old (n=4698) during which the Eating Attitudes Test (EAT-26) was used and results revealed that the risk of EDs varied across these countries. The risk of EDs among our sample was similar to that found in Jordan (31.6%), Palestine (31.7%) and UAE (33.5%) (Musaiger et al., 2012). Whereas Algeria (15.2%), Lybia (26.7%), Syria (22.9%) had lower EDs risk. Also lower proportion of EDs was found in France (20.5%) (n= 3457) and in Greece (23.0%) (n=92) among university students screened by SCOFF and EAT- 26 respectively (Tavolacci et al., 2015). These variations could be justified by the idea that socio - cultural factors are potent factors in influencing the eating attitudes and behaviors and therefore the risk of EDs (Zeeni et al., 2013). Also, Arab cultures are no longer considered protective from EDs and this could be justified by the rapid socio-economic changes in most Arab countries, particularly since 1990's that shifted the attitudes and behaviors of adolescents to more Western values such as thinness as an ideal body shape (Musaiger et al., 2012; Zeeni et al., 2017). The use of different diagnostic and screening tools among the studied samples could also justify the differences in EDs risk (Cotton et al., 2003).

Some socio-demographic and lifestyle characteristics were associated with the risk of EDs. In our sample, females had a higher risk of EDs as compared to males. This gender difference was also observed among other studies conducted on Lebanese (n=2013) and French (n= 3457) students (Tamim et al., 2006; Tavolacci et al., 2015). Also in Denmark, the cumulative risk of EDs among females was more than 17 fold higher than among males (Pedersen et al., 2014). Several authors have observed that women's health is more influenced by structural and psychosocial factors, such as stress and lower levels of self – esteem which form potent risk factors for EDs, whereas men's health is more affected by

health behaviors such as smoking, drinking and physical activity (Tavolacci et al., 2009; Denton et al., 2004). Also it is possible that once females have a high BMI, they feel socially pressured to a greater extent than men to lose weight which exposes them to an increased risk of EDs (Vaughan and Halpern, 2010), and that the image of one's own body and the variables related to one's diet habits represent predicting factors of depression in girls more than in boys (Bearman and Stice, 2008).

In this study, being an overweight/ obese student was related to EDs risk. Similar findings from the French, Lebanese, Turkish (n= 291) and Spanish (n=3571) studies were supportive (Tamim et al., 2006; Veses et al., 2014; Tavolacci et al., 2015; ÇekiÇ et al., 2013). Concerning the other obesity indicators used in our sample other than the BMI, a risky waist circumference, a high total body fat percentage and a risky waist to height ratio were also significantly associated with the risk of EDs. In a cross sectional multidisciplinary study conducted in Spain on adolescent school students (n= 2967) using EAT- 26, results showed that an increase of one point in the BMI or the fat mass increased the probability of being at risk of EDs by 12% and by 4% respectively. Also, risky waist circumference and risky waist to height ratio as independent variables were also significantly associated with the increased risk of EDs (Babio et al., 2009). Overweight/ obese students searching for treatment might adopt easy, unhealthy and extreme weight control measures such as the excessive use of laxatives, starvation, purging and excessive exercise in order to lose weight, which increases their chances to develop EDs, without neglecting the psychological impact of obesity on individuals and the negative perception of body image, the low self-esteem and the negative comments of the family and friends specially in countries that values physical appearances which

might aggravate the risk of EDs (Tamim et al., 2006; Babio et al., 2009; Yahia et al., 2011).

The frequency of meals consumed while watching TV was shown to be significantly associated with the risk of EDs. Those who often ate while watching TV had the higher risk. These findings were also supported by a study conducted in USA on 4746 adolescents that showed an increase of the risk associated with less frequent family meals (Sztainer et al., 2004). Students that consume their meals while watching TV or were cyber addicts, had low meals consumed with their families and therefore were more prone to develop EDs. Studies highlighted the importance of the structured family meals because they were shown to be preventive against EDs by improving the dietary intake, promoting familial and social interactions, and providing the opportunity for parents to integrate healthy eating patterns (Sztainer et al., 2004; Fernández-Aranda et al., 2007; Tavolacci et al., 2015). Usually individuals that eat alone in front of the TV tend to be more isolated as if they are hiding a bad dietary habit that could be easily detected by the parents during shared meals (Proctor et al., 2003; Tani et al., 2015). Also it has been proven that individuals that consume often their meals while watching TV are more prone to consume junk food, have unhealthy eating behaviors, are less active, lose control over the quantity they are eating, are more exposed to westernization and the marketing of unhealthy eating practices and ideal body image which may increase their preference for isolation and the development of obesity and depression which were found to be strongly correlated with the risk of EDs (Robinson, 1999; Proctor et al., 2003; Caroli et al., 2004; Wiecha et al., 2006). The high media influence has been shown to impact greatly the Lebanese students as compared to the Cypriots. Lebanese students were

found to be more influenced by the media that encourages eating and gaining weight more than the Cypriot students, because the media's promotion of unhealthy foods were found to significantly impact the food consumption behavior (Zeeni et al., 2013).

Students who had unhealthy eating behaviors for the past 3 months were found to be at higher risk of EDs. These unhealthy behaviors were defined by meal skipping, late eating, binge eating, or even starvation. These unhealthy behaviors were also significantly correlated with the risk of EDs in a Japanese population (n= 83364) (Tani et al., 2015). Therefore this can be simply justified by the diagnostic criteria of the DSMV were EDs patients usually have inappropriate eating behaviors, with episodes of binge eating and starvation which highlights the diagnostic criteria for these disorders (American Psychiatric Association, 2015).

Concerning the physical activity level, students that had a low and high activity were shown to have somehow similar risk of EDs. Whereas a Portuguese study (n= 192) showed that adolescents who exercised regularly showed fewer EDs behaviors and had more positive psychological functioning (Gomes et al., 2015). Exercise may be an effective way for adolescents to develop a positive self – image. However, it is important to understand the relation between exercise frequency, psychological variables and health related behaviors (Gomes et al., 2015). According to previous research, exercise frequency is related to body dissatisfaction as well as the development and maintenance of eating problems and EDs (GonÇalves and Gomes, 2012). Usually, those who have a sedentary lifestyle tend to eat more and have an unhealthy eating behavior, also aggressive exercisers or athletes may have unhealthy eating behaviors in order to reach the muscularity and achieve weight related competitions (Nergiz- Unal et al., 2014;

Tavolacci et al., 2015). Therefore both low and high physical activity practitioners are more prone to develop EDs. Since moderate physical activity level is followed by the majority of those who control their weight in a healthy way and that moderate physical activity engagement is recommended by the majority of the health care professionals, it is considered a protective way against EDs (Silliman et al., 2004).

In our sample, students that had chronic morbidities were found to be at risk of EDs more than those who were healthy. A British study conducted on 192 young females, showed that EDs were significantly more common in the diabetes participants as compared to the control group (Smith et al., 2008). Since most chronic comorbidities are weight and food related (Cardiovascular, Hypertension, Diabetes, Stroke, Dyslipidemia…), patients may adopt wrong beliefs and unhealthy eating habits thinking that these ways are efficient in controlling their medical conditions and in improving the sensitivity to the treatment (Smith et al., 2008; Neumark-Sztainer et al., 2002).

Being depressed or having a family member diagnosed with depression or other mental illness was associated to the risk of having EDs in our sample. According to literature, both depressive disorders and EDs are multidimensional and heterogeneous disorders. Most of the psychiatric syndromes play an important role in the development and maintenance of EDs (Casper, 1998). A cross sectional survey among normal adolescent population showed positive correlations between mood disturbances and eating and weight concerns in both genders (Richards et al., 1990). EDs symptoms in university students were positively correlated with other mental health problems such as depression and anxiety (Eisenberg et al., 2011; Gadalla and Piran, 2006). Inaccurate perception of body weight can trigger abnormal eating behaviors and EDs in predisposed individuals,

especially in stressful situations (Fragkos and Frangos , 2013). The presence of a family member diagnosed with depression or other mental illnesses may also alter the personal body image of another individual or may give false negative comments related to the body shape which may discourage them and force them to follow unhealthy eating behaviors in order to gain the satisfaction of their closed relatives since they consider their opinion as the most important and true (Le Grange and Eisler, 2009; Neumark-Sztainer et al., 2002). Also, living and taking care of a depressed family member is a major stress that may affect the mood of the student and lead to unhealthy weight practices (Troop et al., 1998). Keeping in mind that some psychological problems may have genetic background, therefore a family member with depression may increase the odds of his/ her daughter or son to also develop psychological problems and therefore higher risk of EDs.

Although EDs were widely studied, there has been relatively little to no research on the dietary nutrient intake of EDs patients. Our study revealed significant association between the risk of EDs and the energy intake, total dietary fiber intake, caffeine intake, potassium intake, magnesium intake, copper intake, fluoride intake, phosphorous intake, vitamin C intake and Vitamin B5, B6 and B7 intake. As compared to the recommended daily intakes, the student's intakes of the mentioned above minerals and vitamins did not reach the recommended levels which may be due either to the lack of proper nutrient and energy intake among anorexics or maybe due to the loss of macro/micro nutrients during the compensatory behavior (vomiting, use of laxatives…) usually adopted by binge eaters and bulimics. Starting with the energy intake, the values showed were very high in both groups; those at risk and not at risk of EDs as compared to the caloric intake usually

recommended for normal individuals. This could be justified by the over estimation of the caloric intake, portion size and quantity of food consumed by the students. This overestimation could be either due to lack of nutritional knowledge in food exchanges or due to the large amount of food usually consumed by binge eaters and bulimics. Even though the caloric intake was overestimated and might not be reflecting the reality, the caloric intake of those who were at risk of EDs was lower than those who were not at risk of EDs. Many studies proved that AN patients may then have not only insufficient intakes of calories, but also inadequate intakes of certain macro/ micro nutrients due to the starvation or the decrease of specific macronutrients intake mainly from fat and carbohydrates (Misra et al., 2006; Siega-Riz et al., 2008; Schebendach et al., 2008; Huse and Lucas, 1984). Also it was shown in a prospective cohort study conducted on 154 American females that lower energy intake could already be observed one to two years before the onset of AN (Affenito et al., 2002). No significant difference on the level of macronutrients was observed among those at risk and not at risk of EDs. Although many studies revealed that AN patients have a greater caloric intake from proteins with reduced intakes of carbohydrates and fats (Huse and Lucas, 1984; Misra et al., 2006). As for the total dietary fiber, the intake was higher among those at risk of EDs and this is also supported by an American community dwelling adolescent girls study (n=78) (Misra et al., 2006) and this could be clearly justified by the positive effect of fibers in weight control (Liu et al., 2003). The caffeine intake among those at risk was higher than those not at risk. This could be justified by the presence of caffeine in most coffee beverages, tea, chocolate, energy drinks and soft drinks that were found to be highly consumed from AN and BN patients to boost their energy without the unwanted effect of consuming

calories (Striegel-Moore et al., 2006). Caffeine is implicated in the exacerbation of anxiety and sleep disorders, and people with EDs often misuse it mainly due to its diuretic action which could be one of the unhealthy weight control practices they adopt (Winston et al., 2005). The intake of potassium, copper and phosphorous were higher among the at risk group in our sample, however these results were not supported by the American community dwelling adolescent girls study, no differences in dietary intakes of amino acids between the 2 groups (EDs and non EDs) were observed (Misra et al., 2006). The high intakes of dietary magnesium and fluoride among the students at risk in our sample could not be compared to any other studies due to the absence of literature related to this topic. However, it could be associated to the idea of high consumption of chocolate, nuts, avocado that are considered high caloric snacks rich in magnesium that might have a positive effect in controlling mood and emotions that are usually associated to EDs. As discussed before that the caffeine intake was high among those at risk of EDs, the fluoride intake could also be high due to the consumption of tea which is considered high source of Fluoride and has no caloric value. Also in our sample, the dietary intake of Vitamin C, Vitamin B5, B6 and B7 were higher among students at risk of EDs. These vitamins except B7 were also found to be higher among anorexic groups in the American community dwelling adolescent girls study as compared to healthy adolescents and it was justified by the use of supplementation among that population (Misra et al., 2006). The preference of fruits and vegetables among other food categories from EDs students due to their low caloric content may justify the high levels of these vitamins. In our sample and in the American community dwelling adolescent girls study, no between group differences in dietary intakes of individual amino acids was observed (Misra et al., 2006).

Preliminary results showed that the “Lebanese Fast Food” pattern mainly high in fat/junk such as nuts and seeds, organ meats, sausages and Makanek, Falafel and Chawarma sandwiches was significantly associated with the risk of EDs. However, after applying the multiple logistic regression and controlling for the gender, BMI, chronic morbidity, depression status, physical activity level, smoking habits, hypertension status and alcohol drinking, it was only shown that students at risk of EDs has a 0.111 lower “Dairy” score than student not at risk of EDs. The “Dairy” pattern as described before was characterized by bread, rice, whole-fat dairy products and ice cream consumption. This could also justify the high dietary intakes of Phosphorous detected among those at risk of EDs since dairy products are usually rich sources of phosphorous. In a study conducted in Spain (n= 1342), it was shown that a high adherence to the Mediterranean diet and a moderate level of physical activity can attenuate the risk of EDs in adolescents (Àlvarez - Malé et al., 2015). The “Traditional Lebanese” pattern identified previously could be considered a sample of the Mediterranean diet; however it showed no significance as protective pattern in our sample. To our knowledge, our study is the first to evaluate the association between risks of ED and different dietary patterns. The adoption of the “Dairy” pattern as a preventive way against EDs could be justified by the fact that the components of this pattern form somehow a complete and balanced intake from carbohydrates, fats, proteins, fibers and energy as compared to other patterns previously identified. This pattern could also be a good option for partially vegan students which ensure them a balanced and varied option of food selection as compared to other non-vegan patterns and to the “Fruit” pattern that has deficiencies in many macro nutrients.

Study strengths and limitations

Our study explored the association between risk of EDs and dietary patterns that was not discussed before among a population similar to ours, hence taking into consideration the complex cumulative effect/ interactions between nutrients that may influence risk of EDs. Moreover, many socio- demographic and lifestyle factors known to influence the risk of EDs were assessed and controlled for when exploring the relationship of dietary patterns with the risk of EDs. Still, we adopted a cross-sectional study design, hence temporal (during the summer semester) association of food intake and risk of EDs cannot be established. Although our sample is quite likely representative of the general population of NDU students; yet it is not representative of the general population of university students in Lebanon. Another study limitation relates to assessment of dietary pattern, as per explanation stated in preceding part. Bearing in mind that diet assessment by way of the 61-items FFQ was conducted in group sessions and by two trained dietitians, collection of valid information on diet pattern was liable to inconsistent interpretations, lower than desired response and completion rates, and under- or over- estimation of subjects' usual dietary intake. Also the risk of EDs was assessed using the SCOFF screening tool which is not a diagnostic tool therefore we cannot assume that the risk of EDs is a diagnosis for EDs where this requires further medical investigation. And therefore we cannot calculate the prevalence of EDs among our sample but the proportion of those at risk.

Conclusion

The risk of EDs among university students in Lebanon was found to be high as compared to other countries, which indicates the necessity of screening students upon entry to universities using a quick and a validated screening tool such as SCOFF because early detection and treatment of the disease could reduce its burden. The risk of EDs was significantly associated to several socio-demographic, anthropometric and lifestyle factors. Being a female, overweight/ obese, with a risky waist circumference, with a risky waist to height ratio, with high body fat composition, with meals often consumed while watching TV, with unhealthy eating behavior for the past 3 months, with low/ high physical activity level, depressed or having a family member diagnosed with depression or other mental illnesses, increased the risk of EDs among the sample of university students in Lebanon. Students at risk of EDs had a 0.111 lower "Dairy" score than students not at risk of EDs. The risk of EDs was found to be also significantly associated to lower daily energy intake, higher total dietary fiber intake, higher caffeine intake, higher dietary intake of magnesium, potassium, copper, fluoride, phosphorous, vitamin C and Vitamin B5, B6, B7. No significant association was detected between the risk of EDs and any of the amino acids intakes. Since our study is the first to our knowledge to evaluate the association between dietary patterns and risk of EDs among university students, further investigations should be done in this field either to validate the efficacy of the "Dairy" pattern as protective against EDs or to find other dietary patterns that might be also protective or causal in EDs development among this population.

REFRENCES

Affenito, S. G., Dohm, F., Crawford, P. B., Daniels, S. R., & Striegel-Moore, R. H. (2002). Macronutrient intake in anorexia nervosa: The national heart, lung, and blood institute growth and health study. *The Journal of Pediatrics, 141*(5), 701-705.

Ahmad, S., Waller, G., & Verduyn, C. (1994). Eating attitudes among asian schoolgirls: The role of perceived parental control. *International Journal of Eating Disorders, 15*(1), 91-97.

Altabe, M., & Thompson, J. K. (1996). Body image: A cognitive self-schema construct? *Cognitive Therapy and Research, 20*(2), 171-193.

Álvarez-Malé, M., Bautista-Castaño, I., & Serra-Majem, L. (2015). Behavioural and psychological variables associated with overweight and obesity in gran canaria, spain. *Obes Res Open J, 2*(1), 24-31.

American College of Sports Medicine, American Dietetic Association, & Dietitians of Canada. (2000). Joint position statement: Nutrition and athletic performance. american college of sports medicine, american dietetic association, and dietitians of canada. *Medicine and Science in Sports and Exercise, 32*(12), 2130-2145.

American Psychiatric Association. (2015). *Feeding and eating disorders: DSM-5® selections* American Psychiatric Pub.

Andreea-Elena, M. (2015a). The risk of eating disorders in adolescence and its association with the impact of the sociocultural attitudes towards appearance. *Procedia-Social and Behavioral Sciences, 187*, 153-157.

Andreea-Elena, M. (2015b). The risk of eating disorders in adolescence and its association with the value of the body mass index, level of anxiety and level of depression. *Procedia-Social and Behavioral Sciences, 187*, 141-146.

Aoun, A., Azzam, J., El Jabbour, F., Hlais, S., Daham, D., El Amm, C., et al. (2015). Validation of the arabic version of the SCOFF questionnaire for the screening of eating disorders. *Eastern Mediterranean Health Journal, 21*(5), 326.

Aoun, A., Garcia, F. D., Mounzer, C., Hlais, S., Grigioni, S., Honein, K., et al. (2013). War stress may be another risk factor for eating disorders in civilians: A study in lebanese university students. *General Hospital Psychiatry, 35*(4), 393-397.

Babio, N., Bullo, M., Basora, J., Martinez-Gonzalez, M., Fernández-Ballart, J., Márquez-Sandoval, F., et al. (2009). Adherence to the mediterranean diet and risk of metabolic syndrome and its components. *Nutrition, Metabolism and Cardiovascular Diseases, 19*(8), 563-570.

Beals, K. A., & Manore, M. M. (2002). Disorders of the female athlete triad among collegiate athletes. *International Journal of Sport Nutrition and Exercise Metabolism, 12*(3), 281-293.

Bearman, S. K., & Stice, E. (2008). Testing a gender additive model: The role of body image in adolescent depression. *Journal of Abnormal Child Psychology, 36*(8), 1251-1263.

Beren, S. E., Hayden, H. A., Wilfley, D. E., & Grilo, C. M. (1996). The influence of sexual orientation on body dissatisfaction in adult men and women. *International Journal of Eating Disorders, 20*(2), 135-141.

Booth, M.L. (2000). Assessment of Physical Activity: An International Perspective. *Research Quarterly for Exercise and Sport, 71* (2), 114-120.

Bulik, C. M., Tozzi, F., Anderson, C., Mazzeo, S. E., Aggen, S., & Sullivan, P. F. (2003). The relation between eating disorders and components of perfectionism. *American Journal of Psychiatry, 160*(2), 366-368.

Byrne, S., & McLean, N. (2001). Eating disorders in athletes: A review of the literature. *Journal of Science and Medicine in Sport, 4*(2), 145-159.

Call, C., Walsh, B. T., & Attia, E. (2013). From DSM-IV to DSM-5: Changes to eating disorder diagnoses. *Current Opinion in Psychiatry, 26*(6), 532-536.

Caroli, M., Argentieri, L., Cardone, M., & Masi, A. (2004). Role of television in childhood obesity prevention. *International Journal of Obesity, 28*, S104-S108.

Casper, R. C. (1998). Depression and eating disorders. *Depression and Anxiety, 8*(S1), 96-104.

Çekiç, A., Özkamali, E., & Buğa, A. (2014). The analysis of variables predicting eating habits of university students. *Procedia-Social and Behavioral Sciences, 116*, 3332-3335.

Centers for Disease Control and Prevention National Health and Nutrition Examination Survey. (2007). Anthropometry Procedures Manual. doi:3–30. 3–31

Cespedes, E. M., & Hu, F. B. (2015). Dietary patterns: From nutritional epidemiologic analysis to national guidelines. *The American Journal of Clinical Nutrition, 101*(5), 899-900.

Cooke, E. A., Guss, J. L., Kissileff, H. R., Devlin, M. J., & Walsh, B. T. (1997). Patterns of food selection during binges in women with binge eating disorder. *International Journal of Eating Disorders, 22*(2), 187-194.

Cotton, M., Ball, C., & Robinson, P. (2003). Four simple questions can help screen for eating disorders. *Journal of General Internal Medicine, 18*(1), 53-56.

Denton, M., Prus, S., & Walters, V. (2004). Gender differences in health: A canadian study of the psychosocial, structural and behavioural determinants of health. *Social Science & Medicine, 58*(12), 2585-2600.

Di Mattei, V. E., Bagliacca, E. P., Lavezzari, L., Di Pierro, R., Carnelli, L., Zucchi, P., et al. (2015). Body image and personality in aesthetic plastic surgery: A case-control study. *Open Journal of Medical Psychology, 4*(02), 35.

Doumit, R., Khazen, G., Katsounari, I., Kazandjian, C., Long, J., & Zeeni, N. (2017). Investigating vulnerability for developing eating disorders in a multi-confessional population. *Community Mental Health Journal, 53*(1), 107-116.

Eisenberg, D., Nicklett, E. J., Roeder, K., & Kirz, N. E. (2011). Eating disorder symptoms among college students: Prevalence, persistence, correlates, and treatment-seeking. *Journal of American College Health, 59*(8), 700-707.

Eisenberg, M. E., Olson, R. E., Neumark-Sztainer, D., Story, M., & Bearinger, L. H. (2004). Correlations between family meals and psychosocial well-being among adolescents. *Archives of Pediatrics & Adolescent Medicine, 158*(8), 792-796.

Fairburn, C. G., & Cooper, Z. (2011). Eating disorders, DSM-5 and clinical reality. *The British Journal of Psychiatry : The Journal of Mental Science, 198*(1), 8-10.

Fairburn, C. G., & Harrison, P. J. (2003). Eating disorders. *The Lancet, 361*(9355), 407-416.

Fairburn, C. G., Cooper, Z., Bohn, K., O'Connor, M. E., Doll, H. A., & Palmer, R. L. (2007). The severity and status of eating disorder NOS: Implications for DSM-V. *Behaviour Research and Therapy, 45*(8), 1705-1715.

Fedoroff, I. C. (1996). Food preferences and desire to eat in anorexia and bulimia nervosa. *International Journal of Eating Disorders, 19*(1), 13-22.

Feldman, M. B., & Meyer, I. H. (2007). Eating disorders in diverse lesbian, gay, and bisexual populations. *International Journal of Eating Disorders, 40*(3), 218-226.

Fernández-Aranda, F., Krug, I., Granero, R., Ramón, J. M., Badia, A., Giménez, L., et al. (2007). Individual and family eating patterns during childhood and early adolescence: An analysis of associated eating disorder factors. *Appetite, 49*(2), 476-485.

Fortesa, K., & Ajete, K. (2014). Family influence on disordered eating behaviour. *Procedia-Social and Behavioral Sciences, 159*, 314-318.

Fragkos, K. C., & Frangos, C. C. (2013). Assessing eating disorder risk: The pivotal role of achievement anxiety, depression and female gender in non-clinical samples. *Nutrients, 5*(3), 811-828.

French, S. A., Story, M., Remafedi, G., Resnick, M. D., & Blum, R. W. (1996). Sexual orientation and prevalence of body dissatisfaction and eating disordered behaviors: A population-based study of adolescents. *International Journal of Eating Disorders, 19*(2), 119-126.

Gadalla, T., & Piran, N. (2007). Co-occurrence of eating disorders and alcohol use disorders in women: A meta analysis. *Archives of Women's Mental Health, 10*(4), 133-140

Garcia, F. D., Grigioni, S., Allais, E., Houy-Durand, E., Thibaut, F., & Déchelotte, P. (2011). Detection of eating disorders in patients: Validity and reliability of the french version of the SCOFF questionnaire. *Clinical Nutrition, 30*(2), 178-181.

Garcia-Campayo, J., Sanz-Carrillo, C., Ibañez, J., Lou, S., Solano, V., & Alda, M. (2005). Validation of the spanish version of the SCOFF questionnaire for the screening of eating disorders in primary care. *Journal of Psychosomatic Research, 59*(2), 51-55.

Goldschmidt, A. B., Hilbert, A., Manwaring, J. L., Wilfley, D. E., Pike, K. M., Fairburn, C. G., et al. (2010). The significance of overvaluation of shape and weight in binge eating disorder. *Behaviour Research and Therapy, 48*(3), 187-193.

Gomes, R., Gonçalves, S., & Costa, J. (2015). Exercise, eating disordered behaviors and psychological well-being: A study with portuguese adolescents. *Revista Latinoamericana De Psicología, 47*(1), 66-74.

Gonçalves, S. F., & Gomes, A. R. (2012). Exercising for weight and shape reasons vs. health control reasons: The impact on eating disturbance and psychological functioning. *Eating Behaviors, 13*(2), 127-130.

Hadigan, C. M., Kissileff, H. R., & Walsh, B. T. (1989). Patterns of food selection during meals in women with bulimia. *The American Journal of Clinical Nutrition, 50*(4), 759-766.

Heffernan, K. (1994). Sexual orientation as a factor in risk for binge eating and bulimia nervosa: A review. *International Journal of Eating Disorders, 16*(4), 335-347.

Huse, D. M., & Lucas, A. R. (1984). Dietary patterns in anorexia nervosa. *The American Journal of Clinical Nutrition, 40*(2), 251-254.

Joja, O., Nanu, C., & von Wietersheim, J. (2015). Weight concerns and eating attitudes among romanian students in comparison to german students and anorexia nervosa patients. *Procedia-Social and Behavioral Sciences, 187*, 402-407.

Jones, J. M., Bennett, S., Olmsted, M. P., Lawson, M. L., & Rodin, G. (2001). Disordered eating attitudes and behaviours in teenaged girls: A school-based study. *CMAJ : Canadian Medical Association Journal = Journal De l'Association Medicale Canadienne, 165*(5), 547-552.

Karsli, Y., & Karsli, T. A. (2015). Media effects on body image and eating attitudes of the women living in metropolitan and rural areas in a turkish population. *Procedia-Social and Behavioral Sciences, 205*, 99-102.

Lähteenmäki, S., Aalto-Setälä, T., Suokas, J. T., Saarni, S. E., Perälä, J., Saarni, S. I., et al. (2009). Validation of the finnish version of the SCOFF questionnaire among young adults aged 20 to 35 years. *BMC Psychiatry, 9*(1), 5.

Le Grange, D., & Eisler, I. (2009). Family interventions in adolescent anorexia nervosa. *Child and Adolescent Psychiatric Clinics of North America, 18*(1), 159-173.

Levická, K., Kovalčíková, N., & Kováčová, L. (2014). Incidence of eating disorders in family environment in high school adolescents. *Procedia-Social and Behavioral Sciences, 132*, 391-397.

Liu, S., Willett, W. C., Manson, J. E., Hu, F. B., Rosner, B., & Colditz, G. (2003). Relation between changes in intakes of dietary fiber and grain products and changes in weight and development of obesity among middle-aged women. *The American Journal of Clinical Nutrition, 78*(5), 920-927.

Maxwell, M., Thornton, L. M., Root, T. L., Pinheiro, A. P., Strober, M., Brandt, H., et al. (2011). Life beyond the eating disorder: Education, relationships, and reproduction. *International Journal of Eating Disorders, 44*(3), 225-232.

Misra, M., Tsai, P., Anderson, E. J., Hubbard, J. L., Gallagher, K., Soyka, L. A., et al. (2006). Nutrient intake in community-dwelling adolescent girls with anorexia nervosa and in healthy adolescents. *The American Journal of Clinical Nutrition, 84*(4), 698-706.

Morgan, J. F., Reid, F., & Lacey, J. H. (1999). The SCOFF questionnaire: Assessment of a new screening tool for eating disorders. *BMJ (Clinical Research Ed.), 319*(7223), 1467-1468.

Muro-Sans, P., Amador-Campos, J. A., & Morgan, J. F. (2008). The SCOFF-c: Psychometric properties of the catalan version in a spanish adolescent sample. *Journal of Psychosomatic Research, 64*(1), 81-86.

Musaiger, A. O., Al-Mannai, M., Tayyem, R., Al-Lalla, O., Ali, E. Y., Kalam, F., et al. (2013). Risk of disordered eating attitudes among adolescents in seven arab countries by gender and obesity: A cross-cultural study. *Appetite, 60*, 162-167.

Naja, F., Nasreddine, L., Itani, L., Adra, N., Sibai, A., & Hwalla, N. (2013). Association between dietary patterns and the risk of metabolic syndrome among lebanese adults. *European Journal of Nutrition, 52*(1), 97-105.

Naja, F., Nasreddine, L., Itani, L., Chamieh, M. C., Adra, N., Sibai, A. M., et al. (2011). Dietary patterns and their association with obesity and sociodemographic factors in a national sample of lebanese adults. *Public Health Nutrition, 14*(9), 1570.

Nergiz-Unal, R., Bilgiç, P., & Yabancı, N. (2014). High tendency to the substantial concern on body shape and eating disorders risk of the students majoring nutrition or sport sciences. *Nutrition Research and Practice, 8*(6), 713-718.

Neumark-Sztainer, D., Wall, M., Story, M., & Fulkerson, J. A. (2004). Are family meal patterns associated with disordered eating behaviors among adolescents? *Journal of Adolescent Health, 35*(5), 350-359.

Parker, S. C., Lyons, J., & Bonner, J. (2005). Eating disorders in graduate students: Exploring the SCOFF questionnaire as a simple screening tool. *Journal of American College Health, 54*(2), 103-107.

Pedersen, C. B., Mors, O., Bertelsen, A., Waltoft, B. L., Agerbo, E., McGrath, J. J., et al. (2014). A comprehensive nationwide study of the incidence rate and lifetime risk for treated mental disorders. *JAMA Psychiatry, 71*(5), 573-581.

Pellet, P., & Shadarevian, S. (1970). Food composition. tables for use in the middle east. *Food Composition.Tables for use in the Middle East.*, (Edn. 2)

Penedo, F. J., & Dahn, J. R. (2005). Exercise and well-being: A review of mental and physical health benefits associated with physical activity. *Current Opinion in Psychiatry, 18*(2), 189-193.

Pike, K. M., Hoek, H. W., & Dunne, P. E. (2014). Cultural trends and eating disorders. *Current Opinion in Psychiatry, 27*(6), 436-442.

Pope, Z., Gao, Y., Bolter, N., & Pritchard, M. (2015). Validity and reliability of eating disorder assessments used with athletes: A review. *Journal of Sport and Health Science, 4*(3), 211-221.

Proctor, M., Moore, L., Gao, D., Cupples, L., Bradlee, M., Hood, M., et al. (2003). Television viewing and change in body fat from preschool to early adolescence: The framingham children's study. *International Journal of Obesity, 27*(7), 827-833.

Richards, M. H., Casper, R. C., & Larson, R. (1990). Weight and eating concerns among pre-and young adolescent boys and girls. *Journal of Adolescent Health Care, 11*(3), 203-209.

Robinson, T. N. (1999). Reducing children's television viewing to prevent obesity: A randomized controlled trial. *Jama, 282*(16), 1561-1567.

Rodríguez-Testal, J. F., Senín-Calderón, C., & Perona-Garcelán, S. (2014). From DSM-IV-TR to DSM-5: Analysis of some changes. *International Journal of Clinical and Health Psychology, 14*(3), 221-231.

Rosen, E. F., Anthony, D. L., Booker, K. M., Brown, T. L., Christian, E., Crews, R. C., et al. (1991). A comparison of eating disorder scores among african-american and white college females. *Bulletin of the Psychonomic Society, 29*(1), 65-66.

Russell, C. J., & Keel, P. K. (2002). Homosexuality as a specific risk factor for eating disorders in men. *International Journal of Eating Disorders, 31*(3), 300-306.

Saariniemi, K. M., Salmi, A. M., Peltoniemi, H. H., Charpentier, P., & Kuokkanen, H. O. (2015). Does liposuction improve body image and symptoms of eating disorders? *Plastic and Reconstructive Surgery.Global Open, 3*(7), e461.

Salameh, P., Jomaa, L., Issa, C., Farhat, G., Zeghondi, H., Gerges, N., et al. (2014). Assessment of health risk behaviours among university students: A cross-sectional study in lebanon. *International Journal of Adolescence and Youth, 19*(2), 203-216.

Samnaliev, M., Noh, H. L., Sonneville, K. R., & Austin, S. B. (2015). The economic burden of eating disorders and related mental health comorbidities: An exploratory analysis using the US medical expenditures panel survey. *Preventive Medicine Reports, 2*, 32-34.

Sansone, R. A., Levitt, J. L., & Sansone, L. A. (2004). The prevalence of personality disorders among those with eating disorders. *Eating Disorders, 13*(1), 7-21.

Schebendach, J. E., Mayer, L. E., Devlin, M. J., Attia, E., Contento, I. R., Wolf, R. L., et al. (2008). Dietary energy density and diet variety as predictors of outcome in anorexia nervosa. *The American Journal of Clinical Nutrition, 87*(4), 810-816.

Shafran, R., Lee, M., Payne, E., & Fairburn, C. G. (2006). The impact of manipulating personal standards on eating attitudes and behaviour. *Behaviour Research and Therapy, 44*(6), 897-906.

Shinohara, M., Mizushima, H., Hirano, M., Shioe, K., Nakazawa, M., Hiejima, Y., et al. (2004). Eating disorders with binge-eating behaviour are associated with the s allele of the 3'-UTR VNTR polymorphism of the dopamine transporter gene. *Journal of Psychiatry & Neuroscience : JPN, 29*(2), 134-137.

Siega-Riz, A. M., Haugen, M., Meltzer, H. M., Von Holle, A., Hamer, R., Torgersen, L., et al. (2008). Nutrient and food group intakes of women with and without bulimia nervosa and binge eating disorder during pregnancy. *The American Journal of Clinical Nutrition, 87*(5), 1346-1355.

Siervo, M., Boschi, V., Papa, A., Bellini, O., & Falconi, C. (2005). Application of the SCOFF, eating attitude test 26 (EAT 26) and eating inventory (TFEQ) questionnaires in young women seeking diet-therapy. *Eating and Weight Disorders-Studies on Anorexia, Bulimia and Obesity, 10*(2), 76-82.

Silliman, K., Rodas-Fortier, K., & Neyman, M. (2004). A survey of dietary and exercise habits and perceived barriers to following a healthy lifestyle in a college population. *Cal J Health Promot, 18*, 281.

Smink, F. R., Van Hoeken, D., & Hoek, H. W. (2012). Epidemiology of eating disorders: Incidence, prevalence and mortality rates. *Current Psychiatry Reports, 14*(4), 406-414.

Smith, F. M., Latchford, G. J., Hall, R. M., & Dickson, R. A. (2008). Do chronic medical conditions increase the risk of eating disorder? A cross-sectional investigation of eating pathology in adolescent females with scoliosis and diabetes. *Journal of Adolescent Health, 42*(1), 58-63.

Stice, E., Marti, C. N., & Rohde, P. (2013). Prevalence, incidence, impairment, and course of the proposed DSM-5 eating disorder diagnoses in an 8-year prospective community study of young women. *Journal of Abnormal Psychology, 122*(2), 445.

Striegel-Moore, R. H., Franko, D. L., Thompson, D., Barton, B., Schreiber, G. B., & Daniels, S. R. (2006). Caffeine intake in eating disorders. *International Journal of Eating Disorders, 39*(2), 162-165.

Su, X., Liang, H., Yuan, W., Olsen, J., Cnattingius, S., & Li, J. (2016). Prenatal and early life stress and risk of eating disorders in adolescent girls and young women. *European Child & Adolescent Psychiatry, 25*(11), 1245-1253.

Sukariyah, M. B., & Sidani, R. A. (2014). Prevalence of and gender differences in weight, body, and eating related perceptions among lebanese high school students: Implications for school counseling. *Procedia-Social and Behavioral Sciences, 159*, 184-191.

Tamim, H., Tamim, R., Almawi, W., Rahi, A., Shamseddeen, W., Ghazi, A., et al. (2006). Risky weight control among university students. *International Journal of Eating Disorders, 39*(1), 80-83.

Tani, Y., Sasaki, Y., Haseda, M., Kondo, K., & Kondo, N. (2015). Eating alone and depression in older men and women by cohabitation status: The JAGES longitudinal survey. *Age and Ageing, 44*(6), 1019-1026.

Tavolacci, M. P., Grigioni, S., Richard, L., Meyrignac, G., Déchelotte, P., & Ladner, J. (2015). Eating disorders and associated health risks among university students. *Journal of Nutrition Education and Behavior, 47*(5), 412-420. e1.

Taylor, C. B., Bryson, S., Celio Doyle, A. A., Luce, K. H., Cunning, D., Abascal, L. B., et al. (2006). The adverse effect of negative comments about weight and shape from family and siblings on women at high risk for eating disorders. *Pediatrics, 118*(2), 731-738.

Troop, N. A., Holbrey, A., & Treasure, J. L. (1998). Stress, coping, and crisis support in eating disorders. *International Journal of Eating Disorders, 24*(2), 157-166.

Vajda, A., & Láng, A. (2014). Emotional abuse, neglect in eating disorders and their relationship with emotion regulation. *Procedia-Social and Behavioral Sciences, 131*, 386-390.

Vaughan, C. A., & Halpern, C. T. (2010). Gender differences in depressive symptoms during adolescence: The contributions of Weight-Related concerns and behaviors. *Journal of Research on Adolescence, 20*(2), 389-419.

Veses, A. M., Martínez-Gómez, D., Gómez-Martínez, S., Vicente-Rodriguez, G., Castillo, R., Ortega, F., et al. (2014). Physical fitness, overweight and the risk of eating disorders in adolescents. the AVENA and AFINOS studies. *Pediatric Obesity, 9*(1), 1-9.

WHO expert consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. (2004). *The Lancet,* 157-163.

Wiecha, J. L., Peterson, K. E., Ludwig, D. S., Kim, J., Sobol, A., & Gortmaker, S. L. (2006). When children eat what they watch: Impact of television viewing on dietary intake in youth. *Archives of Pediatrics & Adolescent Medicine, 160*(4), 436-442.

Williamson, I. (1999). Why are gay men a high risk group for eating disturbance? *European Eating Disorders Review, 7*(1), 1-4.

Wilson, G. T., & Sysko, R. (2009). Frequency of binge eating episodes in bulimia nervosa and binge eating disorder: Diagnostic considerations. *International Journal of Eating Disorders, 42*(7), 603-610.

Wilson, G. T., Perrin, N. A., Rosselli, F., Striegel-Moore, R. H., DeBar, L. L., & Kraemer, H. C. (2009). Beliefs about eating and eating disorders. *Eating Behaviors, 10*(3), 157-160.

Winston, A. P., Hardwick, E., & Jaberi, N. (2005). Neuropsychiatric effects of caffeine. *Advances in Psychiatric Treatment, 11*(6), 432-439.

Wise, R. A. (2006). Role of brain dopamine in food reward and reinforcement. *Philosophical Transactions of the Royal Society of London.Series B, Biological Sciences, 361*(1471), 1149-1158.

Yahia, N., El-Ghazale, H., Achkar, A., & Rizk, S. (2011). Dieting practices and body image perception among lebanese university students. *Asia Pacific Journal of Clinical Nutrition, 20*(1), 21-28.

Zeeni, N., Gharibeh, N., & Katsounari, I. (2013). The influence of sociocultural factors on the eating attitudes of lebanese and cypriot students: A cross-cultural study. *Journal of Human Nutrition and Dietetics, 26*(s1), 45-52.

Zeeni, N., Safieddine, H., & Doumit, R. (2017). Eating disorders in lebanon: Directions for public health action. *Community Mental Health Journal, 53*(1), 117-125.

IX. APPENDICES

Appendix A: Consent Form

This is a consent form to participate in a research study. If you decide to participate, you will have to mark your consent below and return this form to the study investigators.

Who are we?

We are a group of researchers from the Faculty of Nursing & Health Sciences, NDU.

What is the purpose of the study?

We are interested to study the association between dietary patterns & depressive symptoms among Lebanese University students.

What does the study entail?

Participants will be asked to complete a total of 4 questionnaires including a food frequency questionnaire (FFQ). Trained dietitians will visit classrooms for about 45 minutes and assist participating students in completing the FFQ. The remaining 3 questionnaires (background information, measurement of physical activity, and depressive symptoms) will be given to students for completion at home and later on submission to the research staff within a period of 2 weeks in a sealed envelope. Students will be asked to come in person to the nutrition research lab (HA318, third floor, pink building), on Mondays & Wednesdays from 12-1, or Tuesdays & Thursdays from 12:30-1:30, for weight, height, and blood pressure measurements.

Is there any risk to participants in the study?

There is no risk in participating in this study. The information collected will be used only for the purpose described in this form.

What about anonymity, and/ or confidentiality?

You will not be asked to provide your name, ID#, or any other personal identifier. All data from this study will be maintained in a secure location, and access will be strictly limited to study investigators.

What are my rights as a study participant?

Taking part in this research is voluntary and declining to participate will not bear any academic/ nonacademic consequences.

Whom do I call if I have questions?

For questions about the study, contact the researchers: landlines: 09-208707, or 09-208902; cellular lines: 03-423443, 03-871916, or 71-991331.

STATEMENT OF CONSENT:

I have read this form. I have had the opportunity to ask questions and have had them answered to my satisfaction. In addition, I have been assured that any future questions that I may have will also be answered by the research investigators.

☐ By checking this box I indicate that I voluntarily agree to participate in this study.

☐ By checking this box, I indicate that I am not interested in participating in this study.

Date: _____

Appendix B

FOOD FREQUENCY QUESTIONNAIRE

Think about your eating patterns during the past year while answering this questionnaire. Please indicate your usual intake of each of the following food items per Day, Week, or Month.
For example: Apple. If you consume 3 apples daily, write 3 in the "Day" column, if you think you average 3 apples a week over the year, write 3 in the "Week" column. However, if you rarely consume a food, let's say once or twice a year, then tick below "Rarely/Never".
Please be precise as much as you can.
Remember! The accuracy of the study results depends on the accuracy of your answers.

Food item	Serving size	Day	Week	Month	Rarely / Never
Example: Apple	1 item		3		
Bread and Cereals					
1. White bread (1 slice)	1 slice (30g)				
2. Brown or whole wheat bread	1 slice				
3. Breakfast cereals, regular/ bran	1 cup				
4. Rice, white, cooked	1 cup				
5. Pasta, plain, cooked	1 cup				
6. Wheat, whole, cooked / Bulgur	1 cup				
Dairy products					
7. Low-fat milk (2% fat)	1 cup				
8. Whole fat milk	1 cup				
9. Fat free / low fat yogurt	1 cup				
10. Whole fat yogurt	1 cup				
11. Cheese regular	1 slice (30g)				
12. Cheese low fat	1 slice (30g)				
13. Labneh	2 Tbsp				
Fruits & Juices					
14. Citrus Orange (1 item) / Grapefruit (1/2 item)	1 serving				
15. Deep Yellow or orange(Peach, plums, etc..)	1 item				
16. strawberry	1 cup				
17. grapes	1 cup				
18. Others: Banana, medium /Apple, fresh, small	1 item				
19. Dried fruits: raisins (2 Tbsp), dates (2), apricots (4)	1 serving				
20. Fresh fruit juice	1 cup				
21. Fruit drinks: canned/bottled	1 cup				
Vegetables					
22. Salad – green: lettuce, celery, green peppers, cucumber	1 cup				
23. Dark green or deep yellow vegetables (e.g.: spinach, hindbeh,, carrots , …)	1 cup				

24. Tomatoes, fresh, medium	1 item				
25. Corn / green peas, cooked	1 cup				
26. potato, baked / boiled / mashed	1 item				
27. Squash, summer (kussa), Eggplant /cooked	1 cup				
28. Cauliflower/ Cabbage/ broccoli	1 cup				
29. Legumes: lentils, broad beans, chickpeas, etc., cooked	1 cup				
30. Nuts and seeds: peanuts, almonds, sunflower seeds, etc.	1 cup				
31. Red Meat	1 item (3 oz.)				
32. Poultry	1 item (3 oz.)				
33. Fish, (including Tuna)	1 serving (3 oz.)				
34. Eggs, whole, large	1 item				
35. Organ Meats(Liver, kidneys, brain)	1 cup				
36. Luncheon meats: Mortadell, Jambon, salami, turkey, etc.	1 slice (20g)				
37. Sausages, makanek, hot dogs	1 item (30g)				
Fats and oils					
38. Oil: corn / sunflower / soy/olive	1 Tbsp				
39. Olives	1 item				
40. Butter/ghee	1 Tbsp				
41. Mayonnaise	1 Tbsp				
Sweets &Desserts					
42. Cake, Cookies ,Donut, muffin, croissant	1 item				
43. Ice cream	1 cup				
44. Chocolate bar	1 item				
45. Sugar, , honey, jam, molasses	1 Tbsp				
46. Arabic sweets, baklawa, maamoul, Knefeh	1 item (40g)				
Beverages					
47. Soft drinks, regular (1 can = 1½ cup)	1½ cup (11 fl. oz)				
48. Soft drinks, diet (1 can = 1½ cup)	1½ cup (11 fl. oz)				
49. Turkish coffee (1 small cup = ¼ cup)	¼ cup (2 fl oz)				
50. Coffee/Nescafe or tea	1 cup				
51. Hot chocolate or cocoa	1 cup				
52. Beer, regular (1 can = 1½ cup)	1½ cup				
53. Wine: red, white, or blush	½ cup (4 fl. oz)				
54. Liquor: whiskey, vodka, gin, rum	1/6 cup (1.5 fl oz.)				
Miscellaneous					
55. Manaeesh, zaatar, cheese	1 large				
56. French fries	1 cup				
57. Chips: potato, corn, tortilla	1 cup				
58. Falafel sandwich, medium	1 item				
59. Chawarma sandwich, medium	1 item				
60. Burgers(Beef, chicken, fish)	1 item				
61. Pizza	1 slice				

Are there any other foods not mentioned above that you usually eat at least once per week?

Other foods that you usually eat at least once /week	Usual serving size	Servings/week

Appendix C

Background Questionnaire *(41 Q, 5 pages)*

Please check one box for each question where there are check boxes. If you do not wish to answer a question, please draw a line through it.

Medical history- I

1. **Have you been recently diagnosed by a doctor with a <u>mental illness other than depression</u> [for instance any of anxiety disorders, bipolar disorder, eating disorders, impulse control disorder (ADHD), substance abuse/ dependence (alcoholic, drug)]?**

هل عانيت مؤخرا بحسب تشخيص الطبيب المختص من أي إضطراب عقلي غير الكآبة ، (كالقلق، إضطراب المزاج، الخلل في الأكل ، الخلل في التحكم بالإندفاع، الإدمان على الأدوية أو الكحول)

☐No
☐Yes, Specify: _____

2. **Have you been diagnosed by a doctor with any of the following chronic medical conditions? (Check all applicable)**

☐Cardiovascular disease (أمراض القلب والشرايين)	☐Obesity (البدانة)
☐Stroke (السكتة الدماغي)	☐Cancer (السرطان)
☐Hypertension (إرتفاع ضغط الدم)	☐Neurological disease (multiple sclerosis…) (أمراض في الجهاز العصبي (التصلب اللويحي ...)
☐Diabetes (السكري)	☐Kidney disease (أمراض الكلى)
☐Hyperthyroidism (فرط نشاط الغدة الدرقية)	☐Cushing's syndrome
☐Obstructive sleep apnea (توقف التنفس أثناء النوم)	☐Adrenal gland disorders

3. **If your answer is yes to question # 2, have you been taking any medication?**
☐No
☐Yes, Specify name of medication:
_____

4. **Are you pregnant or breastfeeding?**
   ☐No ☐Yes

5. **Are you a professional athlete (لاعب رياضي محترف) who is following specific nutrition requirements (متطلبات تغذية محددة)?**
   ☐No ☐Yes

6. **Do you have any physical disability (إعاقة جسدية)?**
   ☐No
   ☐Yes, Specify: _____

Medical history- II

7. **Has any member of your family (parents, siblings) been diagnosed by a doctor with depression or any other mental illness (bipolar, schizophrenia…)?**

   هل يعاني أحد من أفراد العائلة (الأهل أو الأخوة) من مشاكل نفسية (إضطراب المزاج ، فصام...)

   ☐No
   ☐Yes, Specify: _____

8. **Have you been recently diagnosed by a doctor with <u>depression</u>?**

   هل عانيت مؤخرا من حالات كآبة بحسب تشخيص الطبيب المختص

   ☐No
   ☐Yes, Indicate if you have been taking any antidepressant medication?
   ☐No ☐Yes, Specify name of medication:
   _____

9. **Has any member of your family been diagnosed by a doctor with hypertension (high blood pressure)?**
   ☐No ☐Yes

10. **Has any member of your family been diagnosed by a doctor with heart disease?**
    ☐No ☐Yes

11. **Does your doctor measure your blood pressure during each health care encounter (visit)?**
    ☐No ☐Yes

Sociodemographic, plus anthropometric measurements

12. Gender:

☐Male ☐Female

13. Age: _____

14. Body weight (kg)/Height (cm)

REPORTED BY STUDENT	**MEASURED BY RESEARCHER**
Body weight (kg) _____	Body weight (kg) _____
Height (cm) _____	Height (cm) _____

15. Blood pressure measurement (mmHg): *(leave it empty)* _____

16. Waist circumference (cm): *(leave it empty)* _____

17. Body composition (total body fat %): *(leave it empty)* _____

18. Which faculty you are currently enrolled in?

☐Faculty of Architecture, Art & Design
☐Faculty of Business Administration & Economics
☐Faculty of Engineering
☐Faculty of Humanities
☐Faculty of Law & Political Science
☐Faculty of Natural & Applied Sciences
☐Faculty of Nursing & Health Sciences

Major_____

19. Class:

☐Sophomore ☐Junior ☐Senior

20. Cumulative GPA: _____

21. Marital status:

☐Single
☐Married
☐Separated
☐Divorced

22. Do you have children?

☐No

☐Yes, How many? _____

23. Do you currently have a job in addition to your studies?

☐No

☐Yes, Indicate if: ☐Part-time ☐Full-time

24. Where are you staying at present time?

☐With parents ☐Own apartment

☐In dormitories ☐Other

25. Annual Household Income (دخل الأسرة) (i.e. income generated by all adults in the household) in Lebanese pounds (If you do not know the exact income, please provide an estimate): ----------

Lifestyle questions

26. How many meals do you have per day?

☐One ☐Three

☐Two ☐Four or more

27. How often do you have your meals?

☐Often ☐Occasionally ☐Rarely

28. How often you have a breakfast?

☐Daily ☐Occasionally ☐Rarely

29. How often do you have your meals while watching TV during a week?

☐Often ☐Occasionally ☐Rarely

30. How many snacks (apart from regular meals) do you have per day?

☐One ☐Three

☐Two ☐Four or more

31. Have you been recently taking any dietary supplement (herbal supplements, weight loss pills, energy yielding supplements, vitamins and minerals, caffeine containing pills, etc.)?

☐No

☐Yes; Specify: _____

32. Have you been recently following a special diet (نظام غذائي خاص)?

☐No

☐Yes, Specify: _____

33. Do you have any of unhealthy eating behaviors [for instance binge eating (consumption of an abnormally large amount of food in a relatively short period of time), compulsive overeating (non-stop eating), extreme dieting...] in the past 3 months?

☐No

☐Yes; Specify: _____

34. Smoking habits

☐Non-smoker ☐Previous Smoker ☐Current smoker

35. Do you drink alcohol?

☐Occasionally ☐1-2 drinks per day

☐1-2 drinks per week ☐More than 2 drinks per day

36. Do you make yourself sick (throw up) because you feel uncomfortably full?

☐No ☐Yes

37. Do you worry you have lost control over how much you eat?

☐No ☐Yes

38. Have you recently lost more than one stone (6.35kg) in a 3 month period?

☐No ☐Yes

39. Do you believe yourself to be fat when others say you are too thin?

☐No ☐Yes

40. Would you say that food dominates your life?

☐No ☐Yes

Stressful life events

41. Have you had experienced any of the following stressful life events <u>during the past year</u> (check all applicable answers)?

☐Loss of parent(s) due to death ☐Serious conflicts with parents

☐Loss of a close family member due to ☐Serious financial difficulties

death

☐Loss of a close friend due to death

☐Taking care of a family member with physical disability

☐Parental divorce

☐Parental conflicts

☐Serious academic difficulties

☐Physical abuse (during a lifetime)

☐Sexual abuse (during a lifetime)

Thank you for taking the time to complete this survey.

Appendix D

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE (August 2002)

SHORT LAST 7 DAYS SELF-ADMINISTERED FORMAT

FOR USE WITH YOUNG AND MIDDLE-AGED ADULTS (15-69 years)

The International Physical Activity Questionnaires (IPAQ) comprises a set of 4 questionnaires.
Long (5 activity domains asked independently) and short (4 generic items) versions for use by
either telephone or self-administered methods are available. The purpose of the questionnaires
is to provide common instruments that can be used to obtain internationally comparable data on
health–related physical activity.

Background on IPAQ

The development of an international measure for physical activity commenced in Geneva in
1998 and was followed by extensive reliability and validity testing undertaken across 12
countries (14 sites) during 2000. The final results suggest that these measures have
acceptable measurement properties for use in many settings and in different languages, and are
suitable for national population-based prevalence studies of participation in physical activity.

Using IPAQ

Use of the IPAQ instruments for monitoring and research purposes is encouraged. It is
recommended that no changes be made to the order or wording of the questions as this will
affect the psychometric properties of the instruments.

Translation from English and Cultural Adaptation

Translation from English is supported to facilitate worldwide use of IPAQ. Information on the
availability of IPAQ in different languages can be obtained at www.ipaq.ki.se. If a new
translation is undertaken we highly recommend using the prescribed back translation methods
available on the IPAQ website. If possible please consider making your translated version of
IPAQ available to others by contributing it to the IPAQ website. Further details on translation
and cultural adaptation can be downloaded from the website.

Further Developments of IPAQ

International collaboration on IPAQ is on-going and an ***International Physical Activity Prevalence Study*** is in progress. For further information see the IPAQ website.

More Information

More detailed information on the IPAQ process and the research methods used in the

development of IPAQ instruments is available at www.ipaq.ki.se and Booth, M.L. (2000). *Assessment of Physical Activity: An International Perspective*. Research Quarterly for Exercise
and Sport, 71 (2): s114-20. Other scientific publications and presentations on the use of IPAQ
are summarized on the website.

SHORT LAST 7 DAYS SELF-ADMINISTERED version of the IPAQ. Revised August 2002.

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as
part of their everyday lives. The questions will ask you about the time you spent being
physically active in the **last 7 days**. Please answer each question even if you do not
consider yourself to be an active person. Please think about the activities you do at
work, as part of your house and yard work, to get from place to place, and in your spare
time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe
much harder than normal. Think *only* about those physical activities that you did for at
least 10 minutes at a time.

1. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, aerobics, or fast bicycling?

_____ **days per week**

No vigorous physical activities ***Skip to question 3***

2. How much time did you usually spend doing **vigorous** physical activities on one
of those days?

_____ **hours per day**

_____ **minutes per day**

☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

_____ **days per week**

No moderate physical activities ***Skip to question 5***

4. How much time did you usually spend doing **moderate** physical activities on one of those days?

_____ **hours per day**
_____ **minutes per day**
☐ Don't know/Not sure

Think about the time you spent **walking** in the **last 7 days**. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes
at a time?

_____ **days per week**
No walking ***Skip to question 7***

6. How much time did you usually spend **walking** on one of those days?

_____ **hours per day**
_____ **minutes per day**
☐ Don't know/Not sure

The last question is about the time you spent **sitting** on weekdays during the **last 7 days**. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the **last 7 days**, how much time did you spend **sitting** on a **week day**?

_____ **hours per day**
_____ **minutes per day**
☐ Don't know/Not sure

This is the end of the questionnaire, thank you for participating.