AMERICAN UNIVERSITY OF BEIRUT

ADHERENCE TO THE MEDITERRANEAN DIET AND RISK OF METABOLIC SYNDROME IN LEBANESE URBAN ADULTS

by
CHRISTELLE FADEL CORDAHI

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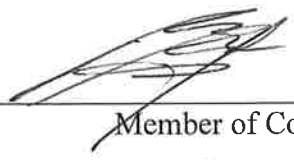
Approved by:

Dr. Lara Nasreddine, Associate Professor — Advisor
Nutrition and Food Sciences



Dr. Farah Naja, Associate Professor — Member of Committee
Nutrition and Food Sciences

Dr. Hani Tamim, Associate Professor — Member of Committee
Internal Medicine

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AN ABSTRACT OF THE THESIS OF

Christelle Fadel Cordahi for Master of Science
Major: Nutrition

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

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

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

95% CI = 0.234-0.788, p = .006) and 55% (OR = 0.453, 95% CI = 0.214-0.961, p = .039) lower prevalence of the MetS respectively.

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

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To My

Beloved Parents

CHAPTER I

INTRODUCTION

The Metabolic Syndrome (MetS) refers to a constellation of cardiometabolic risk factors that include central obesity, high blood pressure, raised plasma glucose and dyslipidemia (Anagnostis, 2012; Kaur, 2014). Other abnormalities, namely hypercoagulability, enhanced inflammatory state, nonalcoholic fatty liver disease (NAFLD), and sleep-disorders have also been associated with the syndrome, adding to the complexity of its pathophysiology (Kassi, Pervanidou, Kaltsas, & Chrousos, 2011). The MetS is a wide-reaching health issue that carries increased risk for Atherosclerotic Cardiovascular Disease (ASCVD) and type 2 diabetes (Grundy, 2008; Mottillo et al., 2010). Worldwide, the MetS has reached epidemic proportions and according to the International Diabetes Federation, approximately 25% of the world's population is afflicted with this syndrome (Alberti, Zimmet, Shaw, & Grundy, 2006). Recently, the MetS has been documented in high proportions in the Middle East, and Lebanon is no exception. According to Sibai *et al*. (2008), nearly one third of the adult Lebanese population has the MetS, with males being more affected than females.

The MetS and its individual metabolic abnormalities result from interactions between genetic and environmental factors (Arya et al., 2002; Branth et al., 2007; Mirmiran, Noori, & Azizi, 2008). Diet in particular, has been recognized as one of the main environmental determinants of the MetS (Andersen & Fernandez, 2013; Yamaoka & Tango, 2012) and several studies have underscored the importance of specific nutrients or food items in MetS development (Baudrand et al., 2014; Volek et al., 2009). The 'single nutrient' approach in analyzing the association between the MetS and

dietary factors could be flawed and there are multiple reasons for which examining dietary patterns and their relationship to diseases offers more advantages. Some of these reasons include investigating the collective effect of many nutrients and the synergistic interaction between them (Hu, 2002). Moreover, guidelines stemming from dietary patterns analyses are more accessible to the general public and thus easier to follow than recommendations resulting from a single food or a single nutrient approach (Jacques & Tucker, 2001).

Studying the impact of different dietary patterns on the MetS has come under scrutiny in the past years and mounting evidence suggests that a Mediterranean dietary pattern is associated with a reduced risk of MetS (Esposito, Kastorini, Panagiotakos, & Giugliano, 2013; Kastorini et al., 2011). The Mediterranean Diet (MD) is a cardioprotective dietary pattern (Widmer, Flammer, Lerman, & Lerman, 2015) common to all countries traditionally specialized in olive-tree planting and bordering the Mediterranean Sea (Willett et al., 1995). Although the diet has many facets and its definition may vary from one country to another, its core constituents remain the same (Noah & Truswell, 2001). The MD is regarded as a balanced dietary regimen loaded with plant-based foods such as cereals, nuts, and fresh fruits and vegetables. The Mediterranean-style diet is also characterized by a moderate intake of fish, eggs, and dairy products, with a reasonable consumption of red wine during meals, while featuring olive oil as the principal source of added fat (Willett et al., 1995). Greater adherence to a Mediterranean dietary pattern has been suggested to lower cardiovascular morbidity and mortality in studies originating from European countries of the Mediterranean basin (Garcia-Fernandez, Rico-Cabanas, Rosgaard, Estruch, & Bach-Faig, 2014; Sofi, Abbate, Gensini, & Casini, 2010). Many indices, stemming from Mediterranean European countries have in fact been put forward to assess

adherence to the MD (Schroder et al., 2011); these include the Greek Mediterranean Diet Score (MDS) (Trichopoulou et al., 1995), the 14-item MD assessment tool of the Spanish PREvencio´n con DIeta MEDiterra´nea (PREDIMED) trial (Martinez-Gonzalez et al., 2012), and the Italian Mediterranean Index (Agnoli et al., 2011). The Middle East and mostly Lebanon, lacked a standardized MD assessment tool until recently when Naja *et al*. (2014) developed a Lebanese index to measure adherence to the local MD (Naja et al., 2014).

Studies examining the association between adherence to the Mediterranean dietary pattern and cardiovascular risk are particularly scarce in countries of the Eastern Mediterranean region. The present study has two main objectives. First, it aims at assessing the prevalence of the MetS across gender in a cross-sectional sample of Lebanese adults living in Beirut. Second, the study aims at investigating the association of the adherence to the MD with MetS. Adherence to the MD is defined based on the use of two indices, namely the MDS (Trichopoulou et al., 1995) and the Lebanese Mediterranean Diet (LMD) score (Naja et al., 2014).

CHAPTER II

LITERATURE REVIEW

A. The Metabolic Syndrome

1. Historical Appraisal of the Metabolic Syndrome

The components of the MetS have been identified about two hundred and fifty years ago (Crepaldi & Maggi, 2006). Back in the 18th century, the Italian physician and anatomist Morgagni described in two medical letters, 'epistola anatomo clinica', the correlation between visceral obesity and other pathological findings such as hypertension, atherosclerosis, obstructive sleep apnea, and hyperuricemia (Enzi, Busetto, Inelmen, Coin, & Sergi, 2003). The concept of the MetS saw the light ninety years ago when a Swedish physician, Eskil Kylin, identified in 1920 a triad of metabolic disturbances known as the 'hypertension–hyperglycaemia–hyperuricaemia syndrome'(Sarafidis & Nilsson, 2006).

Since then, scientists have made significant strides in defining the MetS and understanding the role of insulin resistance as a backbone of its pathophysiology (Sarafidis & Nilsson, 2006). For instance, Himsworth (1936) established for the first time in 1936 the difference between insulin-sensitive and insulin-insensitive diabetes. A few years later Randle, Garland, Hales, and Newsholme (1963) also played a substantial role in explaining the mechanisms by which high levels of Non-Esterified Fatty Acids (NEFA) disrupt insulin sensitivity at the level of the muscle and the adipose tissue; a state they termed the 'Randle cycle'.

In 1947, a French physician, Vague (1956) identified sex differences in obesity and body fat distribution attributing the highest health risks, notably premature

atherosclerosis and diabetes, to the android-type obesity (Vague, 1996). Two decades later, Albrink and Meigs (1964) reinforced these observations by associating acquired obesity (during adult life) with hypertriglyceridemia and abnormal glucose tolerance.

From the 1960s onwards, the MetS became an important worldwide topic of scientific research. Several experts such as the French Camus and the Germans Mehnert and Kuhlmann gave the condition different diagnostic labels, namely the 'metabolic trisyndrome' and the 'syndrome of affluence' (Sarafidis & Nilsson, 2006), given that the word 'syndrome' has a Greek origin (sundromos) that signifies 'to run together'(Milici, 2010). At about the same time, Avogaro and Crepaldi defined the 'plurimetabolic syndrome' as the concurrent manifestation of the following observations: obesity, diabetes and dyslipidemia. These metabolic disorders were often found to increase the risk of Coronary Heart Disease (CHD) regardless of the presence or absence of hypertension (Manzato, Nosadini, & Crepaldi, 1993).

In addition to the above mentioned appellations, Reaven tagged the multifactorial MetS as the 'Syndrome X' (Milici, 2010). He reported that the resistance to insulin-mediated glucose uptake, with the consequent hyperinsulinemia, commonly goes hand in hand with impaired glucose homeostasis, lipid abnormalities, hypertension, and atherosclerotic cardiovascular disease (CVD). Therefore, the 'Syndrome X' was used as an umbrella term to cover the association of the aforementioned disturbances. Several years later, Reaven pointed out the several environmental risk factors for the syndrome, markedly obesity and physical activity. A sharp disagreement arose around the 'deadly quartet' of Kaplan, describing central adiposity as a critical feature of the syndrome (Reaven, 1993). Kaplan has in fact highlighted that glucose intolerance, high blood pressure and raised triglycerides levels gathered more frequently in individuals having excess central body fat. Because of its

detrimental effect on health, the constellation of the aforementioned three pathologies along with obesity was titled ‘the deadly quartet’ (Kaplan, 1989). Towards the beginning of the 90’s, insulin insensitivity resurfaced as the main culprit behind the MetS when scientists DeFronzo and Ferrannini, as well as Haffner referred to it by the name ‘Insulin Resistance Syndrome’(Sarafidis & Nilsson, 2006). Ever since, the pathophysiology of the MetS remained a subject of avid interest among many clinicians and researchers.

2. Definition of Metabolic Syndrome

Clinically, the MetS is a heterogenous disorder presenting with several distinct phenotypes, which explains why a myriad of definitions and diagnostic criteria have been assigned to identify it (Balkau, Valensi, Eschwège, & Slama, 2007). The three leading and most commonly used definitions are: The World Health Organization (WHO) description (Alberti & Zimmet, 1998), the Adult Treatment Panel III (ATPIII) Report ("Executive Summary of The Third Report of The National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, And Treatment of High Blood Cholesterol In Adults (Adult Treatment Panel III)," 2001), and the International Diabetes Federation (IDF) (Alberti, Zimmet, & Shaw, 2006). These definitions have some common characteristics but tend to diverge regarding the adopted cutoff values. In 1998, the WHO pioneered an ‘ABCDE’ methodology to define the MetS. In its report on the diagnosis and classification of diabetes mellitus, the WHO labeled the MetS as an assemblage of glucose insensitivity or overt diabetes and two or more of the following conditions: insulin resistance, high blood pressure (>160/90 mmHg), high triglyceride levels (>150 mg/dl) and/or low High-Density Lipoprotein (HDL) cholesterol (<35 mg/dl for men and >21 mg/dl for women), excess abdominal

body fat measured by elevated Waist to Hip Ratio (WHR) (>0.90 for males and >0.85 for females) or by increased Body Mass Index (BMI), and finally microalbuminuria, defined as a moderate increase in the level of urine albumin. It is worth mentioning that the latter clinical feature is not stated elsewhere (Alberti & Zimmet, 1998). Alternatively, the ATP III of the National Cholesterol Education Program (NCEP) divulged scientifically based recommendations on cholesterol detection and treatment in 2002 (Cleeman, Grundy, Becker, & Clark, 2001). The NCEP/ATP III definition differs from the WHO's description in that it places greater emphasis on central obesity defined by a waist circumference (WC) exceeding 102 cm for men and 88 cm for women (Alberti & Zimmet, 1998; Cleeman et al., 2001). Moreover, the NCEP/ATP III clearly stated that hypercoagulability, inflammation, and insulin resistance are indeed common characteristics of the MetS but they cannot be routinely screened for (Cleeman et al., 2001). In fact, using a clamp to assess insulin sensitivity was also judged by other parties such as the European Group for the study of Insulin Resistance (EGIR), to be impractical and unsuitable for day to day clinical use (Balkau & Charles, 1999). Despite several attempts by different associations to delineate and define the MetS, clinicians and epidemiologists still needed a concrete and unanimously recognized tool in order to standardize the diagnosis of the MetS (K. Alberti et al., 2006; Zimmet, Magliano, Matsuzawa, Alberti, & Shaw, 2005).

Accordingly in 2005; the IDF issued a new definition of the MetS, revolving mainly around android obesity and WC (Balkau et al., 2007; Zimmet et al., 2005) given that the latter is considered a better predictor of visceral fat accumulation than WHR (Pouliot et al., 1994). At about the same time, the new concept of Metabolically Obese Normal Weight (MONW) emerged and several experts reaffirmed the importance of relying on the WC in the diagnosis of the MetS. MONW individuals are those who fall

within the normal BMI range but still suffer from cardiometabolic risk factors making them candidates for the MetS (St-Onge, Janssen, & Heymsfield, 2004).

Interestingly, the IDF proposed ethnic-specific cutoffs for WC amongst Asians, Europids, Chinese, Japanese, Americans, Africans, and Middle East and Eastern Mediterranean populations (Zimmet et al., 2005). In 2009, the IDF and the American Heart Association/National Heart, Lung, and Blood Institute (AHA/NHLBI) developed a harmonized definition of the MetS (Alberti et al., 2009). According to the new definition, for an individual to be classified as having the MetS, he or she must present with any three of the five criteria listed in Table 1 (Alberti et al., 2009).

Table 1. International Diabetes Federation metabolic syndrome worldwide definition

Elevated waist circumference*	Population- and country-specific definitions
Elevated triglycerides (drug treatment for elevated triglycerides is an alternate indicator) †	≥150 mg/dL (1.7 mmol/L)
Reduced HDL-C (drug treatment for reduced HDL-C is an alternate indicator) †	< 40 mg/dL (1.0 mmol/L) in males and <50 mg/dL (1.3 mmol/L) in females
Elevated blood pressure (antihypertensive drug treatment in a patient with a history of hypertension is an alternate indicator)	systolic ≥ 130 and/or diastolic ≥ 85 mm Hg
Elevated fasting glucose ‡ (drug treatment of elevated glucose is an alternate indicator)	≥ 100 mg/dL

HDL-C indicates high-density lipoprotein cholesterol.
*It is recommended that the IDF cut points be used for non-Europeans and either the IDF or AHA/NHLBI cut points used for people of European origin until more data are available.
†The most commonly used drugs for elevated triglycerides and reduced HDL-C are fibrates and nicotinic acid. A patient taking 1 of these drugs can be presumed to have high triglycerides and low HDL-C. A high-dose of ω3 fatty acids presumes high triglycerides.
‡Most patients with type 2 diabetes mellitus will have the metabolic syndrome by the proposed criteria.
Source: Alberti, K.G., Eckel, R.H., Grundy, S.M., Zimmet, P.Z., Cleeman, J.I., Donato, K.A.,... Smith, S.C., Jr. (2009)." Harmonizing the metabolic syndrome: a joint interim statement of the International Diabetes Federation Task Force on Epidemiology and Prevention; National Heart, Lung, and Blood Institute; American Heart Association; World Heart Federation; International Atherosclerosis Society; and International Association for the Study of Obesity". *Circulation, 120*(16), 1640-1645.

3. Epidemiology of Metabolic Syndrome

Based on the Joint Statement that harmonized all definitions of the MetS, nearly 20% of the American adult population has been diagnosed with the syndrome in 2010 with ethnic/racial and gender disparities. Since 1999, the previously mentioned age-adjusted prevalence hasn't changed much while some of the syndrome's criteria have. For instance, there was a rise in the prevalence of both android obesity (measured by WC) and hyperglycemia, by 5% and 7% respectively in a decade. In parallel, the prevalence of hypertriglyceridemia, low HDL levels and hypertension dropped by at least 8% in the same time frame with a concomitant increased use of lipid lowering medications. Of all MetS components, central obesity was the most prevalent abnormality (56.1% for the total population in 2010) (Beltran-Sanchez, Harhay, Harhay, & McElligott, 2013).

In a review of ten studies carried on individuals from Latin-American countries, the weighted average age-standardized prevalence of MetS was found to be 28% according to ATP III definition (Marquez-Sandoval et al., 2011). It has also been shown that in Latin American countries (Brazil, Chile, Columbia, Peru, Puerto Rico, Venezuela, and Virgin Islands) except Mexico, the MetS primarily affected people over fifty years of age, while prevalence rates in younger populations have remained relatively low. Also notable are the low HDL levels that contributed significantly to the regional spread of the MetS. In this respect, most of the studies showed that females were more likely to have low levels of HDL cholesterol than their male counterparts (Marquez-Sandoval et al., 2011).

The MetS pandemic has also spread across Europe. In Norway, the age-specific prevalence of IDF-defined MetS for males was 29.0%. As for Norwegian females, 30.3% were diagnosed with the MetS (Hildrum, Mykletun, Hole, Midthjell, &

Dahl, 2007). Conversely, the prevalence of MetS among Spanish women as reported by Tauler *et al*. (2014) in a recent cross-sectional study was strikingly low. Based on the IDF criteria, 10.07% of females were diagnosed with the MetS and only 6.94% according to the ATP III standards (Tauler et al., 2014). On the other hand, the rates in males were higher using both criteria (21.39% with the ATP III and 16.46% with the IDF). Also, this study shed light on another aspect of the MetS, the premorbid metabolic syndrome (PMetS), a new concept that stems from the WHO classification. The PMetS meets all the criteria of the traditional metabolic syndrome except for pre-established diabetes and CVD. The discrepancy between the two definitions ultimately led to lower prevalence rates in the PMetS for both genders (Tauler et al., 2014). Along the countries of the Mediterranean Sea, Greece was also shown to have high MetS prevalence rates. As a matter of fact, a cross sectional study including 4153 Greek adults and conducted by Athyros *et al*. (2005), indicated that the age adjusted prevalence of the MetS was 23.6% as per the NCEP ATP- III descriptions. However, in another cross sectional study with a larger sample of 9669 Greek adults, the prevalence of MetS was estimated at 45.7% based on the IDF criterion (Athyros et al., 2010).

Recent studies have also suggested high rates of the MetS in the Middle East and the Arab world. According to NCEP ATP- III and IDF definition, Qatar and Iran have prevalence rates of MetS ranging between 26.5% and 37.4% (Bener, Zirie, Musallam, Khader, & Al-Hamaq, 2009; Delavari, Forouzanfar, Alikhani, Sharifian, & Kelishadi, 2009). Using the IDF definition, it has been suggested that almost half of the studied population in Abu Dhabi was diagnosed with the MetS, out of which 78.6% were diabetic (Hajat and Shather (2012).

Lebanon suffers as much as the rest of the Eastern Mediterranean countries from a high prevalence of MetS. According to Sibai *et al*. (2008) who relied on the IDF

criteria, approximately one third of Lebanese adults attending health care centers have the MetS. Similar findings were noted in a study by Naja *et al*. (2013) where the prevalence of MetS in Lebanese adults was 34.7% . Additionally, central obesity and low HDL-cholesterol rates were shown to be the leading risk factors and males were more likely than females to have the MetS (Sibai et al., 2008).

4. Pathophysiology of Metabolic Syndrome

Despite tremendous recent progress in the understanding of the pathophysiology of the MetS, this field of study remains in its infancy (Kassi et al., 2011). Nonetheless, central obesity has long been recognized as a major cause in the etiology of the MetS, thus its role in the first IDF definition as the main prerequisite in the identification of the syndrome (K. Alberti et al., 2006). In fact, obesity, and particularly abdominal obesity, has been linked to an inflammatory state that lies at the heart of the adiposity-induced insulin insensitivity (Emanuela et al., 2012). The fatty tissue is more than an ordinary reserve of fat and among the several theories that have been proposed in this regard, such as the activation of the immune system by abdominal fat, it has been hypothesized that the enlarged adipocytes are deprived of adequate oxygen supply. The latter mechanism stimulates the entry of macrophages and the subsequent release of adipocytokines notably TNFα and IL-6 which promote insulin resistance (Emanuela et al., 2012; Esser, Legrand-Poels, Piette, Scheen, & Paquot, 2014).

Moreover, subjects with excess visceral fat have low levels of plasma adiponectin (Di Chiara, Argano, Corrao, Scaglione, & Licata, 2012), an anti-inflammatory adipokine with insulin sensitizing properties (Kloting & Bluher, 2014). Unlike gynoid obesity, the android phenotype is characterized by an increased release of

free fatty acids (FFAs) that are delivered directly and at high rates to the liver via the portal vein leading to a multitude of negative consequences, particularly insulin insensitivity and disturbed endothelial function (Miles & Jensen, 2005). Endothelial dysfunction is accompanied by an impaired nitric oxide-mediated vasodilation that puts the individual at a greater risk of atherosclerotic vascular disease (Aizawa, Shoemaker, Overend, & Petrella, 2009) and hypertension (Emanuela et al., 2012). FFAs have also been shown to be responsible for the secretion of other deleterious substances such as plasminogen activator inhibitor-1 (PAI-1) an atherothrombotic marker (Kaur, 2014) involved in a two-way relationship with the metabolic syndrome. Indeed, there is mounting evidence that PAI-1 contributes to the development of the MetS by negatively affecting adipogenesis and insulin signaling pathways and increasing the risk for type 2 diabetes (Alessi & Juhan-Vague, 2006).

5. Impact on Health

The MetS increases the individual's risk for several serious health conditions, including NAFLD, CVD, diabetes, and cancer.

- *Metabolic syndrome and NAFLD.* NAFLD, recognized as "the hepatic component" of the MetS, includes a range of liver-related pathologies with nonalcoholic steatohepatitis (NASH) being the most detrimental condition (McCullough, 2011). Marchesini *et al*. (2003) emphasized the interrelationship between MetS and NAFLD by showing that 36% out of the 304 NAFLD patients had at least three components of the MetS. Moreover, 88% of patients diagnosed with NASH according to liver biopsies, had the MetS, the age, gender and sex adjusted OR attaining 3.2. In addition, hepatic insulin resistance accompanies NAFLD leading to increased liver glucose output and therefore high concentrations of plasma glucose (Vanni et al., 2010). In

turn, hyperglycemia triggers insulin secretion and hyperinsulinemia. The latter has been shown to stimulate sympathetic activity (Vollenweider et al., 1994) and sodium reabsorption (Ferrari & Weidmann, 1990) at the level of the kidney, both of which could potentially cause high blood pressure.

- *Metabolic Syndrome and CVD.* According to a systematic review and meta-analysis of eighty seven studies, the MetS is associated with a twofold increase in the risk of developing CVD, affecting women more than men (Mottillo et al., 2010). Menopause and polycystic ovary syndrome were among the many reasons explaining the stronger association in females (Mottillo et al., 2010). Atherogenic dyslipidemia, one of the major cardiometabolic abnormalities of the MetS, was also found to be independently and positively associated with higher cardiovascular risk in patients with MetS (Ginsberg & MacCallum, 2009). Atherogenic dyslipidemia is defined by elevated levels of triglycerides (TG) and small-dense low-density lipoprotein and low levels of high-density lipoprotein cholesterol (HDL-C) (Grundy, 2006; Kathiresan et al., 2006).

- *Metabolic Syndrome and Diabetes***.** It has long been established that MetS, irrespective of the diagnostic criteria used, predicts increased risk of diabetes mellitus type 2 with a relative risk (RR) ranging between 3.5 and 5.2 (Ford, Li, & Sattar, 2008). Several theories analyzing the different constituents of the MetS, have been postulated to explain this solid association, and many emphasized the impact of abdominal obesity on fasting plasma glucose levels (FPG) (Ford et al., 2008). A cohort sub study of the Framingham Offspring Study reported that metabolic syndrome patients having impaired fasting glucose (IFG) had a very high risk of developing diabetes mellitus type 2 with a RR of 11. Contrastingly, subjects without IFG manifested a lower type 2 diabetes risk with a RR of 5 (Wilson, D'Agostino, Parise, Sullivan, & Meigs, 2005).

- *Metabolic Syndrome and Cancer.* A meta-analyses of prospective cohort

studies stated that the risk of certain cancers are amplified in the presence of MetS; the highest associations were for liver cancer in men with a RR of 1.43 and postmenopausal breast cancer in women with a RR of 1.61 (Esposito, Chiodini, Colao, Lenzi, & Giugliano, 2012). Interestingly, obesity and the subsequent hyperinsulinemia were found to be one of the main culprits behind these associations. In fact, elevated insulin levels result in the accumulation of free insulin growth factor-1 (IGF-1), a molecule involved in obesity-related tumorigenesis (Renehan, Frystyk, & Flyvbjerg, 2006).

6. Environmental Risk Factors for the Metabolic Syndrome

- *Diet and metabolic syndrome.* The growing overweight and obesity rate among adults is raising serious public health concerns about the burdens of NCDs and its risk factors including the MetS. Obesity prevalence has risen drastically over the past thirty three years in several affluent countries mainly USA, UK, and Australia and the following countries account for more than half of the world's obese population: USA, China, India, Russia, Brazil, Mexico, Egypt, Germany, Pakistan, and Indonesia (Ng et al., 2014). In addition, according to a trend analysis conducted by Nasreddine, Naja, Chamieh, et al. (2012), that investigated the variations in overweight and obesity prevalence in Lebanon between 1997 and 2009, the Lebanese population witnessed a dramatic and worrying rise in obesity rates. An identical trend was seen in other countries from the Eastern Mediterranean region such as Iran (Esteghamati et al., 2010), Saudi Arabia (Al-Baghli et al., 2008) and Kuwait (Al-Kandari, 2006).

Obesity prevalence has also risen drastically over the past thirty three years in several affluent countries mainly USA, UK, and Australia and the following countries account for more than half of the world's obese population: USA, China, India, Russia, Brazil, Mexico, Egypt, Germany, Pakistan, and Indonesia. (Ng et al., 2014). Dietary

shifts and changes in food consumption patterns have occurred in most countries of the region, with the adoption of a Westernized diet and lifestle. For instance, the consumption of high fructose corn syrup (HFCS), a sweetener widely used in sugar sweetened beverages and other processed foods as an alternative to sucrose was reported to increase during the past three decades which may have important implications for obesity epidemic and the MetS (Ferder, Ferder, & Inserra, 2010). In human and animal studies, HFCS has been found to favor the growth of visceral fat and to stimulate hepatic de novo lipogenesis (DNL) (Malik et al., 2010). In the liver, fructose bypasses the highly regulated steps of glycolysis catalyzed by phosphofructokinase, which is usually inhibited by increasing concentrations of its byproducts (Stanhope et al., 2009). Instead, fructose enters the pathway at a level that is not regulated and results in unlimited production of lipogenesis byproducts (Stanhope et al., 2009) leading to the development of the atherogenic lipid triad: low HDL, elevated triglycerides and small dense LDL levels (Malik et al., 2010). Compelling evidence also shows that HFCS has been linked to a higher risk for type 2 diabetes and increases in HFCS consumption were in fact mirrored by increases in the prevalence of diabetes (Goran, Ulijaszek, & Ventura, 2013). In this regard, a recent review by Dekker, Su, Baker, Rutledge, and Adeli (2010) highlighted again the detrimental implication of fructose on the MetS and its components, where fructose-induced insulin insensitivity was illustrated as the root cause. Fructose-induced insulin resistance at the level of the muscle and the liver, due to accumulation of central fat and the subsequent high concentrations of NEFA in the bloodstream, is a major risk factor for the MetS, diabetes type 2 and CVD (Rutledge & Adeli, 2007). Moreover, fructose, sucrose, and glucose have been shown to directly decrease the activity of delta 6 and delta 5 desaturases, enzymes participating in the formation of Arachidonic Acid (AA), eicosapentaenoic

acid (EPA) and docosahexaenoic acid (DHA) (Corpeleijn et al., 2006; Das, 2006; Wang et al., 2006). Low plasma levels of the aforementioned fatty acids may increase an individual's risk for developing IR and the MetS (Das, 2005, 2010). Saturated Fatty Acids (SFA) also play a pivotal role in the development of insulin resistance and thus MetS. Glass and Olefsky (2012) showed that SFA indirectly stimulate the toll-like receptor (TLR) 4 signaling pathway which in turn activates c-Jun N-terminal kinase (JNK) and IκB kinase (IKK). JNK and IKK activation leads to serine phosphorylation of insulin receptor substrate-1 (IRS-1) and the production of inflammatory cytokines, both of which inhibit insulin signaling (Glass & Olefsky, 2012). High salt intake was also found to be associated with MetS as well as with mechanisms leading to the MetS namely insulin resistance and increased concentrations of urine glucocorticoid metabolites, suggesting an additive mechanism in the pathogenesis of the MetS (Baudrand et al., 2014).

The 'single nutrient' approach in analyzing the association between the MetS and dietary factors could be flawed and there are multiple reasons for which examining dietary patterns and their relationship to diseases offers more advantages. Some of these reasons include investigating the collective effect of many nutrients and the synergistic interaction between them (Hu, 2002). Moreover, guidelines stemming from dietary patterns analyses are more accessible to the general public and thus easier to follow than recommendations resulting from a single food or a single nutrient approach (Jacques & Tucker, 2001).

According to the "Atherosclerosis Risk in Communities" prospective study, the Western diet consisting of processed and fried foods, refined grains, and red meat, increases the risk of developing the Mets by 18% (Lutsey, Steffen, & Stevens, 2008). Moreover, a recent study by Naja *et al*. (2013) reported that the fast food/dessert dietary

pattern that resembles the Western pattern is positively associated with impaired glucose metabolism and MetS in a sample of Lebanese adults. A study comparing the impact of a vegetarian and a nonvegetarian diet on metabolic risk factors and the prevalence of the MetS, showed that consuming red meat and chicken more than once a month conferred a higher risk of metabolic syndrome reaching 39.7% (Rizzo, Sabate, Jaceldo-Siegl, & Fraser, 2011).

- *Lifestyle and metabolic syndrome.* Epidemiological studies showed that being sedentary and watching TV for prolonged periods of time may actually increase the risk of MetS and its 'intermediate risk factors' thus leading to increased risk of cardiovascular disease and diabetes. The negative consequence of sedentarity such as TV viewing was shown to be independent of the level of exercise (Bertrais et al., 2005). It has also been consistently shown that physical inactivity and the MetS are indeed positively correlated. A recent study reported that walking regularly for 60 to 300 minutes per day, decreases the incidence of MetS by 29% (Najafian, Mohammadifard, Naeini, & Nouri, 2014) .

- *Socioeconomic status and metabolic syndrome.* A review by Darmon and Drewnowski (2008) supports a link between the unhealthy dietary patterns consisting of foods high in energy, fat and sugar and poor in nutrients, with a lower socioeconomic status (SES). Less fortunate individuals with lower educational levels and those earning low wages tend to be less health-oriented and suffer from higher obesity rates than their wealthier counterparts (Darmon & Drewnowski, 2008). These findings were further validated in the Lebanese context where the crowding index, reflecting the mean number of residents per room, correlated with the unhealthy fast food/dessert dietary pattern and subsequently with the MetS and its comorbidities (Naja et al., 2013).

B. The Mediterranean Diet

1. History of the Mediterranean Diet

The Mediterranean Diet (MD) is not a novel concept. In 1952, the American scientist Ancel Keys led sixteen subcohorts, five of which were conducted in countries from the Mediterranean basin; his main interest was to examine the relationship between diet and the risk of ischemic heart disease (Altomare et al., 2013; Trichopoulou & Lagiou, 1997). Keys concluded that Mediterranean populations exhibited a healthier cardiometabolic profile characterized by lower CHD and mortality patterns. He attributed these observations to the lower intake of SFA (Trichopoulou & Lagiou, 1997) and the higher reliance on plant-based foods in these populations (Altomare et al., 2013). Few years later, in 1963, the European Atomic Energy Commission (EURATOM) performed a two year study in the north and south of Europe in order to quantify the intake of radioactive nuclides (Ferro-Luzzi & Branca, 1995). This study has also offered additional comparative data regarding food consumption patterns in the Mediterranean area as well as other parts of Europe (Nestle, 1995). One of the most striking differences observed between the North and South of Europe, pertained to the consumption of animal-based foods among the northern population. Conversely, the southern group's diet consisted mainly of cereals, fruits, vegetables, herbs and fish. Moreover, the southern Mediterranean population emphasized olive oil as the main source of added fat as opposed to their northern counterpart who consumed mainly butter and lard in addition to other types of vegetable oil (Ferro-Luzzi & Branca, 1995). The protective effects of the MD on CHD have fueled scientific interest in this dietary pattern. In 2010, the United Nations Educational, Scientific and Cultural Organization (UNESCO) recognized it as an Intangible Cultural Heritage of Humanity ("Lists of intangible cultural heritage and Register of best safeguarding practices" 2010.).

2. Definition and Scores

Countries bordering the Mediterranean Sea and adopting the MD are those traditionally specialized in olive-tree planting such as Greece, Italy, Spain, Tunisia, Turkey, Lebanon, Syria, and some regions in France (Willett et al., 1995). These countries are diverse and each one holds its own culture, ethnic origin, tradition, and economic system.

In a review by Noah and Truswell (2001), the authors categorized the Mediterranean countries into four clusters based on their predominant dietary patterns. The four groups were the following: the Western group comprising Spain, France, Italy and Malta, the Adriatic group including Croatia, Bosnia, and Albania, the Eastern group involving Greece, Lebanon, Cyprus, Turkey, and Egypt, and the North African group consisting of Libya, Algeria, Morocco, and Tunisia. Despite the fact that these clusters have their own food customs and cuisines, they all gather under the umbrella term of the 'Mediterranean Diet'. The consumption of the foods belonging to the different groups of the MD differs not only from one country to another as mentioned earlier but also between regions of the same country (Noah & Truswell, 2001). Therefore, there is no one typical MD and its characteristics do vary from one nation to another across the Mediterranean basin, but the core remains the same (Noah & Truswell, 2001). In fact, the MD is loaded with homegrown cultivated plant-based foods (vegetables, whole grain breads and cereals, and fresh fruits as dessert) and healthy fats mainly Monounsaturated Fatty Acids (MUFA) from olive oil. The MD is also characterized by a moderate intake of eggs and dairy products, a reasonable consumption of red wine, and an occasional intake of simple sugars in the form of sweets. Concerning meats and sea food, the MD advocates a higher fish and poultry consumption as compared to red meat (Willett et al., 1995). The MD is regarded as a healthy and balanced dietary

regimen that incorporates an optimal proportion between carbohydrates, fats and proteins, but mostly a low intake of SFA contributing to less than 7% to 8% of the total daily energy intake (Garcia-Fernandez et al., 2014; Willett et al., 1995). The diet is also rich in antioxidants, fiber and low glycemic index foods, all of which confer protection against many diseases referred to as 'cardiodiabesity' (Garcia-Fernandez et al., 2014).

Throughout the years, many indices have been put forward to assess adherence to the MD (Schroder et al., 2011). The traditional Greek MDS elaborated by Trichopoulou *et al*. (1995) is the most widely used. The index is made up of eight elements: an elevated ratio of monounsaturated lipids to saturated lipids, a moderate ethanol intake, a high intake of legumes, a high consumption of cereals such as bread and potatoes, a high fruit intake, a high vegetable intake, a low consumption of meat and meat products, and a moderate intake of milk and dairies (Bach et al., 2007; Trichopoulou et al., 1995). The intake of the eight food groups is expressed in grams per day and a value of 0 or 1 is allocated to each constituent according to the sex-specific median of each. For olive oil, fruits, vegetables, legumes, and cereals, one point is assigned each time the consumption of the respective food group was equivalent or above the respective sample median. Whereas if the consumption of meat, chicken, and full fat milk and dairy products was equal to or higher than the sample median of each, no points are given. Alcohol intake is also scored based on a gender specific classification. Men and women, whose consumption fell in the range of 10 to 50g/day and 5 to 25g/day respectively, are allotted one point. The final score was determined by adding up all the points earned by the individual and vary between 0 and 8 where 8 represents maximal compliance with the MD (Bach et al., 2007; Trichopoulou, Costacou, Bamia, & Trichopoulos, 2003; Trichopoulou et al., 1995). Due to fluctuations in energy consumption, dietary analyses are adjusted for total energy intake

and standardized to 2500 kcal in males and 2000 kcal in women (Bach et al., 2007). The MDS was further reviewed and edited to comprise fish consumption as a ninth component (Trichopoulou et al., 2003).

The PREDIMED study, a large Spanish cohort study including 7447 participants with an unfavorable cardiovascular risk profile, used a short questionnaire of 14 criteria to evaluate adherence to the MD (Table 2). Each criterion was worth one point (Martinez-Gonzalez et al., 2012). The PREDIMED survey was derived from a former nine, food item questionnaire designed to quantitatively study the link between the MD and Myocardial Infarction (MI). The short questionnaire originated from a previously validated FFQ and included nine recognized heart-healthy foods (Martinez-Gonzalez, Fernandez-Jarne, Serrano-Martinez, Wright, & Gomez-Gracia, 2004).

Agnoli *et al*. (2011) constructed an Italian Mediterranean Index comprising eleven food constituents out of which six were typical Mediterranean food components (fruits, leafy vegetables and tomatoes, legumes, olive oil, fish, onion, and garlic) and four "non-Mediterranean" food components that are not typically part of the Mediterranean cuisine ("soft drink, butter, red meat, and potatoes"). Alcohol was the eleventh food item. A value of 1 was assigned to individuals whose intake of Mediterranean food components was among the highest tertile and to those whose intake of "non-Mediterranean" food components was among the lowest tertile. As for ethanol, persons consuming no more than 12 g per day scored one point; those who refrained from alcohol or ingested more than the previously mentioned threshold scored zero points (Agnoli et al., 2011).

Table 2. PREDIMED short questionnaire to assess adherence to the MeDiet

Questions	Criteria for 1 point
1. Do you use olive oil as main culinary fat?	Yes
2. How much olive oil do you consume in a given day (including oil used for frying, salads, out-of-house meals, etc.)?	≥ 4 tbsp
3. How many vegetable servings do you consume per day? [1 serving: 200 g (consider side dishes as half a serving)]	≥ 2 (≥ 1 portion raw or as a salad)
4. How many fruit units (including natural fruit juices) do you consume per day?	≥ 3
5. How many servings of red meat, hamburger or meat products (ham, sausage, etc.) do you consume per day?	< 1
6. How many servings of butter, margarine, or cream do you consume per day? (1 serving: 12 g)	< 1
7. How many sweetened and/or carbonated beverages do you drink per day?	< 1
8. How much wine do you drink per week?	≥ 7 glasses
9. How many servings of legumes do you consume per week? (1 serving: 150 g)	≥ 3
10. How many servings of fish or shellfish do you consume per week? (1 serving 100–150 g of fish or 4–5 units or 200 g of shellfish)	≥ 3
11. How many times per week do you consume commercial sweets or pastries (not homemade), such as cakes, cookies, biscuits or custard?	< 3
12. How many servings of nuts (including peanuts) do you consume per week? (1 serving 30 g)	≥ 1
13. Do you preferentially consume chicken, turkey or rabbit meat instead of veal, pork, hamburger	Yes
14. How many times per week do you consume vegetables, pasta, rice or other dishes seasoned with sofrito (sauce made with tomato and onion, leek or garlic and simmered with olive oil)?	≥ 2

Source: Martinez-Gonzalez, M.A., Corella, D., Salas-Salvado, J., Ros, E., Covas, M.I., Fiol, M., . . . Investigators, Predimed Study. (2012). "Cohort profile: design and methods of the PREDIMED study". *Int J Epidemiol*. 41(2), 377-385.

On the other hand, the Middle East, and particularly Lebanon, lacked a standardized Mediterranean diet assessment tool. The latter was crucial for comparing compliance with the MD, between European and Middle Eastern countries of the

Mediterranean Sea (Naja et al., 2014). Therefore, Naja *et al*. (2014) developed a Lebanese index to assess adherence to the MD. The index was based on nine characteristic foods of the traditional Lebanese pattern including: "fruits, vegetables, legumes, olive oil, burghol (crushed whole wheat), milk and dairy products, starchy vegetables (including potato, corn and peas), dried fruits and eggs." Consumption data of each of these nine foods/food groups were divided into tertiles and a value of 1, 2, and 3 was assigned to the first, second and third tertiles of consumption, respectively. The final scored ranged between 9 (minimal adherence) and 27 (maximal adherence) (Naja et al., 2014).

3. Impact on Health

- *Mediterranean diet and cancer.* The Greek European Prospective Study into Cancer and Nutrition (EPIC) study, a prospective cohort covering ten European countries, indicated that a greater compliance with the MD significantly reduced overall cancer risk and mostly cancers associated with smoking including but not limited to lung, kidney, upper Gastro Intestinal tract, and colon cancer (Couto et al., 2011). A modified version of the MDS was used for assessing adherence to the MD. The main food categories believed to be responsible for this beneficial effect included: fruits and vegetables, nuts, cereals, and a high proportion of unsaturated to saturated fats (Couto et al., 2011). Moreover, Li *et al*. (2014) demonstrated that the higher the Alternate Mediterranean Diet (aMED) score the lower the risk of Head and Neck Cancer (HNC) in both males and females. The advantageous effects of light alcohol drinking, a feature of the MD, have also been studied and Tramacere *et al*. (2012) showed that moderate ethanol consumption protected from Hodgkin lymphoma (HL) via an unclear process. The overall RR for HL among light drinkers consuming one drink or less per day, as

opposed to non-drinker was 0.71 and the overall RR for moderate to heavy drinkers consuming more than one drink daily compared to their non-drinkers counterparts was 0.73 (Tramacere et al., 2012).

Several explanations have been proposed to elucidate the link between MD and protective effects against cancer and recent studies indicated that the MD has the potential to enhance the defense against oxidative stress (Azzini *et al*. 2011), a biological mechanism implicated in the multiple steps of carcinogenesis such as tumor promotion and progression (Terlizzi, Casolaro, Pinto and Sorrentino 2014).

- *Mediterranean diet and degenerative nerve diseases.* The MD has been linked to a decrease in the risk of a variety of neurological disorders. Recent systematic reviews showed that a greater compliance with the MD may be positively associated with cognitive function and negatively associated with the risk of Alzheimer (Lourida et al., 2013) (Singh et al., 2014). A number of mechanisms and food components have been proposed to account for such associations. Adherence to the MD has been suggested to decrease plasma concentrations of C-reactive protein (Chrysohoou, Panagiotakos, Pitsavos, Das, & Stefanadis, 2004), a general indicator of inflammation involved in the pathogenesis of Alzheimer's disease (Gupta et al., 2005). Abuznait, Qosa, Busnena, El Sayed, and Kaddoumi (2013) explored the beneficial effects of oleocanthal, a phenolic ingredient found in extra virgin olive oil, on nerve cells. The authors concluded that the previously mentioned compound stimulated the elimination of the toxic β-amyloid from the brain thus lowering the risk of developing Alzheimer. Furthermore, Roberts *et al*. (2010) have shown that an optimal ratio of unsaturated fatty acids (MUFA and PUFA) to SFA, a high consumption of vegetables on a daily basis, and a moderate intake of ethanol may also contribute to the favorable effects of the MD on Mild Cognitive Impairment (MCI) that precedes dementia.

- *Mediterranean diet and kidney disease***.** The ATTICA, an epidemiological study using a random sample of 3042 healthy participants, revealed that individuals following the MD had a higher creatinine clearance rate. The study also found that with a greater compliance to the MD, the concentrations of urea and creatinine were lower (Chrysohoou et al., 2010). In a report from the Dietary Intervention Randomized Controlled Trial (DIRECT) study, 318 participants were randomly assigned to three different weight loss dietary approaches: a low fat diet restricted in calories, a low carbohydrate diet non-restricted in calories, and an energy restricted MD. The three diet strategies ameliorated kidney function and increased estimated glomerular filtration rate to the same extent (Tirosh et al., 2013).

4. Mediterranean Diet and Metabolic Syndrome Components

- *The link.* Mounting evidence from cross-sectional and prospective studies and clinical trials suggested that a Mediterranean dietary pattern is associated with a reduced risk of MetS (Esposito et al., 2013) (Kastorini et al., 2011). A high intake of legumes, the consumption of olive oil, and moderate wine drinking were the key elements of the MD behind this inverse relationship (Babio et al., 2009). However, a MD supplemented with mixed nuts (walnuts, hazelnuts, and almonds) has been shown to exert a significantly greater protective effect against MetS as compared to a MD supplemented with virgin olive oil (Salas-Salvado et al., 2008).

- *Mediterranean diet and obesity.* Visceral fat has been shown to play a critical role in the pathophysiology of MetS and many researchers examined the beneficial effects of the MD on central obesity as a key component of MetS (Hajer, van Haeften, & Visseren, 2008). A cross-sectional study involving 497,308 adult participants recruited from across 10 European countries, proved that the MD assessed

by the modified MDS, an alternative of the traditional MDS, was inversely and significantly associated with WC after adjustment for BMI; the association being more pronounced in men (Romaguera et al., 2009). While similar findings were noted in rural areas of Lebanon, the results were more noticeable in women (Issa et al., 2011). In fact, a 2-unit rise in the composite Mediterranean (MED) score was associated with a 2.77cm drop in WC in men and 4.66cm in women. Likewise, the relationship between the composite MED and BMI followed the same trend where a 2-unit rise in the composite Mediterranean (MED) score was associated with a 0.510 kg/m^2drop in BMI in men and 0.784 kg/m^2 in women (Issa et al., 2011). The MD emphasizes eating primarily plant-based foods such as fruits and vegetables, whole grain products, and legumes and nuts, which might play an important anti-obesity role because of their fiber content (Buckland, Bach, & Serra-Majem, 2008; Schroder, 2007). Dietary fibers enhance satiety and satiation via several routes namely, promoting chewing and stimulating the release of gastrointestinal satiety peptides such as cholecystokinin. A high intake of MUFA in the form of olive oil as advocated in the MD had the same positive impact on weight management (Schroder, 2007). Piers, Walker, Stoney, Soares, and O'Dea (2003) led a randomized crossover study where 8 overweight or obese participants underwent two diets for a month each, to investigate the impact of MUFA versus SFA on body composition and weight. Evidence showed that replacing SFA with MUFA induced weight loss and decreased fat mass mainly in the abdominal region (Piers et al., 2003).

- *Mediterranean diet and diabetes.* The MD has been reported to improve indices related to glycemic control among diabetic patients. In a cross-sectional analysis, glycosylated hemoglobin was significantly and inversely linked to the MDS and two of its components: the daily consumption of unrefined cereals and the ratio of

MUFA to SFA (Esposito, Maiorino, Di Palo, & Giugliano, 2009). In another study, diabetic subjects with a mean HbA1c of 7.1% followed a calorically unrestricted MD for 3 months (Itsiopoulos et al., 2011). At the end of the 12 week period, the participants witnessed a significant decrease in their HbA1c level, which was reported to decrease from 7.1% to 6.8% (Itsiopoulos et al., 2011).

- *Mediterranean diet and CVD.* Many studies have been conducted association between adherence to the MD and CVD risk factors namely, high blood pressure and hyperlipidemia, in healthy patients and those at high cardiovascular risk (Gotsis et al., 2015). A meta-analysis of 9 Randomized Control Trials (RCT) including patients with established type 2 Diabetes Mellitus (T2D), assessed the effect of high adherence to the MD versus a control diet on cardiovascular risk factors. The Mediterranean style diet appeared to be effective in reducing not only markers of glycemic control in diabetes but also total cholesterol (mean difference: − 0.14 mmol/l; 95% CI: − 0.19 to − 0.09) and triglyceride (−0.29 mmol/l; CI: − 0.47 to − 0.10) concentrations. Likewise, HDL levels, and Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (SBP) were significantly improved (Huo et al., 2014). The favorable effects of the MD on CVD risk go beyond lipid lowering. Chrysohoou *et al*. (2004) demonstrated that adherence to the MD was significantly associated with lower concentrations of the following biochemical markers of thrombosis and inflammation: fibrinogen, Interleukin 6 (IL-6), homocysteine, and CRP.

CHAPTER III

MATERIALS AND METHODS

A. Study Population

A population-based cross-sectional study nested in an observational cross-sectional study ("Assessment of BPA levels and their association with the health status among the Lebanese population") was conducted in Beirut, Lebanon. A random sample of 501 adult Lebanese subjects residing in Greater Beirut was selected through the support of "Information International S.A.L" which is a research and consultancy firm based in Beirut - Lebanon. The inclusion and exclusion criteria considered for this study were as follows:

- Inclusion:
    - Lebanese, residing in Greater Beirut
    - Age > 18 years
- Exclusion:
    - Plastic or chemical factory workers
    - Pregnant women
    - Dialysis patients
    - Individuals with mental disabilities

The random selection of the study participants was based on a multistage probability sampling, where the strata were the districts of Central Administrative Beirut in addition to areas in the districts of Chouf, Aley, Baabda, Metn and Keserwan. The second stage included the selection of neighborhoods within each of the selected areas in a way to represent the make-up of the areas, then selecting households based on

a systematic random sample in each selected neighborhood according to the estimated number of buildings in the neighborhood, and finally sampling a primary respondent within each household based on the most recent birthday.

The interviewer asked about the total number of adults aged 18 years and over living in the household, and chose the one with the most recent birthday (at the date of the interview) to be the main respondent (excluding pregnant and lactating women as well as residents with mental disabilities). If the selected person was not at home, one follow-up was conducted before declaring a non-response. This method ensured that everyone had an equal chance of inclusion, with no one allowed to self-select into the sample. The name, date of birth, availability on week days and telephone number of the potential participant were recorded for further follow up to specify the exact dates for taking them to AUB.

The study protocol was approved by the Institutional Review Board of the American University of Beirut. All participants provided written informed consent (Appendix I and Appendix II) prior to the initiation of the study and had the right to withdraw from participation at any time.

B. Data Collection

A total of 501 participants, based on a rate of 10 participants per working day over 5 working days per week (Monday through Friday), excluding official holidays, were invited to visit AUB to participate in the study. Subjects were instructed to fast overnight and those on regular medication were requested to bring their medications with them when visiting AUB on the assigned date. Data collection took place at the Department of Nutrition and Food Sciences (NFSC) in the Faculty of Agricultural and Food Sciences at AUB. Exhaustive "data collection forms" (Appendix III) were filled

for each candidate through one to one interviews, physical examination, and blood tests.

1. Demographic, Socio-Economic Status and Lifestyle Information

The sociodemographic and lifestyle questionnaire inquired about information regarding age (continuous in years), gender, monthly income (expressed in U.S dollars), marital status, education, smoking status and pattern, alcohol and coffee intake, physical activity (vigorous physical activity including activities such as heavy lifting, aerobics, or fast bicycling; moderate physical activity similar to carrying light loads, bicycling at a regular pace, or tennis; and walking), family and personal medical history (coronary artery disease, hypertension, diabetes mellitus, dyslipidemia, thyroid disease, cancer).

2. Anthropometric Measurements

Anthropometric measurements including weight, height, waist circumference (WC), and percent body fat were obtained with the participants wearing light clothing and barefoot or in stocking feet. All measures were taken by trained personnel and according to standardized procedures (Lee and Nieman 2009; "National Institutes of Health, National Heart, Lung, and Blood Institute (NHLBI)," n.d.; International Society for the Advancement of Kinanthropometry 2006; Biospace Co. InBody 230 User's Manual 1996-2006).

- *Weight and height.* Body weight (kg) was measured to the nearest 0.1 kg using a calibrated body composition analyzer (Inbody 3.0, Biospace Co. Ltd, Korea). Standing body height (cm) was measured to the nearest 0.5 cm with a portable wall stadiometer (Seca 213, Germany). The candidates were completely aligned and flat against the measuring board, their shoulders were relaxed, and their upper arms were hanging freely by the sides. BMI was calculated as weight divided by height squared

(kg/m2).

- *Waist circumference.* WC was measured using a plastic, inelastic measuring tape to the nearest 0.5cm (Seca 201, Germany). After locating the upper hip bone and the right superior border of the ilium, the tape was placed around the abdomen, parallel to the ground, at the level of the iliac crest, and without exerting pressure on the skin. Measurements were made following a normal expiration and in duplicate. The mean of the two values was calculated and used.

- *Body fat.* Body fat was estimated using the Bioelectrical Impedance Analysis (BIA) technique (Inbody 3.0, Biospace Co. Ltd, Alpha-Tec s.a.r.l.).

3. Dietary Intake Assessment

Dietary habits were assessed in an interview setting by trained dietitians by means of an 86-item, semi-quantitative, and culture specific food frequency questionnaire (FFQ) (Appendix III). The FFQ surveyed the food intake of the last 12 months before the interview. The reference portion for each food item represented one standard serving expressed in household measures (cups, spoons and plates) and/or customary packing size. In order to assist in quantifying the reference portion size, the standard two-dimensional food portion visual chart was also used (Posner et al., 1992). This chart has been developed by Nutrition Consulting Enterprises and validated for use amongst adult men and women aged 20 to 70+ years as part of the Framingham Heart Study (Posner et al., 1992). A database application using Microsoft Access (Microsoft Corp., Redmond, WA, USA) was developed for the purpose of this study and used for data entry. The devised analysis module permitted to group food items into 16 categories and to determine mean consumption values per food item and per food group (g/day), average daily intake per individual, per sex group (g/day) and per age group

(g/day), and the percentage of consumers per food item and per food group. Nutritionist Pro software, version 1.2, was used to estimate the intakes of energy and macronutrients. In order to estimate the energy and macronutrient values of traditional food items not included in the above mentioned database, recipes were added based on a local cookbook (Kamal and Osman 1995). Composite dishes were analyzed as normally consumed, i.e. without extracting added oil, fat or other ingredients from the recipes. Energy, proteins, fat and carbohydrates per gram were calculated for each food item on the semi-quantitative FFQ list. Individual daily energy intake was then computed by summation of the respective products of the quantity consumed and the energy per gram value for each food item (Flegal, Larkin, Metzner, Thompson, & Guire, 1988). The same procedure was used to determine the daily intake of each macronutrient (Flegal & Larkin, 1990).

4. Physical Activity Assessment

The short version of the International Physical Activity Questionnaire (IPAQ) was adopted as an interviewer-administered questionnaire to assess physical activity (IPAQ Research Committee, 2005). Three categories of physical activity were assigned based on METS-min per week (low: <600, moderate: at least 600 and high: at least 3,000) according to the guidelines set by the IPAQ Research Committee, 2004.

5. Biochemical Measurements and Blood Pressure Data

Ten milliliters of blood were withdrawn from each participant and divided into EDTA and chemistry tubes. EDTA tubes were stored at -20 ºC whereas chemistry tubes were centrifuged and then stored at -80 ºC. All tubes were kept frozen until analysis. Serum triglycerides, HDL-C, LDL-C, CRP, and glucose were measured by an

enzymatic spectrophotometric technique using Vitros 350 analyzer (Ortho-Clinical Diagnostics, Johnson and Johnson, 50–100 Holmers Farm Way, High Wycombe, Buckinghamshire, HP12 4DP, United Kingdom) at the department of NFSC. As for the hemoglobin A1c (HbA1c) analysis, the Department of Pathology and Laboratory Medicine at the American University of Beirut Medical Center (AUBMC) performed the test according to the high-performance liquid chromatography method, using the BioRad Variant Hemoglobin Analyzer. Blood pressure was measured in the seated position after a ten-minute rest with a standard digital sphygmanometer. Measurements were repeated twice and the mean of the two values was calculated and used.

C. Diagnostic Criteria for the Metabolic Syndrome

Prevalence of the MetS was assessed based on the National Cholesterol Education Program Adult Treatment Panel (NCEP ATP) III and the new International Diabetes Federation (IDF) definitions (Alberti et al., 2009; "Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report," 2002). According to the IDF, for an individual to be classified as having the MetS, he or she must present with any three of the following criteria: abdominal obesity (WC $\geq$ 94 cm for males and $\geq$ 80 cm for females since Eastern Mediterranean and Middle Eastern (Arabs) population use European data); elevated TG ($\geq$ 150 mg/dL) or undergoing a specific treatment for this lipid disorder; low levels of HDL (< 40 mg/dL for males and < 50 mg/dL for females) or undergoing a specific treatment for this lipid disorder; high systolic blood pressure (SBP) ($\geq$ 130 mmHg) or high diastolic blood pressure (DBP) ($\geq$ 85 mmHg) or undergoing a treatment for previously diagnosed hypertension; high fasting glucose ($\geq$ 100 mg/dL) or undergoing a

treatment for previously diagnosed type 2 diabetes (Alberti et al., 2009).

The NCEP ATP III definition is similar to the new IDF criteria with a few notable differences in WC and fasting glucose cutoffs. Central obesity is defined by a WC exceeding 102 cm for men and 88 cm for women while fasting glucose is regarded as a risk factor if greater than or equal to 110 mg/dl ("Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III) final report," 2002).

D. Calculation of the Mediterranean Diet Scores

Two scores have been used to assess adherence to the MD, the Mediterranean Diet Score (MDS) (Trichopoulou et al., 1995) and the LMD (Naja et al., 2014). The MDS is made up of nine elements: an elevated ratio of monounsaturated lipids to saturated lipids, a moderate ethanol intake, a high intake of legumes, a high consumption of cereals such as bread and potatoes, a high fruit intake, a high vegetable intake, a moderately high intake of fish, a low consumption of meat and meat products, and a moderate intake of milk and dairies (Bach et al., 2007; Trichopoulou et al., 2003; Trichopoulou et al., 1995). The intake of the nine food groups was expressed in grams per day and a value of 0 or 1 was assigned to all constituents according to the sex-specific median of each. If the consumption of olive oil, fruits, vegetables, legumes, and cereals was equivalent to or above the respective sample median of each, one point was assigned. Whereas if the consumption of meat, chicken, and full fat milk and dairy products was equal to or higher than the sample median of each, no points were given. Alcohol intake was also scored based on a gender specific classification. Men and women, whose consumption fell in the range of 10 to 50g/day and 5 to 25g/day

respectively, were assigned one point. The final score was determined by adding up all the points earned by the consumer and varied between 0 and 9 where 9 represented maximal compliance with the MD (Bach et al., 2007; Trichopoulou et al., 2003; Trichopoulou et al., 1995).

As for the LMD recently developed by Naja *et al*. (2014), nine characteristic foods of the Lebanese traditional pattern, constituted the index: "fruits, vegetables, legumes, olive oil, burghol (crushed whole wheat), milk and dairy products, starchy vegetables (including potato, corn and peas), dried fruits and eggs." The calculation of the LMD score was based on the number of portions of these nine foods/food groups consumed daily. Specifically, consumption data of each of these nine foods/food groups were divided into tertiles and a value of 1, 2, and 3 was assigned to the first, second and third tertiles of consumption, respectively. The Lebanese pattern score was then calculated, for each subject, as the sum of points received on the consumption of the nine foods/food groups. The final score ranged between 9 (minimal adherence to LMD) and 27 (maximal adherence to LMD) (Naja et al., 2014).

E. Statistical Analysis

Frequencies, means, and standard deviations (SD) for socio-demographic characteristics, anthropometric measurements, biochemical indices, cardiometabolic risk factors, and dietary intake were calculated for the total study population as well as across categories of Metabolic Syndrome (MetS) status defined based on the IDF criteria (Alberti et al., 2009). To improve the general quality of the dietary data in this study, mean intakes of total energy and macro- and micronutrients as well as percent of energy from macronutrients were computed after exclusion of outliers, using the outlier labeling method (Hoaglin & Iglewicz, 1987), yielding a sample size of 487 subjects (14

over-reporters, data not shown). Independent student t-test and Chi-square test were used to compare continuous and categorical variables respectively. Adherence to the MD was defined based on the use of two indices, namely the MDS (Trichopoulou et al., 1995) and the Lebanese Mediterranean Diet (LMD) score (Naja et al., 2014). Study participants were grouped into tertiles using the scores of each Mediterranean diet (MD). To assess the association of adherence to each of the MDs with the MetS, multivariable logistic regression analysis was conducted with the MetS as the dependent variable and the score of each MD [first tertile (low adherence) vs. second and third tertile (medium and high adherence)] as independent variables while adjusting for age, gender, and energy. Statistical analysis was carried out using the Statistical Analysis Package for Social Sciences, version 16.0 (SPSS Inc., Chicago, IL, USA). All analyses were two tailed, and a p value < 0.05 was considered statistically significant.

CHAPTER IV

RESULTS

A. Prevalence of the Metabolic Syndrome among Lebanese Urban Adults

1. Socio-Demographic Characteristics

Baseline socio-demographic and lifestyle characteristics of the study sample are presented in Table 3 for the total sample (n = 501) and separately for males and females. Overall, the study sample consisted of 35.7 % males (n = 179) and 64.3 % females (n = 322) with a mean age of 41.9 ± 16.3 and 47.2 ± 13.8 years, respectively. Celibacy (never married, divorced, or widowed) was higher in men (42.1%) than women (28.7%). Ninety one percent of subjects had a monthly income lower than 2000 USD, with males having a significantly higher income than females. The majority of study participants had primary level education or below (36.3%) while 10.7% of men and 10.9% of women had college education. Compared to males, a lower percentage of females smoked cigarettes (p <0.05). Most of the subjects (79.6%) had a crowding index ≥1 persons/room, reflecting a low (SES). Almost half of the study population (47.7 %) had a low level of physical activity, with only 16% of men and women were engaging in health-enhancing physical activity (HEPA). HEPA represents at least 1.5-2 hours of physical activity per day which exceed the minimum public health physical activity recommendations of 30 min (IPAQ Research Committee 2005).

Table 3. Socio-demographic and lifestyle characteristics of the study sample by gender[a]

	Total [b] (n = 501)	**Males (n = 179)**	**Females (n = 322)**	**Significance [c]**
Age (years) (Mean ± SD)	45.3 ± 14.9	41.9 ± 16.3	47.2 ± 13.8	**p < .001**
Marital Status [d]				$x^2 = 9.337$, **p = .002**
Single	167 (33.5)	75 (42.1)	92 (28.7)	
Married	332 (66.5)	103 (57.9)	229 (71.3)	
Income Per Month [e]				$x^2 = 23.867$, **p < .001**
< 600$	153 (33.8)	43 (25.6)	110 (38.6)	
600$ ≤ income ≤ 2000$	260 (57.4)	97 (57.7)	163 (57.2)	
> 2000$	40 (8.8)	28 (16.7)	12 (4.2)	
Education				$x^2 = 23.044$, **p < .001**
Illiterate, primary school	181 (36.3)	48 (27.0)	133 (41.6)	
Intermediate school	136 (27.3)	45 (25.3)	91 (28.4)	
Secondary school	92 (18.5)	45 (25.3)	47 (14.7)	
Technical diploma	35 (7.0)	21 (11.8)	14 (4.4)	
University degree	54 (10.8)	19 (10.7)	35 (10.9)	
Smoking [f]				$x^2 = 6.352$, **p = .012**
No	179 (35.7)	51 (28.5)	128 (39.8)	
Yes	322 (64.3)	128 (71.5)	194 (60.2)	
Crowding Index				$x^2 = 0.331$, p = .565
< 1 person/room	101 (20.4)	39 (21.8)	62 (19.6)	
≥ 1 person/room	394 (79.6)	140 (78.2)	254 (80.4)	
Physical Activity				
Total minutes per day (from all three domains)	107.59 ± 79.51	111.36 ± 88.15	105.58 ± 74.57	p = 0.477
Met-minutes of heavy work per week	243.35 ± 1136.74	433.07 ± 1374.48	137.89 ± 966.40	**p = 0.011**
Met-minutes of Moderate work per week	134.05 ± 503.11	168.83 ± 529.91	114.72 ± 487.34	p = 0.249
Met-minutes of Walking per week	1343.17±1446.30	1145.97±1360.78	1452.80±1482.46	**p = 0.020**
Total Met-minutes from all three categories per week	2042.68±2063.75	2128.35±2153.53	1996.88±2016.63	p = 0.534
Sedentary (minutes/day)	291.90 ± 176.07	314.49 ± 186.72	279.24 ± 168.81	**p = 0.032**
Levels of physical activity				$x^2 = 0.248$, p = .883
Low-intensity activity	239 (47.7)	83 (46.4)	156 (48.4)	
Moderate-intensity activity	156 (31.1)	58 (32.4)	98 (30.4)	
High-intensity activity	106 (21.2)	38 (21.2)	68 (21.1)	
Engagement in Physical Activity				$x^2 = 0.932$, p = .334
None	79 (15.8)	32 (17.9)	47 (14.6)	
Any	422 (84.2)	147 (82.1)	275 (85.4)	

[a] Categorical variables are reported as N(%): frequency and percentage within column; continuous variables are reported as Mean ± SD. SD: Standard deviation.
[b] Lack of corresponding sum of frequencies with total sample size is due to missing data.
[c] Significant differences between males and females; p value was derived from chi-square for categorical variables and from independent t test for continuous variables.
[d] Single includes divorced and widowed.
[e] Income is expressed in terms of U.S. dollars.
[f] Smoking either cigarette or hookah (narghile).

2. Anthropometric Characteristics, Biochemical and Blood Pressure Data

Anthropometric characteristics, biochemical and blood pressure data of the study sample are shown in Table 4 for the total sample (n = 501) and separately for males and females. The mean BMI for the total sample was 28.89 ± 5.40, with males having significantly lower BMI than females. Overall, the study sample presented a high prevalence of overweight and obesity (34.5% and 37.9% respectively).

Table 4. Anthropometric characteristics, biochemical and blood pressure data of the study sample by gender[a]

	Total [b] (n = 501)	**Males (n = 179)**	**Females (n = 322)**	**Significance [c]**
Anthropometric characteristics				
BMI[d] (Kg/m2) (Mean ± SD)	28.89 ± 5.40	27.89 ± 4.91	29.44 ± 5.58	**p = .002**
BMI categories[e]				$x^2 = 9.500$, **p = .050**
Underweight (BMI < 18.50)	5 (1.0)	1 (0.6)	4 (1.3)	
Normal weight (BMI = 18.50 - 24.99)	117 (23.6)	51 (28.6)	66 (20.8)	
Overweight (BMI = 25.00 – 29.99)	171 (34.5)	66 (37.1)	105 (33)	
Obese (BMI = 30 – 39.99)	188 (37.9)	58 (32.6)	130 (40.8)	
Morbidly obese (BMI ≥ 40)	15 (3.0)	2 (1.1)	13 (4.1)	
Percent Body Fat (%) (Mean ± SD)	36.80 ± 10.38	28.18 ± 8.68	41.64 ± 7.80	**p < .001**
Waist Circumference (cm) (Mean ± SD)	95.25 ± 13.96	97.7 ± 12.87	93.85 ±14.36	**p = .003**
Biochemical and blood pressure data[f]				
TC (mg/dL) (Mean ± SD)	185.56 ± 39.19	180.38 ± 37.84	188.39 ± 39.68	**p = .003**
HDL-C (mg/dL) (Mean ± SD)	49.08 ± 13.91	43.28 ± 11.01	52.34 ± 14.31	**p < .001**
LDL-C (mg/dL) (Mean ± SD)	107.52 ± 34.62	105.22 ± 34.94	108.77 ± 34.43	p = .276
TG (mg/dL) (Mean ± SD)	134.35 ± 70.55	150.73 ± 76.41	125.47 ± 65.58	**p < .001**
FBG (mg/dL) (Mean ± SD)	100.72 ± 11.99	101.28 ± 10.73	100.41 ± 12.64	p = .460
HbA1c (%) (Mean ± SD)	5.66 ± 0.67	5.58 ± 0.73	5.70 ± 0.64	p = .058
Insulin (mU/mL) (Mean ± SD)	27.27 ± 10.81	27.44 ± 11.04	27.19 ± 10.73	p = .837
SBP (mmHg) (Mean ± SD)	120.73 ± 17.93	125.73 ± 17.70	117.95 ± 17.48	**p < .001**
DBP (mmHg) (Mean ± SD)	74.71 ± 9.73	78.50 ± 9.30	72.60 ± 9.33	**p < .001**

[a] Categorical variables are expressed as N(%): frequency and percentage within column; continuous variables are expressed as Mean ± SD. SD: Standard Deviation.
[b] Lack of corresponding sum of frequencies with total sample size is due to missing data.
[c] Significant differences between males and females; it is derived from the independent t-test for continuous variables and the chi square test for categorical variables.
[d] BMI: Body Mass Index.
[e] The classification criteria for overweight and obesity were defined according to World Health Organization (WHO) standardized criteria (Panel, 1998).
[f] TC: Total Cholesterol; HDL-C: High Density Lipoprotein-Cholesterol; LDL-C: Low Density Lipoprotein-Cholesterol; TG: Triglycerides; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; FBG: Fasting Blood Glucose; HbA1c: glycated hemoglobin.

Mean estimates of percent body fat in men (28.18 ± 8.68) were significantly lower than in women (41.64 ± 7.80), while waist circumference (cm) estimates were significantly higher in men (97.7 ± 12.87) than women (93.85 ± 14.36). Mean serum TC and HDL-C were significantly lower and TG and systolic and diastolic blood pressure significantly higher in males as compared to females.

3. Prevalence of Metabolic Syndrome and Cardiometabolic Risk Factors

The prevalence of the MetS and individual cardiometabolic risk factors amongst the study sample are presented in Table 5 for the total sample (n = 501) and separately for males and females. Based on the new IDF criteria (Alberti et al., 2009), the overall prevalence of the metabolic syndrome was 50.2% in the total sample, 55.2% and 47.5% among men and women, respectively. According to the NCEP ATP III definition (Cleeman et al., 2001), the overall prevalence of the metabolic syndrome was 43.2% in the total sample, 44.8% and 42.4% among men and women, respectively. Besides abdominal obesity (76.3%) which was the most prevalent abnormality, this study showed that low HDL-C, elevated blood pressure, and elevated fasting blood glucose were equally prevalent in the study sample (44.6%, 44.9%, and 46% respectively), as defined by IDF criteria. When looking at subjects with the MetS, the main contributors to the MetS were elevated waist circumference (91.9%), followed by elevated fasting blood glucose (68.5%) and low HDL-C (65.8%) (Data shown in Table 8).

Table 5. Metabolic syndrome and cardiometabolic risk factors of the study sample by gender[a]

Cardiometabolic Risk Factors [d]	Total[b] (n = 501)	Males (n = 179)	Females (n = 322)	Significance[c]
Waist Circumference (WC)				
Normal WC	118 (23.7)	62 (34.8)	56 (17.6)	$x^2 = 18.835$, **p < .001**
WC: M ≥ 94 cm; F ≥ 80cm (IDF)	379 (76.3)	116 (65.2)	263 (82.4)	
Triglycerides				
Normal triglyceride levels(the range)	315 (64)	94 (54.3)	221 (69.3)	$x^2 = 10.875$, **p < .001**
Triglycerides ≥ 150 mg/dl	177 (36)	79 (45.7)	98 (30.7)	
Risk factor 2: elevated TG [e]	180 (36.6)	80 (46.2)	100 (31.3)	$x^2 = 10.726$, **p = .001**
HDL-C				
Normal HDL-C levels	281 (56.2)	110 (61.8)	171 (53.1)	$x^2 = 3.518$, p = .061
HDL-C: M < 40 mg/dl; F < 50 mg/dl	219 (43.8)	68 (38.2)	151 (46.9)	
Pharmacologic Treatment of Dyslipidemia (raised cholesterol or triglycerides)	66 (13.2)	16 (8.9)	50 (15.5)	$x^2 = 4.367$, **p = .037**
Risk factor 3: reduced HDL [f]	221 (44.6)	69 (38.8)	152 (47.9)	$x^2 = 3.892$, **p = .049**
Blood Pressure				
Normal systolic and diastolic BP	315 (63.1)	91 (50.8)	224 (70)	$x^2 = 18.107$, **p < .001**
Hypertension: systolic BP ≥ 130 or diastolic BP ≥ 85 mm Hg	184 (36.9)	88 (49.2)	96 (30)	
Pharmacologic Treatment of Hypertension	109 (21.8)	30 (16.8)	79 (24.5)	$x^2 = 4.085$, **p = .043**
Risk factor 4: elevated blood pressure [g]	224 (44.9)	98 (54.7)	126 (39.4)	$x^2 = 10.967$, **p = .001**
Fasting Blood Glucose				
Normal fasting blood glucose levels	251 (54.9)	80 (49.4)	171 (58)	$x^2 = 3.112$, p = .078
Fasting blood glucose: ≥ 100 mg/Dl (IDF)	206 (45.1)	82 (50.6)	124 (42)	
Pharmacologic Treatment of Hyperglycemia or Diabetes	59 (11.8)	16 (8.9)	43 (13.4)	$x^2 = 2.159$, p = .142
Risk factor 5: elevated fasting blood glucose [h]	210 (46)	84 (51.9)	126 (42.7)	$x^2 = 3.517$, p = .061
Metabolic Syndrome (IDF)	244 (50.2)	95 (55.2)	149 (47.5)	$x^2 = 2.691$, p = .101
Metabolic Syndrome (ATP)	210 (43.2)	77 (44.8)	133 (42.4)	$x^2 = 0.263$, p = .608

[a] Categorical variables are expressed as N(%): frequency and percentage within column.
[b] Lack of corresponding sum of frequencies with total sample size is due to missing data.
[c] Significant differences between males and females; p value was derived from chi-square for categorical variables and from independent t test for continuous variables.
[d] The metabolic syndrome was defined according to the criteria established by the new IDF definition (Alberti et al., 2009); HDL-C: High Density Lipoprotein-Cholesterol; BP: Blood Pressure.
[e] Risk factor 2 includes patients with high TG levels and/or undergoing specific treatment for this lipid abnormality. The most commonly used drugs for elevated triglycerides are fibrates and nicotinic acid.
[f] Risk factor 3 includes patients with low HDL-C levels and/or undergoing specific treatment for this lipid abnormality. The most commonly used drugs for low HDL-C are fibrates and nicotinic acid.
[g] Risk factor 4 includes patients with elevated blood pressure and/or undergoing specific treatment for previously diagnosed hypertension.
[h] Risk factor 5 includes patients with elevated fasting blood glucose and/or undergoing specific treatment for previously diagnosed type 2 diabetes.

4. Dietary Energy, Macronutrient, and Micronutrient Intakes

Macronutrient and micronutrient intakes of the study sample are presented in Table 6 for the total sample (n = 501) and separately for males and females. Genders combined, mean energy intake amounted to 3319.97 ± 1594.23 kcal/day, of which 41.2% was derived from fat consumption.

Table 6. Dietary energy, macronutrient, and micronutrient intakes of the study sample by gender[a]

	Total[b] (n = 501)	**Males (n = 179)**	**Females (n = 322)**	**Significance[c]**
Energy (Kcal/day) (Mean ± SD)	3319.97 ± 1594.23	4350.42 ± 1738.82	2791.94 ± 1215.64	**p < .001**
Macronutrients [d]				
Protein (g/day) (Mean ± SD)	104.46 ± 61.16	140.38 ± 62.12	86.05 ± 51.84	**p < .001**
Protein (% of energy)	12.62 ± 3.24	13.04 ± 2.88	12.41 ± 3.39	**p = .042**
Fat (g/day) (Mean ± SD)	153.45 ± 83.75	197.46 ± 90.85	130.90 ± 69.99	**p < .001**
Fat (% of energy)	41.22 ± 8.99	40.47 ± 7.80	41.61 ± 9.53	p = .157
SFA (g/day) (Mean ± SD)	38.39 ± 22.91	50.44 ± 26.10	32.22 ± 18.28	**p < .001**
SFA (% of energy)	10.17 ± 2.79	10.21 ± 2.72	10.15 ± 2.83	p = .795
MUFA (g/day) (Mean ± SD)	58.51 ± 33.59	73.92 ± 35.97	50.61 ± 29.37	**p < .001**
MUFA (% of energy)	15.75 ± 4.86	15.14 ± 4.06	16.06 ± 5.20	**p = .033**
PUFA (g/day) (Mean ± SD)	42.50 ± 27.72	54.07 ± 28.20	36.57 ± 25.56	**p < .001**
PUFA (% of energy)	11.52 ± 4.61	11.16 ± 3.64	11.70 ± 5.04	p = .176
Cholesterol (mg/day) (Mean ± SD)	315.35 ± 284.91	466.69 ± 375.98	237.80 ± 181.30	**p < .001**
Carbohydrates (g/day) (Mean ± SD)	383.70 ± 188.73	493.99 ± 207.12	327.19 ± 150.19	**p < .001**
Carbohydrate (% of energy)	46.96 ± 8.98	46 ± 8.37	47.46 ± 9.25	p = .089
Dietary Fibers (g/day) (Mean ± SD)	41.80 ± 39.86	52.27 ± 45.67	36.44 ± 35.42	**p < .001**
Sucrose (g/day) (Mean ± SD)	30.65 ± 23.04	38.80 ± 29.04	26.47 ± 17.93	**p < .001**
Sucrose (% of energy)	3.84 ± 2.24	3.58 ± 2.08	3.97 ± 2.31	p = .068
Micronutrients				
Sodium (mg/day) (Mean ± SD)	3133.12 ± 1720.91	4131.42 ± 1864.54	2621.57 ± 1390.27	**p < .001**
Potassium (mg/day) (Mean ± SD)	3722.63 ± 1827.50	4654.08 ± 2044.34	3245.33 ± 1498.91	**p < .001**
Calcium (mg/day) (Mean ± SD)	892.85 ± 493.48	1119 ± 533.48	777.05 ± 428.48	**p < .001**
Iron (mg/day) (Mean ± SD)	14.41 ± 8.48	19.08 ± 9.45	12.01 ± 6.80	**p < .001**

[a] Continuous variables are expressed as Mean ± SD. SD: Standard Deviation.
[b] Lack of corresponding sum of frequencies with total sample size is due to missing data.
[c] Significant differences between males and females; p value was derived from independent t test for continuous variables.
[d] SFA: Saturated Fatty Acid; MUFA: Monounsaturated Fatty Acid; PUFA: Polyunsaturated Fatty Acid.

Both male and female subjects exceeded saturated-fat recommendations. The average contributions of protein and carbohydrates to energy intake were 12.6% and 46.9%, respectively. The average intake of sodium was 3133.12 ± 1720.91 mg/day and the mean intake of potassium was 3722.63 ± 1827.50 mg/day. The intakes of energy, MUFA, cholesterol, and micronutrient listed in Table 6 were all significantly higher in males compared to females.

B. Association of the Metabolic Syndrome with Adherence to the Mediterranean Diet

1. Socio-demographic and lifestyle characteristics of participants with and without the metabolic syndrome

For the investigation of the association between adherence to the MD and MetS, participants without a self-reported history of dyslipidemia, hypertension, and diabetes were selected, since subjects who have been previously diagnosed with chronic diseases may have changed their dietary habits and food consumption patterns. Subjects were then divided into two subgroups based on their MetS status. Baseline socio-demographic and lifestyle characteristics of participants with and without the MetS are presented in Table 7. Participants with MetS (43.90 ± 14.84) were significantly older than those without MetS (37.46 ± 12.98). Additionally, the prevalence of MetS was equally distributed between males and females. Compared to healthy participants, a higher level of sedentary behavior was reported among participants with MetS.

Table 7. Socio-demographic and lifestyle characteristics of participants with and without the metabolic syndrome[ab]

	Total[c] (n=314)	**Participants without MetS (n = 200)**	**Participants with MetS (n = 111)**	**Significance[d]**
Age (years) (Mean ± SD)	39.79 ± 13.94	37.46 ± 12.98	43.90 ± 14.84	**p < .001**
Gender				x^2 = 9.307, **p = .002**
Male	120 (38.2)	64 (32)	55 (49.5)	
Female	194 (61.8)	136 (68)	56 (50.5)	
Income Per Month [e]				x^2 = 1.895, p = .388
< 600$	76 (26.4)	43 (24)	32 (30.2)	
600$ ≤ income ≤ 2000$	177 (61.5)	112 (62.6)	64 (60.4)	
> 2000$	35 (12.2)	24 (13.4)	10 (9.4)	
Education				x^2 = 8.623, p = .071
Illiterate, primary school	92 (29.5)	53 (26.8)	38 (34.2)	
Intermediate school	87 (27.9)	52 (26.3)	35 (31.5)	
Secondary school	62 (19.9)	41 (20.7)	21 (18.9)	
Technical diploma	26 (8.3)	15 (7.6)	9 (8.1)	
University degree	45 (14.4)	37 (18.7)	8 (7.2)	
Physical Activity				
Total minutes per day (from all three domains)	112.56 ± 84.74	115.57 ± 85.48	106.71 ± 84.33	p = .422
Met-minutes of heavy work per week	361.53 ± 1410.20	382.80 ± 1389.49	332.97 ± 1469.93	p = .767
Met-minutes of Moderate work per week	188.15 ± 593.55	227.20 ± 687.16	122.88 ± 374.41	p = .084
Met-minutes of Walking per week	1324.47 ± 1419.40	1387.11±1419.08	1202.81±1406.45	p = .272
Total Met-minutes from all three categories per week	2179.56 ± 2291.83	2256.62±2343.63	2045.68±2206.23	p = .479
Sedentary (minutes/day)	280.82 ± 174.13	263.63 ± 175.29	307.43 ± 168.09	**p = .034**
Levels of physical activity				
Low-intensity activity	139 (44.3)	84 (42)	53 (47.7)	
Moderate-intensity activity	102 (32.5)	64 (32)	38 (34.2)	
High-intensity activity	73 (23.2)	52 (26)	20 (18)	
Engagement in Physical Activity				x^2 = 3.235, p = .072
None	44 (14)	23 (11.5)	21 (18.9)	
Any	270 (86)	177 (88.5)	90 (81.1)	

[a] Categorical variables are expressed as N(%): frequency and percentage within column; continuous variables are expressed as Mean ± SD. SD: Standard Deviation

[b] The metabolic syndrome was defined according to the criteria established by the new IDF definition (Alberti et al., 2009).

[c] Lack of corresponding sum of frequencies with total sample size is due to missing data.

[d] Significant differences between participants without the MetS and those with the MetS; p value was derived from chi-square for categorical variables and from independent t test for continuous variables.

[e] Income is expressed in terms of U.S. dollars.

2. Anthropometric Characteristics, Biochemical and Blood Pressure Data of Participants with and without the Metabolic Syndrome

Anthropometric characteristics, biochemical and blood pressure data of participants with and without the MetS are presented in Table 8. Compared to participants without MetS, those with MetS had a significantly higher BMI (30.49 ± 4.74 vs. 25.94 ± 4.67 Kg/m2), higher percent body fat (37.40 ± 9.88 vs. 33.07 ± 10.81), and a larger waist circumference (100.13 ± 11.58 vs. 86.94 ± 11.80 cm). The same trend was observed for biochemical and blood pressure data. Compared to participants without MetS, those with MetS had a significantly higher mean serum TG (161.38 ± 71.42 vs. 95.31 ± 49.61 mg/dl), higher mean serum FBG (103.43 ± 8.80 vs. 94.30 ± 7.40 mg/dl), higher systolic blood pressure (125.83 ± 18.65 vs. 111.90 ± 12.95 mmHg), higher diastolic blood pressure (77.67 ± 9.42 vs. 70.38 ± 8.28 mmHg), and a lower mean serum HDL-C (42.16 ± 10.55 vs. 54.88 ± 14.09 mg/dl). Moreover, participants having the MetS presented a higher prevalence of overweight and obesity (35.8% and 51.4% respectively) than their healthy counterparts.

3. Dietary Energy and Macronutrient Intakes of Participants with and without the Metabolic Syndrome

Dietary energy and macronutrient intakes of participants with and without the MetS are presented in Table 9. Subjects in both subgroups were comparable across dietary energy, protein, fat, and carbohydrate intakes.

Table 8. Anthropometric characteristics, biochemical and blood pressure data of participants with and without the metabolic syndrome[ab]

	Total [c] (n=314)	**Participants without MetS (n = 200)**	**Participants with MetS (n = 111)**	**Significance[d]**
Anthropometric characteristics				
BMI (Kg/m2) (Mean ± SD)	27.57 ± 5.16	25.94 ± 4.67	30.49 ± 4.74	**p <.001**
BMI categories[e]				x^2 = 47.679, **p < .001**
Underweight (BMI < 18.50)	4 (1.3)	4 (2)	0 (0)	
Normal weight (BMI = 18.50 - 24.99)	101 (32.5)	87 (43.7)	14 (12.8)	
Overweight (BMI = 25.00 – 29.99)	111 (35.7)	70 (35.2)	39 (35.8)	
Obese (BMI = 30 – 39.99)	90 (28.9)	37 (18.6)	52 (47.7)	
Morbidly obese (BMI ≥ 40)	5 (1.6)	1 (0.5)	4 (3.7)	
Percent Body Fat (%) (Mean ± SD)	34.61 ± 10.67	33.07 ± 10.81	37.40 ± 9.88	**p = .001**
Waist Circumference (WC)				
WC (cm) (Mean ± SD)	91.71 ± 13.30	86.94 ± 11.80	100.13 ± 11.58	**p < .001**
% Elevated WC	213 (67.8)	108 (54)	102 (91.9)	x^2 = 46.737, **p < .001**
Biochemical and blood pressure data[f]				
TC (mg/dL) (Mean ± SD)	181.61 ± 37.66	176.16 ± 35.11	191.18 ± 40.49	**p = .001**
LDL-C (mg/dL) (Mean ± SD)	105.29 ± 33.76	100.34 ± 31.70	114.59 ± 35.65	**p < .001**
Triglycerides				
TG (mg/dL) (Mean ± SD)	118.75 ± 66.14	95.31 ± 49.61	161.38 ± 71.42	**p < .001**
% Elevated serum TG	84 (27.1)	22 (11)	61 (56.5)	x^2 = 73.691, **p < .001**
HDL-C				
HDL-C (mg/dL) (Mean ± SD)	50.31 ± 14.27	54.88 ± 14.09	42.16 ± 10.55	**p < .001**
% Low HDL-C	118 (38.3)	45 (23)	73 (65.8)	x^2 = 54.878, **p <.001**
Blood Pressure				
SBP (mmHg) (Mean ± SD)	116.92 ± 16.56	111.90 ± 12.95	125.83 ± 18.65	**p < .001**
DBP (mmHg) (Mean ± SD)	72.99 ± 9.33	70.38 ± 8.28	77.67 ± 9.42	**p < .001**
% Elevated blood pressure	87 (27.8)	24 (12.1)	62 (55.9)	x^2 = 68.179, **p <.001**
Fasting Blood Glucose				
FBG (mg/dL) (Mean ± SD)	97.47 ± 9.03	94.30 ± 7.40	103.43 ± 8.80	**p < .001**
% Elevated FBG	107 (34.6)	33 (16.5)	74 (68.5)	x^2 = 83.703, **p <.001**
HbA1c (%) (Mean ± SD)	5.45 ± 0.46	5.34 ± 0.38	5.64 ± 0.50	**p < .001**
Insulin (mU/mL) (Mean ± SD)	25.07 ± 9.39	23.23 ± 8.89	28.35 ± 9.43	**p < .001**

[a] Categorical variables are expressed as N (%): frequency and percentage within column; continuous variables are expressed as Mean ± SD.

[b] The metabolic syndrome was defined according to the criteria established by the new IDF definition (Alberti et al., 2009).

[c] Lack of corresponding sum of frequencies with total sample size is due to missing data.

[d] Significant differences between healthy participants without MetS and those with MetS; p value was derived from chi-square for categorical variables and from independent t test for continuous variables.

[e] The classification criteria for overweight and obesity were defined according to World Health Organization (WHO) standardized criteria (Panel, 1998).

[f] TC: Total Cholesterol; LDL-C: Low Density Lipoprotein-Cholesterol; TG: Triglycerides; HDL-C: High Density Lipoprotein-Cholesterol; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; FBG: Fasting Blood Glucose; HbA1c: glycated hemoglobin.

Table 9. Dietary energy and macronutrient intakes of participants with and without the metabolic syndrome[ab]

	Total (n=314)	**Participants without MetS (n = 200)**	**Participants with MetS (n = 111)**	**Significance[c]**
Energy (Kcal/day) (Mean ± SD)	3544.05 ± 1643.27	3516.67 ± 1636.10	3606.15 ± 1664.62	p = .653
Macronutrients				
Protein (g/day) (Mean ± SD)	110.64 ± 66.51	111.70 ± 70.86	109.20 ± 58.80	p = .756
Protein (% of energy)	12.41 ± 3.38	12.59 ± 3.69	12.07 ± 2.74	p = .198
Fat (g/day) (Mean ± SD)	164.76 ± 86.84	164.73 ± 86.82	164.84 ± 87.20	p = .992
Fat (% of energy)	41.44 ± 8.61	41.69 ± 8.42	40.90 ± 8.96	p = .443
Carbohydrates (g/day) (Mean ± SD)	406.38 ± 186.08	397.16 ± 178.60	425.27 ± 198.86	p = .212
Carbohydrates (% of energy)	46.80 ± 8.86	46.36 ± 8.83	47.64 ± 8.94	p = .234

[a] Continuous variables are expressed as Mean ± SD. SD: Standard Deviation.
[b] The metabolic syndrome was defined according to the criteria established by the new IDF definition
[c] Significant differences between healthy participants without MetS and those with MetS.
p value was derived from chi-square for categorical variables and from independent t test for continuous variables.

4. Mediterranean Diet Score (MDS) and Daily Intake of Food Groups Constitutive Of the MDS among Participants With and Without the Metabolic Syndrome

Mediterranean diet scores in participants with and without the MetS as well as the daily intake of food groups (expressed in g/day) constitutive of the MDS are presented in Table 10. The consumption of the studied dietary variables was divided according to sex-specific medians. Consistent across both subgroups was the high rate of medium adherence to the MD (diet score of 4-5). Intake of alcoholic beverages was low for both groups. No significant differences in food intake were found between subjects with and without MetS except for dairy products and fish and sea food which were higher among subjects without MetS. Surprisingly, dairy product consumption (presumed to be detrimental in the MDS) was higher in subjects without MetS than subjects with MetS.

Table 10. Mediterranean Diet Score (MDS) and daily intake of food groups constitutive of the MDS among participants with and without the metabolic syndrome[ab]

		Total[c] (n=314)	**Participants without MetS (n = 200)**	**Participants with MetS (n = 111)**	**Significance[d]**
MDS categories					$x^2 = 2.767$, p = .251
Diet score of 0-3	108 (35.8)		64 (33.3)	43 (40.2)	
Diet score of 4-5	145 (48.0)		100 (52.1)	45 (42.1)	
Diet score of 6-9	49 (16.2)		28 (14.6)	19 (17.8)	
MDS variables [e]					
Ratio of MUFA to SFA (g/day) (Mean ± SD)	1.56 ± 0.48		1.57 ± 0.46	1.53 ± 0.52	p = .493
Median (g/day) M: 1.54; F: 1.55					$x^2 = 0.163$, p = .686
≥ Median	138 (45.7)		89 (46.4)	47 (43.9)	
< Median	164 (54.3)		103 (53.6)	60 (56.1)	
Vegetables (g/day) (Mean ± SD)	203.04 ± 191.57		208.46 ± 198.94	187.51 ± 169.03	p = .358
Median (g/day) M: 153.75; F: 156.23					$x^2 = 0.757$, p = .384
≥ Median	149 (49.3)		98 (51)	49 (45.8)	
< Median	153 (50.7)		94 (49)	58 (54.2)	
Fruits and nuts (g/day) (Mean ± SD)	307.54 ± 228.20		302.78 ± 216.40	315.92 ± 250.77	p = .635
Median (g/day) M: 293.5; F:243.13					$x^2 = 0.013$, p = .910
≥ Median	157 (52)		100 (52.1)	55 (51.4)	
< Median	145 (48)		92 (47.9)	52 (48.6)	
Cereals (g/day) (Mean ± SD)	392.24 ± 212.99		381.20 ± 203.29	415.13 ± 228.71	p = .187
Median (g/day) M: 437.9; F: 312.28					$x^2 = 0.355$, p = .551
≥ Median	156 (51.7)		102 (53.1)	53 (49.5)	
< Median	146 (48.3)		90 (46.9)	54 (50.5)	
Legumes (g/day) (Mean ± SD)	45.86 ± 49.11		46.37 ± 48.31	45.27 ± 51.19	p = .853
Median (g/day) M: 45.17; F: 26.73					$x^2 = 1.743$, p = .187
≥ Median	157 (52)		105 (54.7)	50 (46.7)	
< Median	145 (48)		87 (45.3)	57 (53.3)	
Fish and seafood (g/day) (Mean ± SD)	22.24 ± 30.25		23.00 ± 28.75	21.06 ± 33.22	p = .599
Median (g/day) M: 20.54; F: 6.86					$x^2 = 6.491$, **p = .011**
≥ Median	160 (53)		112 (58.3)	46 (43)	
< Median	142 (47)		80 (41.7)	61 (57)	
Alcohol (g/day) (Mean ± SD)	41.16 ± 169.23		45.08 ± 191.96	35.29 ± 121.70	p = .634
10g < M < 50g; 5g < F < 25g	14 (4.6)		10 (5.2)	4 (3.7)	$x^2 = 0.333$, p = .564
Dairy products(g/day) (Mean ± SD)	182.64 ± 151.21		189.75 ± 143.73	164.91 ± 162.30	p = .173
Full fat dairy products (g/day) (Mean ± SD)	149.40 ± 144.25		155.65 ± 138.12	133.94 ± 153.00	p = .211
Low fat dairy products (g/day) (Mean ± SD)	33.24 ± 57.40		34.10 ± 59.21	30.96 ± 53.80	p = .651
Median (g/day) M: 167.3; F: 120.19					$x^2 = 7.941$, **p = .005**
≥ Median	153 (50.7)		108 (56.2)	42 (39.3)	
< Median	149 (49.3)		84 (43.8)	65 (60.7)	
Meat, chicken and derivatives (g/day) (Mean ± SD)	108.76 ± 166.91		114.66 ± 191.71	98.94 ± 112.00	p = .438
Median (g/day) M: 99.94; F: 53.33					$x^2 = 3.501$, p = .061
≥ Median	154 (51)		106 (55.2)	47 (43.9)	
< Median	148 (49)		86 (44.8)	60 (56.1)	

[a] Continuous variables are expressed as Mean ± SD. SD: Standard Deviation.
[b] The metabolic syndrome was defined according to the criteria established by the new IDF definition (Alberti et al., 2009).
[c] Lack of corresponding sum of frequencies with total sample size is due to missing data.
[d] Significant differences between healthy participants without MetS and those with MetS. p value was derived from chi-square for categorical variables and from independent t test for continuous variables.
[e] MUFA: Monounsaturated Fatty Acid; SFA: Saturated Fatty Acid.

5. Lebanese Mediterranean Diet (LMD) and Daily Intake of Food Groups Constitutive of the LMD among Participants with and without the Metabolic Syndrome

Adherence to the LMD in study participants with and without the MetS as well as the daily intake of food groups (expressed in serving/day) constitutive of the LMD are presented in Table 11. The studied dietary variables were divided into tertiles according to food consumption. As previously noted for the MDS, the high rate of medium adherence (diet score of 16-20) to the MD was consistent across both subgroups. No significant differences in food intake were found between subjects with and without MetS.

Table 11. Lebanese Mediterranean Diet (LMD) and daily intake of food groups constitutive of the LMD among participants with and without the metabolic syndrome[ab]

	Total[c] (n=314)	**Participants without MetS (n = 200)**	**Participants with MetS (n = 111)**	**Significance[d]**
LMD categories				$x^2 = 5.052$, p = .080
Diet score of 9-15	88 (29.1)	49 (25.5)	39 (36.4)	
Diet score of 16-20	144 (47.7)	99 (51.6)	42 (39.3)	
Diet score of 21-27	70 (23.2)	44 (22.9)	26 (24.3)	
LMD variables				
Vegetables (serving/day) (Mean ± SD)	2.02 ± 1.90	2.07 ± 1.98	1.86 ± 1.68	p = .369
Tertiles				$x^2 = 1.940$, p = .379
1st tertile	113 (37.4)	67 (34.9)	46 (43)	
2nd tertile	91 (30.1)	61 (31.8)	29 (27.1)	
3rd tertile	98 (32.5)	64 (33.3)	32 (29.9)	
Fruits (serving/day) (Mean ± SD)	4.37 ± 3.27	4.36 ± 3.23	4.37 ± 3.38	p = .972
Tertiles				$x^2 = 0.384$, p = .825
1st tertile	99 (32.8)	65 (33.9)	33 (30.8)	
2nd tertile	99 (32.8)	63 (32.8)	35 (32.7)	
3rd tertile	104 (34.4)	64 (33.3)	39 (36.4)	
Burghol (serving/day) (Mean ± SD)	0.25 ± 0.44	0.25 ± 0.45	0.25 ± 0.45	p = .990
Tertiles				$x^2 = 0.112$, p = .945
1st tertile	123 (40.7)	78 (40.6)	44 (41.1)	
2nd tertile	90 (29.8)	59 (30.7)	31 (29)	
3rd tertile	89 (29.5)	55 (28.6)	32 (29.9)	
Legumes (serving/day) (Mean ± SD)	0.46 ± 0.49	0.46 ± 0.48	0.45 ± 0.51	p = .853
Tertiles				$x^2 = 2.715$, p = .257
1st tertile	98 (32.5)	56 (29.2)	41 (38.3)	
2nd tertile	99 (32.8)	67 (34.9)	31 (29)	
3rd tertile	105 (34.8)	69 (35.9)	35 (32.7)	

"Tale 11 – *Continued*"

	Total (n=314)	**Participants without MetS [c] (n = 200)**	**Participants with MetS [c] (n = 111)**	**Significance [d]**
Olive oil (serving/day) (Mean ± SD)	4.73 ± 5.04	4.69 ± 4.34	4.87 ± 6.17	p = .768
Tertiles				$x^2 = 0.118$, p = .943
1st tertile	102 (33.8)	64 (33.3)	37 (34.6)	
2nd tertile	112 (37.1)	72 (37.5)	38 (35.5)	
3rd tertile	88 (29.1)	56 (29.2)	32 (29.9)	
Dairy products (serving/day) (Mean ± SD)	2.61 ± 2.27	2.69 ± 2.29	2.48 ± 2.28	p = .458
Tertiles				$x^2 = 0.565$, p = .754
1st tertile	98 (32.5)	61 (31.8)	37 (34.6)	
2nd tertile	97 (32.1)	60 (31.2)	35 (32.7)	
3rd tertile	107 (35.4)	71 (37)	35 (32.7)	
Starchy vegetables (serving/day) (Mean ± SD)	0.28 ± 0.35	0.28 ± 0.36	0.28 ± 0.33	p = .921
Tertiles				$x^2 = 4.376$, p = .112
1st tertile	101 (33.4)	57 (29.7)	42 (39.3)	
2nd tertile	96 (31.8)	69 (35.9)	27 (25.2)	
3rd tertile	105 (34.8)	66 (34.4)	38 (35.5)	
Dried fruits (serving/day) (Mean ± SD)	0.25 ± 0.99	0.27 ± 1.17	0.21 ± 0.58	p = .593
Tertiles				$x^2 = 4.746$, p = .093
1st tertile	186 (61.6)	110 (57.3)	74 (69.2)	
2nd tertile	19 (6.3)	12 (6.2)	7 (6.5)	
3rd tertile	97 (32.1)	70 (36.5)	26 (24.3)	
Eggs (serving/day) (Mean ± SD)	0.47 ± 0.64	0.45 ± 0.60	0.52 ± 0.70	p = .378
Tertiles				$x^2 = 5.792$, p = .055
1st tertile	100 (33.1)	61 (31.8)	38 (35.5)	
2nd tertile	103 (34.1)	74 (38.5)	27 (25.2)	
3rd tertile	99 (32.8)	57 (29.7)	42 (39.3)	

[a] Continuous variables are expressed as Mean ± SD. SD: Standard Deviation.
[b] The metabolic syndrome was defined according to the criteria established by the new IDF definition (Alberti et al., 2009).
[c] Lack of corresponding sum of frequencies with total sample size is due to missing data.
[d] Significant differences between healthy participants without MetS and those with MetS.
p value was derived from chi-square for categorical variables and from independent t test for continuous variables.

6. Association between Adherence to the Mediterranean Diet and Metabolic Syndrome among Participants with No Prior History of Chronic Diseases (Univariate Regression)

The association between adherence to the Mediterranean diet (assessed using the MDS and the LMD score) and the prevalence of MetS among participants with no prior history of chronic diseases is presented in Table 12. Univariate regression

analysis did not show any significant relationship between the aforementioned variables.

Table 12. Association between adherence to the Mediterranean diet and metabolic syndrome[a] among participants with no prior history of chronic diseases (univariate regression) (n = 314)

	Odds Ratio (95% CI)	Significance
MDS categories		
Diet score of 0-3	-	-
Diet score of 4-5	0.670 (0.397-1.130)	p = .133
Diet score of 6-9	1.010 (0.502-2.032)	p = .978
LMD categories		
Diet score of 9-15	-	-
Diet score of 16-20	0.533 (0.306-0.928)	p = .026
Diet score of 21-27	0.742 (0.391-1.411)	p = .363

[a] The metabolic syndrome was defined according to the criteria established by the new IDF definition (Alberti et al., 2009).

7. Association between the Mediterranean Diet Score (MDS) and Metabolic Syndrome among Participants with No Prior History of Chronic Diseases (Multivariate Regression)

The association between adherence to the Mediterranean diet (assessed using the MDS) and the prevalence of MetS among participants with no prior history of chronic diseases is presented in Table 13. After adjusting for confounding variables (age, gender, and energy intake), findings of the logistic regression analysis showed that a higher adherence to the MD was found to be significantly and negatively associated with the MetS. Subjects in the second tertile (diet score 4-5) of adherence to the MD pattern, presented a 47% lower prevalence of the MetS (OR = 0.530, 95% CI = 0.300-0.936, p = .029). No significant association was found between a Mediterranean Diet Score of 6-9 and MetS.

Table 13. Association between the Mediterranean Diet Score (MDS) and the metabolic syndrome[a] among participants with no prior history of chronic diseases (multivariate regression) (n = 314)

	Odds Ratio (95% CI)	Significance
MDS categories[b]		
Diet score of 0-3	-	-
Diet score of 4-5	0.530 (0.300-0.936)	**p = .029**
Diet score of 6-9	0.840 (0.394-1.789)	p = .652

[a] The metabolic syndrome was defined according to the criteria established by the new IDF definition (Alberti et al., 2009).
[b] Adjustments were made for confounding variables: age, gender, and energy intake.

8. Association between the Lebanese Mediterranean Diet (LMD) and Metabolic Syndrome among Participants with No Prior History of Chronic Diseases (Multivariate Regression).

The association between adherence to the Mediterranean diet (assessed using the LMD score) and the prevalence of MetS among participants with no prior history of chronic diseases is presented in Table 14. After adjusting for confounding variables (age, gender, and energy intake), findings of the logistic regression analysis showed that a higher adherence to the MD was found to be significantly and negatively associated with the MetS. Subjects in the second and third tertiles (diet score of 16-20 and diet score of 21-27 respectively) of the LMD presented a 57% (OR = 0.430, 95% CI = 0.234-0.788, p = .006) and 55% (OR = 0.453, 95% CI = 0.214-0.961, p = .039) lower prevalence of the MetS respectively.

Table 14. Association of the Lebanese Mediterranean Diet (LMD) with the metabolic syndrome[a] in the study population (multivariate regression) (n = 314)

	Odds Ratio (95% CI)	**Significance**
LMD categories [b]		
Diet score of 9-15	-	-
Diet score of 16-20	0.430 (0.234-0.788)	**p = .006**
Diet score of 21-27	0.453 (0.214-0.961)	**p = .039**

[a] The metabolic syndrome was defined according to the criteria established by the new IDF definition (Alberti et al., 2009).

[b] Adjustments were made for confounding variables: age, gender, and energy intake.

CHAPTER V

DISCUSSION

Worldwide, metabolic syndrome has become a public health challenge and is considered to be a major driving force behind the emerging diabetes and CVDs epidemics (Zimmet et al., 2005). Early diagnosis of MetS is crucial for identifying individuals at high metabolic risk in order to slow or halt its progression to more serious chronic abnormalities, namely CVD and type 2 diabetes (Smith, 2006). Therefore, early screening of MetS has become increasingly important.

This study aimed at determining the prevalence of MetS across gender among Lebanese urban adults aged 18 years and over. According to the IDF definition (Alberti et al., 2009), the prevalence of MetS was shown to be 50.2%. Using NCEP ATP-III criteria (Cleeman et al., 2001), the study findings documented a lower prevalence (43.2%). No significant differences were observed between males and females when applying the two diagnostic criteria. These results are in contrast with other national and regional studies that reported gender differences in MetS prevalence (Bener et al., 2009; Delavari et al., 2009; Sibai et al., 2008). However, the prevalence of the MetS as estimated in the present study, contribute to the body of evidence that highlights a high prevalence of MetS in Lebanon when compared to other countries in the region and worldwide (Sibai et al., 2008). In fact, our results exceeded that reported from developed countries such as Greece (45.7%) (Athyros et al., 2010), and Spain (16.46%) (Tauler et al., 2014), and those reported from neighboring countries, namely Qatar (33.7%) (Bener et al., 2009) and Iran (37.4%) (Delavari et al., 2009). For comparison purposes, all aforementioned prevalence rates were calculated using the IDF definition

(Alberti et al., 2009).

The prevalence estimates for MetS in our study were also higher than those reported by previous cross-sectional studies conducted in Lebanon (Chedid, Gannage-Yared, Khalife, Halaby, & Zoghbi, 2009; Naja et al., 2013; Sibai et al., 2008). Naja *et al*. (2013) examined the prevalence of MetS in a sample of 323 adults with an age range comparable to our study population. Using the IDF definition (Alberti et al., 2009), they reported a MetS prevalence of 34.7%. It is important to note that only subjects with no prior history of chronic diseases were included in the study by Naja *et al*. (2013) which could offer a possible explanation for the discrepancy in the MetS prevalence estimates between the study by Naja *et al*. (2013) and the present study. Another study by Sibai et al. (2008) also reported a similar prevalence (31.2%) of MetS among Lebanese adult aged 18–65 years recruited from health centers.

The higher prevalence of the MetS as estimated in the present study compared to that reported in earlier studies in Lebanon may be a reflection of the high obesity rates documented in the study sample. Our findings showed that over 34% of study participants are overweight and 40% are obese. These obesity rates are considerably higher than previously published reports (Chamieh et al., 2015; Sibai et al., 2008) and indicate that obesity is increasing at an alarming rate, thus resulting in a rapid upsurge in the prevalence of metabolic syndrome. This rising trend in obesity prevalence is consistent with a previous study that revealed a two fold increase in the prevalence of obesity over a 12-year period, between 1997 and 2009 (Nasreddine, Naja, Chamieh, et al., 2012).

Evidence supports the contribution of both excess energy intake and decreased energy expenditure in the obesity epidemic (Nasreddine et al., 2013; Rahim et al., 2014). In the present study, the mean caloric intake (3319.97 Kcal/day), recorded by

means of a food frequency questionnaire, was notably high exceeding previously published data (2087.18 Kcal/day) (Sibai et al., 2008). Our results are in agreement with recent studies on secular trends in dietary patterns in Lebanon that indicate an increased caloric intake over time and a shift towards a Western diet rich in energy-dense foods (Mehio Sibai et al., 2010; Naja et al., 2011).

In line with previous findings, the dietary intake of the study population was found to be high in fat (41.22%) exceeding the recommendations (Chamieh et al., 2015). In fact, according to the Food and Nutrition Board of the Institute of Medicine, the Acceptable Macronutrient Distribution Range (AMDR) for fat has been set in the range of 20 to 35% of energy (Trumbo, Schlicker, Yates, & Poos, 2002). The upper limit of 35% energy from fat has been also adopted by the AHA (Lichtenstein et al., 2006). Numerous epidemiological studies showed that energy-dense high-fat diets are significantly and independently associated with weight gain (Astrup, 2001). Therefore, reducing dietary fat intake plays a pivotal role in the prevention of overweight, and subsequently decreases the risk of developing MetS (Riccardi, Giacco, & Rivellese, 2004). Quality of dietary fat should also be taken into consideration. SFA for instance, have been causally linked to insulin resistance which contributes to the development of MetS (Glass & Olefsky, 2012; Rivellese & Lilli, 2003). In the current study, dietary intake of SFA accounted for about 10.17% of total energy, which is higher than what is officially recommended by the AHA (Lichtenstein et al., 2006).

Data from this study also revealed that almost half of the study population had a low level of physical activity (47.7%). These rates are slightly higher than those reported by a recent national study conducted amongst Lebanese adults (45.5%) using the same measurement tool (IPAQ) as in the present study (Chamieh et al., 2015). Data on trends in physical activity in the Middle East and North Africa (MENA) region are

scarce. A review by Mehio Sibai *et al*. (2010) documented large disparities in physical activity behaviors among adults in various countries of the MENA region, with the prevalence of physical inactivity ranging between 21.6 and 86.8%: Lebanon fell toward the upper end of the range with a prevalence of 68.7% (Mehio Sibai et al., 2010). Physical activity is a well-known modifiable risk factor significantly associated with obesity as well as MetS, regardless of BMI (Zhu, St-Onge, Heshka, & Heymsfield, 2004).

Besides abdominal obesity (76.3%) which was the most prevalent abnormality in the overall sample, this study showed that almost half (44.9%) of the study subjects had elevated blood pressure. The high prevalence of hypertension has been previously described by Nasreddine *et al*. (2013) where it was argued that this high prevalence may be a reflection of the obesity epidemic, while also highlighting the role of other environmental and dietary risk factors such as high dietary intake of sodium (Graudal, Hubeck-Graudal, & Jurgens, 2011; He, Li, & Macgregor, 2013). A systematic analysis of sodium intake of different populations from around the world estimated that in 2010 the average intake of sodium in Lebanon was 3.13g/day, exceeding the WHO recommended level of 2 g/day (Powles et al., 2013). In accordance with these results, we also found high intakes of dietary sodium in our population (3.1g) with intakes being significantly higher in males (4.1 g/day) compared to females (2.6 g/day).

Among subjects having the MetS, abdominal obesity estimated by an increased WC was also found to be the most prevalent abnormality (92%), followed by elevated fasting blood glucose (68.5%) and low HDL-C (65.8%). In this aspect, our results are comparable to those of a national study by Sibai *et al*. (2008) where elevated waist circumference and reduced HDL levels were reported as the main contributors to the MetS in Lebanese adults. It is worth noting that low HDL-C has also previously

emerged as the most common metabolic abnormality among Lebanese adolescents having the MetS (Nasreddine, Naja, Tabet, et al., 2012). Moreover, the high prevalence rates of abdominal obesity and abnormal glucose metabolism found in this study support the existence of an association between excess body fat, impaired glucose tolerance and type 2 diabetes (Felber & Golay, 2002).

This study also aimed at investigating the association between adherence to the MD and the MetS in a sample of Lebanese urban adults with no prior history of chronic diseases. Adherence to the MD was evaluated using the MDS (Trichopoulou et al., 2003) and the LMD (Naja et al., 2014) scores. After adjustments were made for confounding variables (age, gender, and energy intake) in multivariate regression analyses, a higher adherence to the MD was found to be significantly and negatively associated with the MetS in the study sample. Subjects in the second tertile (diet score 4-5) of adherence to the MD pattern assessed using the MDS (Trichopoulou et al., 1995), presented a 47% lower prevalence of the MetS ($p = .029$). These findings are consistent with those reported by previous cross-sectional and prospective studies, showing that adherence to the MD as assessed by the MDS is associated with a reduced risk of MetS (Esposito et al., 2013) (Kastorini et al., 2011). A Greek cross sectional study including 2282 participants with no prior chronic diseases showed that a higher adherence to the MD (assessed using the MDS) was associated with a 20% lower odds of having the MetS (Panagiotakos et al., 2004). Similar results were observed when using the LMD index to assess adherence to the MD. In fact, subjects in the second and third tertiles (diet score of 16-20 and diet score of 21-27 respectively) of the LMD presented a 57% ($p = .006$) and 55% ($p = .039$) reduction in the risk of MetS, respectively. The advantage of the LMD index is that it includes traditional foods commonly consumed in Lebanon as well as in other countries of the Eastern

Mediterranean region namely, Turkey, Iraq, Iran, Syria and Egypt (Naja et al., 2014). Unfortunately, we cannot compare the aforementioned results with findings from other regional studies since the association between the MD and MetS has not been previously explored in countries of the Eastern Mediterranean region.

Most of the characteristic food components of the traditional MD have been shown to confer cardioprotective and other beneficial health effects and could explain the inverse relationship between the Mediterranean dietary pattern and the risk of MetS (Widmer et al., 2015). The widely studied omega-3 PUFA (eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA)) found in oily fish, were previously shown to be inversely associated with the risk of MetS, HTN (Abeywardena & Patten, 2011), and abdominal obesity (Garaulet et al., 2001). These data further support the role of marine omega-3 PUFA in the primary prevention of CVD (Widmer et al., 2015). In this context, in our sample, the proportion of subjects consuming more fish and seafood (expressed in g/d) was significantly higher among subjects without MetS compared to those with MetS.

Moderate alcohol intake has been suggested to exert a positive impact on the MetS and some of its components (Alkerwi et al., 2009). A meta-analysis of 15 prospective cohort studies indicated a U-shaped relationship between alcohol intake and type 2 diabetes: both low and high levels of alcohol consumption were linked to increased risk of type diabetes (Koppes, Dekker, Hendriks, Bouter, & Heine, 2005). Alcohol consumption has also been associated with higher serum HDL levels (Kato et al., 2003). In agreement with previous findings (Nasreddine, Hwalla, Sibai, Hamzé, & Parent-Massin, 2006), the study findings revealed a low intake of alcoholic beverages in the study sample. This is possibly because that alcohol use is prohibited in some religions. Nevertheless, participants without MetS reported a higher alcohol intake

(45.08g/day) than their counterparts with MetS (35.29g/day), although the difference did not reach statistical significance.

Surprisingly, the proportion of subjects consuming more dairy products expressed in g/day (predominantly full-fat dairy products) was significantly higher among subjects without MetS compared to those with MetS. The relationship of whole-fat dairy products with MetS is multifaceted. According to the MDS (Trichopoulou et al., 1995), full-fat dairy products were presumed to be detrimental. On the other hand, some studies suggest that whole-fat dairy products consumption may act as a potential protective factor against weight gain (Sanchez-Villegas, Bes-Rastrollo, Martinez-Gonzalez, & Serra-Majem, 2006). In the Women's Health Study conducted in the USA, calcium and dairy products intake were inversely associated with the prevalence of MS, and full-fat dairy products yielded a stronger protection than low-fat dairy products (Liu et al., 2005).

Our study has several limitations worth mentioning. First, because of its cross-sectional design, the present study does not allow for a causal inference regarding the observed associations. Hence, it remains unclear from our findings whether individuals who adhere to a MD have a lower prevalence of MetS or those diagnosed with MetS tend to value healthy eating. Second, the threshold values used for WC were the ones applicable to the European population due to the unavailability of WC cut off points specific to our study sample. Some studies suggested lower WC cutoffs for ethnic Arabs implying that the values we used may not be fully adapted to our study sample (Al-Lawati & Jousilahti, 2008). The third limitation of our study is related to the method we used for the dietary survey; a semi quantitative food-frequency questionnaire (FFQ). The latter relies on subject recall which raises concerns regarding the possibility of recall bias among participants who may have under- or over-reported

their dietary intake (Kushi, 1994). Also, social desirability bias with a tendency for respondents to under-report dietary intake and over-report physical activity may have influenced our findings. Nevertheless, the FFQ was not self-completed; instead, it was conducted by experienced dietitians who have been trained to avoid leading questions and judgmental comments, which should have contributed towards enhancing the quality of the collected data. Finally, our sample may be over representative of low socioeconomic status and low education population groups. Compared to findings from a recent national study (Chamieh et al., 2015), our study included a higher proportion of subjects of low socioeconomic status as defined by crowding index ≥1 person/room (78.2% and 80.4% vs. 60.5% and 64.3% of men and women, respectively, had a high crowding index) and low educational attainment (10.7% and 10.9% vs. 28.6% and 29.1% of men and women, respectively, had college education).

CHAPTER VI

CONCLUSION

This study documented a high prevalence of MetS amongst Lebanese urban adults, with almost half of the population being diagnosed with the MetS according to the IDF and NCEP ATP III criteria. These rates are higher than those previously reported in Lebanon. One of the explanations may be the high obesity rates which appear to be higher than those reported in previous studies (Chamieh et al., 2015; Sibai et al., 2008). Obesity is in fact a condition that leads to insulin resistance and several of the metabolic abnormalities characterizing the MetS. Interestingly, the study identified unhealthy lifestyle practices that may have led to a positive energy balance and obesity namely low levels of physical activity, and the consumption of a high-calorie high-fat diet. These facts highlight the importance of developing healthy behaviors, such as proper nutrition, weight management, and regular exercise among Lebanese urban adults to curb the obesity epidemic and decrease the burden of the metabolic syndrome and its associated comorbidities.

This study is, amongst the few in the Eastern Mediterranean region and in Lebanon, to investigate the association between the MD and the MetS. Based on the MDS and the LMD score, adherence to the MD was associated with a lower risk of MetS as defined by the IDF criteria. Compared to the MDS, the LMD score yielded a stronger association with the MetS. These finding complements previous data demonstrating the role of the Traditional Lebanese diet in decreasing the risk of type 2 diabetes (Naja et al., 2012). Therefore, promoting the MD, and particularly the LMD, as an effective tool for the primary prevention of MetS might be a solution to the

growing burden of type 2 diabetes, MetS, and CVD in Lebanon. Even though the Mediterranean dietary pattern can be easily embraced by all populations and different cultures (Trichopoulou et al., 2007), a collaborative and multidisciplinary approach including public health policy makers, physicians, nutritionists, dietitians, researchers, and academicians is essential in the success of this approach.

In regard to the individual components of both MD scores, we found no significant differences in food intake (except for dairy products and fish and seafood) between subjects with and without MetS. This may be because individual food components exert their beneficial effects only when they are integrated into an overall score. Further clinical and experimental studies may be warranted to validate our findings and clarify the mechanisms underlying the protective effects of the LMD, against MetS.

APPENDIX I

CONSENT FORM TO PARTICIPATE IN A RESEARCH STUDY (ARABIC)

1

اسم الموافقة على الإشتراك في دراسة تتعلق بالأبحاث الجينية

تقييم مستويات ثنائي الفينول أ عند اللبنانيين وتقييم إرتباطه بالوضع الصحي لهم

رقم البروتوكول: IM.HT.03
الباحث: د. هاني تميم
العنوان: شارع القاهرة- بيروت – لبنان
تلفون : 01350000 ext: 5453
المكان الذي سوف تتم فيه الدراسة: المركز الطبي في الجامعة الأميركية في بيروت (AUBMC)

أنت مدعو(ة) للمشاركة ببحث علمي سريري سيجرى في الجامعة الأميركية في بيروت. الرجاء أن تأخذ(ي) الوقت الكافي لقراءة المعلومات التالية بتأن قبل أن تقرر(ي) إذا كنت تريد(ين) المشاركة أم لا. بإمكانك طلب إيضاحات أو معلومات إضافية عن أي شيء مذكور في هذه الإستمارة أو عن هذه الدراسة ككل.

إن الهدف من دراستنا هو قياس مستويات ثنائي الفينول أ (BPA) في عينة تمثل السكان اللبنانيين المقيمين في بيروت الكبرى، وتقييم إرتباط المستويات بمختلف الأمراض . كما نود أن نرى أيضا إذا كانت مستويات BPA تتغير مع مرور الوقت في كل شخص. ستتألف هذه الدراسة من مرحلتين، المرحلة الأولى عند بدء الدراسة والثانية بعد سنتين للمتابعة. سنقوم بتسجيل ما يقارب 500 مشارك في الدراسة التي ستتم في المركز الطبي في الجامعة الأميركية في بيروت (AUBMC) حيث سيتم حصر استخدام هذه الموافقة الموقعة ومعها البيانات التي يتم جمعها لغايات هذه الدراسة من دون أي استخدام آخر.

ال BPA مادة كيميائية مصنّعة تتعارض مع الهرمونات الطبيعية في الجسم. ومن الممكن العثور عليها في زجاجات من البلاستيك وحاويات المياه والزجاجات وأكواب الأطفال، والحاويات البلاستيكية، والبطانة الداخلية لعلب الطعام والمشروبات. قد يتناول البشر ال BPA إذا انتقل من الحاوية البلاستيكية إلى الطعام أو الشراب في ظل ظروف معينة. ويرتبط استهلاك ال BPA بالآثار الصحية الضارة بما في ذلك أمراض القلب وارتفاع ضغط الدم، ومرض السكري، والتغيرات في الكولسترول، والدهون الثلاثية، ومستوى هرمونات الغدة الدرقية. من الممكن أن مادة ال BPA تؤثر أيضا على الموك الجينية (DNA).

سيقوم الباحثون الميدانيون أصحاب شهادة (CITI) العاملون في شركة "الدولية للمعلومات" (Information International) المتعاقد معها استخدام الطريقة المباشرة لتعيين المشاركين. وسوف يقومون بزيارة المشاركين في مكان إقامتهم لشرح أهداف الدراسة وطريقة التنفيذ. ثم تأخذ موافقة المشاركين وسيتم إعطاء تفاصيل عن تاريخ ووقت الدراسة. و سيتم تسجيل اسم المشارك وتاريخ الميلاد، و أيام الأسبوع المتوافر فيها للمشاركة ورقم هاتف لإتاحة المجال للمتابعة .تحديد التاريخ الدقيق لتظلم الى المركز الطبي في الجامعة الأميركية في بيروت (AUBMC) وسوف تشمل كل زيارة 10 مشاركين سوف يقومون بالإجراءات المبينة أدناه.

إن مشاركتكم تعني أنكم ستقابلون شخصاً مؤهلاً يجري معكم دراسة تتضمّن العديد من الأسئلة حول الوضع الديمغرافي والاجتماعي والاقتصادي (العمر، والجنس، وموقع السكن، والتعليم، والمهنة والدخل)، ونمط لحياة (التدخين، الكحول، القهوة والنشاط البدني)، والحالة الصحية (التاريخ الطبي والأدوية)، والعادات الغذائية (الاستمارة الغذائية). وعلاوة على ذلك، سوف تخضعون لاختبار يشمل قياس الوزن والطول ومحيط الخصر وضغط الدم، ومعدل ضربات القلب. بالإضافة على ذلك سيتم فحص مستوى السكر بالدم بواسطة الاصبع، ويتضمن وخزة صغيرة واحدة في الاصبع لاخذ أقل من نقطة دم واحدة لإجراء الفحص. كما يطلب منكم الخضوع لسحب الدم الاختبارات الجينية المحددة (الحامض النووي) والفحوصات المخبرية (بما في ذلك مخزون السكر(HbA1c)، نسبة السكر الصباحي في الدم ، الكريانينين، الدهون، هرمونات الغدة الدرقية (TSH)، خمائر الكبد (SGPT و GGT)، الانسولين، الكريانينين البولية، الزلالي، فيتامين د (25 OH vit D)، الكورتيزول، الليبتين، البروتين، البيتيد C. وعلاوة على ذلك، سيتم جمع البول لقياس مستويات ال BPA. وسوف تنجز هذه الفحوصات المخبرية مجانا، ولكن في وقت لاحق أثناء الدراسة.

خلال زيارتك، من المتوقع أن تكون مدة الانتهاء من الإجراءات خلال اليوم الواحد حوالي ساعة ونصف فقط، مقسمة بين 30 دقيقة لسحب الدم وجمع البول، و 60 دقيقة لملء الاستمارات لكل مشارك .ومن المتوقع ن تستغرق الزيارة مدة قصوى 3 ساعات بالنظر إلى أن سيكون هناك مشاركين آخرين يمرون بنفس العملية.

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بعد حوالي سنتين من الزيارة الأولى، سيتم الاتصال بكم هاتفياً لدعوتكم إلى استكمال الجزء الثاني من الدراسة وذلك من خلال زيارة المركز الطبي في الجامعة الأميركية في بيروت (AUBMC) والقيام بنفس الإجراءات التي قمتم بها في الزيارة الأولى.

على الرغم من أن أي دراسة قد تترافق مع مخاطر لا يمكن التنبؤ بها، هذه الدراسة تحمل الحد الأدنى من المخاطر. لا تحمل أي من عمليات جمع البيانات أية مخاطر على المدى الطويل، وسوف يتم سحب الدم ضمن ظروف وقاية صحية صارمة وحجم الدم الإجمالي المطلوب هو 20 سم مكعب. ومن الآثار الجانبية الضئيلة التي من المحتمل أن تصيبكم: ألم معتدل، نزف محدود، رضّة خفيفة في موضع إدخال الإبرة. وقد تحدث في بعض الأحيان حالات إغماء أو دوار خفيف، ولكنها لا تدوم عادةً أكثر من دقائق قليلة.

ستقدم نتائج جميع الاختبارات التي أجريت مجاناً للمشاركين وذلك عبر الإتصال بهم وتزويدهم بنتائج الفحوصات المخبرية عند انتهائها. وعلاوة على ذلك، سيتم تعويض المشاركين عن نفقات التنقل بمبلغ 30,000 ليرة لبنانية عند وصولهم إلى المركز الطبي في الجامعة الأميركية في بيروت (AUBMC)، كما سيزود المشتركون بوجبة الفطور في ذات اليوم.

إذا وافقت على الإشتراك بهذا البحث سوف تبقى المعلومات سرية. وحدهم الأطباء وإدارة الأخلاقيات والمحققين في المؤسسات العامة يمكنهم الإطلاع على النتائج بناءً لأمر قانوني فقط.

سيتم تخزين كافة البيانات والعينات البيولوجية التي تم جمعها بطريقة سرية. وستتخذ جميع التدابير لضمان عدم حدوث أي خرق لخصوصية المشتركين. وعلاوة على ذلك، سيتم تخزين ما تبقى من عينات الدم والبول بشكل آمن إلى أجل غير مسمى في مختبر الدكتورة نادالي زغيب خوري في المركز الطبي في الجامعة الأميركية في بيروت (AUBMC). إذا اخترتم سحب موافقتكم من الدراسة، سيتم تدمير العينات الخاصة بك.

بناءً على طلبكم، سوف نزودكم بنتائج الفحوصات الجينية وشرح أهميتها لكم. سيتم الابقاء على سرية المعلومات.

أود أن أعرف ما إذا كنت على استعداد للمشاركة في هذه الدراسة. لديك الحق في قبول أو رفض المشاركة. في حال رفض المشاركة، لن يكون هناك أي خسارة للمنافع التي يقدمها المركز الطبي التابع للجامعة الأميركية في بيروت (AUBMC). كما يحق لكم الانسحاب من هذه الدراسة في أي وقت من دون خسارة المنافع التي يقدمها المركز الطبي التابع للجامعة الأميركية في بيروت (AUBMC). أيضاً، يحق للباحث انهاء مشاركتك بهذه الدراسة.

أوافق على المشاركة في هذه الدراسة والإجراءات المحددة أعلاه.
نعم_____ **لا**_____

أوافق على أن يتم التواصل معي للدراسات المستقبلية
نعم_____ **لا**_____

أوافق على أن يتم التواصل معي إذا كانت نتائج الفحوصات الجينية ذات أهمية طبية
نعم_____ **لا**_____

استخدام ما تبقى من عينات الدم والبول للدراسات المستقبلية
نود تخزين ما تبقى من عينات الدم والبول لاستخدام محتمل في دراسات مستقبلية. للقيام بذلك، قد يكون هناك في المستقبل متعاونين في الجامعة الأميركية في بيروت، أو في المؤسسات الأخرى في لبنان وأو خارج بنان. لن يتم أي عمليات وخز إضافية. وسيتم "ترميز" عينات الدم المخزنة. *(تشير عبارة "ترميز" إلى قابلية التعريف والتعقب.لا يتم تعريف عينات الدم لغايات الأبحاث، ولكن يمكن ربطها بمصدرها عبر استخدام الرموز. إلا أن الباحث المسؤول أو المشرف الأساسي هو الوحيد الذي يحق له الحصول على اللائحة التي تحدد الرمز الخاص بكل مريض).*

أوافق على أن يتم استخدام ما تبقى من عينات الدم والبول للدراسات المستقبلية
نعم_____ **لا**_____

كانون الثاني: 2014 رقم البروتوكول: IM.HT.03

يمكن مشاركة عينات دمكم المرمّزة مع باحثين آخرين لدراسات ذات صلة. ولن يعرف هؤلاء الباحثون هويتكم.

أوافق على مشاركة عيّنات دمي المرمّزة مع باحثين آخرين لإجراء دراسات ذات صلة.
نعم_____ لا_____

إقرار المريض بالمشاركة في البحث:

أنا الموقع أدناه وبعد أن اطلعت واستوعبت كل جوانب هذا البحث وأجبت عن كل أسئلتي أوافق بملئ إرادتي على المشاركة في هذه الدراسة وأنا على علم تام بأنني أستطيع الإتصال بالدكتور هاني تميم على الرقم 01350000 المقسم 5453 أو بأي من ممثليه الضالعين بهذه الدراسة وذلك إذا أردت توجيه أي سؤال، كما أنني أعلم أنه فيما لو أن أسئلتي لم يجاوب عليها بطريقة مقنعة يمكنني الإتصال بأحد أعضاء لجنة الأخلاقيات على المقسم 5445. كما إنني أعلم أنه يمكنني الإنسحاب من المشاركة في هذه الدراسة في أي وقت شئت حتى بعد التوقيع على هذه الوثيقة وإن العناية التي أتلقاها لن تتأثر بهذا الإنسحاب وإنني سوف أزود بنسخة عن هذه الوثيقة.

_____ _____
إسم المريض أو ممثله القانوني/قريبه أو وصيه التوقيع

_____
التاريخ و الساعة

_____ _____
إسم الشاهد التوقيع
التاريخ و الساعة

إقرار الباحث باستلام التعهد بالإشتراك:

لقد أطلعت بالتفصيل على التعهد بالإشتراك في البحث مع_____ (إسم المريض، ممثله القانوني، قريبه، وصيه)، وأفهمت المريض الغاية من هذه الدراسة ومن أخطارها وفوائدها. لقد أجبت المشترك على جميع الأسئلة التي تقدم بها بوضوح تام وتعهدت له بإعلامه عن أي تغيير يطرأ في موضوع هذا البحث.

_____ _____
التوقيع إسم الباحث أو ممثل المشترك

_____
التاريخ و الساعة

أسس الموافقة على الإشتراك في دراسة تتعلق بالأبحاث الجينية

تقييم مستويات ثنائي الفينول أ عند اللبنانيين وتقييم إرتباطه بالوضع الصحي لهم

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تلفون : 01350000 ext: 5453
المكان الذي سوف تتم فيه الدراسة: المركز الطبي في الجامعة الأميركية في بيروت (AUBMC)

أنت مدعو(ة) للمشاركة ببحث علمي سريري سيجرى في الجامعة الأميركية في بيروت. الرجاء أن تأخذ(ي) الوقت الكافي لقراءة المعلومات التالية بتأن قبل أن تقرر(ي) إذا كنت تريد(ين) المشاركة أم لا. بإمكانك طلب إيضاحات أو معلومات إضافية عن أي شيء مذكور في هذه الإستمارة أو عن هذه الدراسة ككل.

إن الهدف من دراستنا هو قياس مستويات ثنائي الفينول أ (BPA) في عينة تمثل السكان اللبنانيين المقيمين في بيروت الكبرى، وتقييم إرتباط المستويات بمختلف الأمراض . كما نود أن نرى أيضا إذا كانت مستويات BPA تتغير مع مرور الوقت في كل شخص. ستتألف هذه الدراسة من مرحلتين، المرحلة الأولى عند بدء الدراسة والثانية بعد سنتين للمتابعة. سنقوم بتسجيل ما يقارب 500 مشارك في الدراسة التي ستتم في المركز الطبي في الجامعة الأميركية في بيروت (AUBMC) حيث سيتمّ حصر استخدام هذه الموافقة الموقّعة ومعها البيانات التي يتمّ جمعها لغايات هذه الدراسة من دون أي استخدام آخر.

ال BPA مادة كيميائية مصنّعة تتعارض مع الهرمونات الطبيعية في الجسم. ومن الممكن العثور عليها في زجاجات من البلاستيك وحاويات المياه والزجاجات وأكواب الأطفال، والحاويات البلاستيكية، والبطانة الداخلية لعلب الطعام والمشروبات. قد يتناول البشر ال BPA إذا انتقل من الحاوية البلاستيكية إلى الطعام أو الشراب في ظل ظروف معينة. ويرتبط استهلاك ال BPA بالآثار الصحية الضارة بما في ذلك أمراض القلب وارتفاع ضغط الدم، ومرض السكري، والتغيرات في الكولسترول، والدهون الثلاثية، ومستوى هرمونات الغدة الدرقية. من الممكن أن مادة ال BPA تؤثر أيضا على المواد الجينية (DNA).

سيقوم الباحثون الميدانيون أصحاب شهادة (CITI) العاملون في شركة "الدولية للمعلومات" (Information International) المتعاقد معها استخدام الطريقة المباشرة لتعيين المشاركين. وسوف يقومون بزيارة المشاركين في مكان إقامتهم لشرح أهداف الدراسة وطريقة التنفيذ. ثم تأخذ موافقة المشاركين وسيتم إعطاء تفاصيل عن تاريخ ووقت الدراسة. و سيتم تسجيل اسم المشارك وتاريخ الميلاد، و أيام الأسبوع المتوافر فيها للمشاركة ورقم هاتف لاتاحة المجال للمتابعة وتحديد التاريخ الدقيق لنقلهم الى المركز الطبي في الجامعة الأميركية في بيروت (AUBMC) وسوف تشمل كل زيارة 10 مشاركين سوف يقومون بالإجراءات المبينة أدناه.

إن مشاركتكم تعني أنّكم ستقابلون شخصاً مؤهّلاً يجري معكم دراسة تتضمّن العديد من الأسئلة حول الوضع الديمغرافي والاجتماعي والاقتصادي (العمر، والجنس، وموقع السكن، والتعليم، والمهنة والدخل)، ونمط الحياة (التدخين، الكحول، القهوة والنشاط البدني)، والحالة الصحية (التاريخ الطبي والأدوية)، والعادات الغذائية (الاستمارة الغذائية). وعلاوة على ذلك، سوف تخضعون لاختبار بدني لقياس الوزن والطول ومحيط الخصر وضغط الدم، ومعدل ضربات القلب. بالإضافة على ذلك سيتم فحص مستوى السكر بالدم بواسطة الاصبع، ويتضمن وخزة صغيرة واحدة في الاصبع لاخذ أقل من نقطة دم واحدة لإجراء الفحص. كما يطلب منكم الخضوع لسحب الدم الاختبارات الجينية المحددة (الحامض النووي) والفحوصات المخبرية (بما في ذلك مخزون السكر(HbA1c)، نسبة السكر الصباحي في الدم ، الكرياتينين، الدهون، هرمونات الغدة الدرقية (TSH)، خمائر الكبد (SGPT و GGT)، الانسولين، الكرياتينين البولية، الزلالي، فيتامين د (25 OH vit D), الكورتيزول، الليبتين، البرولاكتين، الببتيد C. وعلاوة على ذلك، سيتم جمع البول لقياس مستويات ال BPA. وسوف تنجز هذه الفحوصات المخبرية مجانا، ولكن في وقت لاحق أثناء الدراسة.

خلال زيارتك، من المتوقع أن تكون مدة الانتهاء من الإجراءات خلال اليوم الواحد حوالي ساعة ونصف فقط، مقسمة بين 30 دقيقة لسحب الدم وجمع البول, و 60 دقيقة لملء الاستمارات لكل مشارك .ومن المتوقع أن تستغرق الزيارة مدة أقصاها 3 ساعات، بالنظر إلى أن سيكون هناك مشاركين آخرين يمرون بنفس العملية.

بعد حوالي سنتين من الزيارة الأولى، سيتم الاتصال بكم هاتفياً لدعوتكم إلى استكمال الجزء الثاني من الدراسة وذلك من خلال زيارة المركز الطبي في الجامعة الأميركية في بيروت (AUBMC) والقيام بنفس الإجراءات التي قمتم بها في الزيارة الأولى.

على الرغم من أن أي دراسة قد تترافق مع مخاطر لا يمكن التنبؤ بها، هذه الدراسة تحمل الحد الأدنى من المخاطر. لا تحمل أي من عمليات جمع البيانات أية مخاطر على المدى الطويل، وسوف يتم سحب الدم ضمن ظروف وقاية صحية صارمة وحجم الدم الإجمالي المطلوب هو 20 سم مكعب. ومن الآثار الجانبية الضئيلة التي من المحتمل أن تصيبكم: ألم معتدل، نزف محدود، رضّة خفيفة في موضع إدخال الإبرة. وقد تحدث في بعض الأحيان حالات إغماء أو دوار خفيف، ولكنّها لا تدوم عادةً أكثر من دقائق قليلة.

ستقدم نتائج جميع الاختبارات التي أجريت مجاناً للمشاركين وذلك عبرالإتصال بهم وتزويدهم بنتائج الفحوصات المخبرية عند انتهائها. وعلاوة على ذلك، سيتم تعويض المشاركين عن نفقات التنقل بمبلغ 30,000 ليرة لبنانية عند وصولهم إلى المركز الطبي في الجامعة الأميركية في بيروت (AUBMC)، كما سيزود المشتركون بوجبة الفطور في ذات اليوم.

إذا وافقت على الإشتراك بهذا البحث سوف تبقى المعلومات سرية. وحدهم الأطباء ودائرة الأخلاقيات والمحققين في المؤسسات العامة يمكنهم الإطلاع على النتائج بناءً لأمر قانوني فقط.

سيتم تخزين كافة البيانات والعينات البيولوجية التي تم جمعها بطريقة سرية. وستتخذ جميع التدابير لضمان عدم حدوث أي خرق لخصوصية المشتركين. وعلاوة على ذلك، سيتم تخزين ما تبقى من عينات الدم والبول بشكل آمن إلى أجل غير مسمى في مختبر الدكتورة ناتالي زغيب خويري في المركز الطبي في الجامعة الأميركية في بيروت (AUBMC). إذا اخترتم سحب موافقتكم من الدراسة، سيتم تدمير العينات الخاصة بك.

بناءً على طلبكم، سوف نزودكم بنتائج الفحوصات الجينية وشرح أهميتها لكم. . سيتم الابقاء على سرية المعلومات.

أود أن أعرف ما إذا كنت على استعداد للمشاركة في هذه الدراسة. لديك الحق في قبول أو رفض المشاركة. في حال رفض المشاركة، لن يكون هنالك أي خسارة للمنافع التي يقدمها المركز الطبي التابع للجامعة الأميركية في بيروت (AUBMC). كما يحق لكم الانسحاب من هذه الدراسة في أي وقت من دون خسارة المنافع التي يقدمها المركز الطبي التابع للجامعة الأميركية في بيروت (AUBMC). أيضاً, يحق للباحث انهاء مشاركتك بهذه الدراسة.

أوافق على المشاركة في هذه الدراسة والإجراءات المحدّدة أعلاه.
نعم_____ لا_____

أوافق على أن يتم التواصل معي للدراسات المستقبلية
نعم_____ لا_____

أوافق على أن يتم التواصل معي إذا كانت نتائج الفحوصات الجينية ذات أهمية طبية
نعم_____ لا_____

استخدام ما تبقى من عينات الدم والبول للدراسات المستقبلية
نودّ تخزين ما تبقى من عينات الدم والبول لاستخدام محتمل في دراسات مستقبلية. للقيام بذلك، قد يكون هناك في المستقبل متعاونين في الجامعة الأميركية في بيروت، أو في المؤسسات الأخرى في لبنان و/أو خارج لبنان. لن يتمّ أي عمليات وخز إضافية. وسيتمّ "ترميز" عيّنات الدم المخزّنة. *(تشير عبارة "ترميز" إلى قابلية التعريف والتعقّب.لا يتمّ تعريف عينات الدم لغايات الأبحاث، ولكن يمكن ربطها بمصدرها عبر استخدام الرموز؛ إلاّ أنّ الباحث المسؤول أو المشرف الأساسي هو الوحيد الذي يحق له الحصول على اللائحة التي تحدّد الرمز الخاص بكل مريض).*

أوافق على أن يتم استخدام ما تبقى من عينات الدم والبول للدراسات المستقبلية
نعم_____ لا_____

ن مشاركة عينات دمكم المرمّزة مع باحثين آخرين لدراسات ذات صلة. ولن يعرف هؤلاء الباحثون هويتكم.

ق على مشاركة عيّنات دمي المرمّزة مع باحثين آخرين لإجراء دراسات ذات صلة.

_____ لا _____

إقرار المريض بالمشاركة في البحث:

أنا الموقع أدناه وبعد أن اطلعت واستوعبت كل جوانب هذا البحث وأجبت عن كل أسئلتي أوافق بملئ إرادتي على المشاركة في هذه الدراسة وأنا على علم تام بأنني أستطيع الإتصال بالدكتور هاني تميم على الرقم 01350000 المقسم 5453 أو بأي من ممثليه الضالعين بهذه الدراسة وذلك إذا أردت توجيه أي سؤال، كما أنني أعلم أنه فيما لو أن أسئلتي لم يجاوب عليها بطريقة مقنعة يمكنني الإتصال بأحد أعضاء لجنة الأخلاقيات على المقسم 5445. كما إنني أعلم أنه يمكنني الإنسحاب من المشاركة في هذه الدراسة في أي وقت شئت حتى بعد التوقيع على هذه الوثيقة وإن العناية التي أتلقاها لن تتأثر بهذا الإنسحاب وإنني سوف أزود بنسخة عن هذه الوثيقة.

_____ _____

إسم المريض أو ممثله القانوني/قريبه أو وصيه — التوقيع

_____

التاريخ و الساعة

_____ _____

إسم الشاهد — التوقيع

التاريخ و الساعة

إقرار الباحث باستلام التعهد بالإشتراك:

لقد أطلعت بالتفصيل على التعهد بالإشتراك في البحث مع_____ (إسم المريض، ممثله القانوني، قريبه، وصيه)، وأفهمت المريض الغاية من هذه الدراسة ومن أخطارها وفوائدها. لقد أجبت المشترك على جميع الأسئلة التي تقدم بها بوضوح تام وتعهدت له بإعلامه عن أي تغيير يطرأ في موضوع هذا البحث.

_____ _____

التوقيع — إسم الباحث أو ممثل المشترك

_____

التاريخ و الساعة

Institutional Review Board
American University of Beirut
17 FEB 2014
APPROVED

APPENDIX II

CONSENT FORM TO PARTICIPATE IN A RESEARCH STUDY (ENGLISH)

Consent to participate in a genetic research study

Assessment of BPA levels and their association with the health status among Lebanese population

Protocol number: IM.HT.03
Investigator: Dr. Hani Tamim
Address: American University Hospital
Hamra Street
Beirut, Lebanon
Phone: (01) 350 000 ext: 5453

Site where the study will be conducted: AUBMC

You are being asked to participate in a clinical research study conducted at the American University of Beirut. Please take time to read the following information carefully before you decide whether you want to take part in this study or not. Feel free to ask the representative of the contracted company if you need more information or clarification about what is stated in this form and the study as a whole.

The aim of our study is to measure Bisphenol A (BPA) levels in a representative sample from the Lebanese population residing in Greater Beirut, and to assess if it is related to different diseases. We also would like to see if BPA measures change over time in any person. This study will be composed of 2 stages; at baseline and a 2-year follow up. We will be recruiting approximately 500 subjects and study will be conducted at AUBMC whereby this informed consent along with the data collected will be used for this study only.

BPA is a synthetic chemical that interferes with the natural hormones in the body. It can be found in plastic bottles and water containers, baby bottles and toddler cups, plastic ware, the inner lining of food cans and beverages. Humans may ingest BPA if it leaches from the plastic container into the food or drink under certain conditions. Consumption is associated with adverse health effects including heart disease, high blood pressure, diabetes, changes in cholesterol, triglycerides, and thyroid levels. BPA can also affect the expression of DNA material, called 'epigenetic effect.

The CITI certified field workers employed by the contracted company (Information International) will use the direct approaching method to recruit the cohort. They will visit the respondents in their residence to explain the study aims and method of implementation. Then the respondents will be consented and given the details of the date and time of the study. The name, date of birth, availability on week days and telephone number of the potential participant will be recorded for further follow up to specify the exact date for taking them to AUBMC. Each visit will include 10 participants who will complete the procedures described below.

Participating in this study means that you will sit with a certified research assistant who will conduct a survey which includes multiple questions about the demographic and socioeconomic status (Age, gender, location, education, occupation, income), lifestyle (smoking, alcohol, coffee, physical activity),

health status (medical history and medication), and dietary habits (Food Frequency Questionnaire). Moreover, you will undergo a physical exam to measure weight, height, waist circumference, blood pressure, and heart rate. Moreover, your blood sugar will be checked by a fingerstick, which means a very small prick will be done to your finger to get less than a drop of blood to do the test. You will also be asked to have blood withdrawn for specific genetic testing (DNA methylation) and clinical laboratory tests (including HBA1c, fasting blood sugar, creatinine, lipid profile, TSH, SGPT, GGT, fasting insulin, urinary creatinine, microalbuminuria, 25 OH vit D, Cortisol, leptine, C-peptide, prolactin). Moreover, urine will be collected for measuring BPA levels. These tests will be done free of charge, but will be done at a later time during the study.

During your visit, the duration for completing the procedures is expected to be for around an hour and a half over one day only, divided between 30 minutes for blood withdrawal and urine collection and 60 minutes for filling the surveys for each participant. Your total visit time to AUBMC is expected to be for a maximum of 3 hours, given that there will be other participants undergoing the same process.

After around 2 years from the baseline visit, you will be contacted by phone to be invited to complete the second part of the study (2-year follow-up stage) by visiting the AUBMC and going through the same process as the one described at baseline.

Although any study may be associated with any unforeseeable risk, this proposal has minimal risk. None of the data collection measures bare any long term hazards, and all blood withdrawal will be done under sterile hygienic conditions and the total volume required is 20 cc. Possible side effects include mild pain, bleeding, bruising at the site of the needle insertion. Fainting or light-headedness can sometimes occur, but usually last only a few minutes.

The results of all tests conducted will be freely provided to the participants by calling them and providing them with the results of the test upon its completion. Moreover, the participants will be compensated for travel expenses with 30,000 LBP upon arriving to AUBMC. In addition, we will provide the participants with breakfast the same day.

If you agree to participate in this research study, the information will be kept confidential. Unless required by law, only the study doctor and designee, the ethics committee and inspectors from governmental agencies will have direct access to your information collected.

All data and biological samples collected will be stored in a confidential manner. These measures will all be conducted ensuring there is no breach of participants' privacy. Moreover, the remaining blood and urine samples will be stored securely indefinitely in Dr. Nathalie Zgheib Khoueiry's laboratory at the AUBMC. If you elect to withdraw your consent for the study, your samples will be destroyed.

You may ask that we provide you with the genetic results and explain their significance to you. The information will be kept confidential.

I would like to know if you would be willing to participate in this study. You have the right to accept or decline participation. Refusing to participate will not involve any loss of benefits offered in the future by AUBMC. Moreover, you are entitled to withdraw from the study at any time without any loss of benefits offered by AUBMC at any time.

I agree to participate in this study and the procedures explained above.

YES ……. NO…….

I agree to be contacted for future studies

YES ……. NO…….

I would like to be contacted if the genetic test results are significant

YES ……. NO…….

Using remaining blood and urine for other future studies

We would like to keep the remaining blood and urine samples for potential use in other future studies. To do so, there might be future collaborators at AUB, at other institutions in Lebanon and/or outside Lebanon. There will be no extra prick. The stored blood and urine samples will be coded (*"Coded" means identifiable, traceable. Blood* and urine *samples that are unidentified for research purposes but can be linked to their source through the use of codes; however, the principal investigators or VMP will be the only ones to have the list linking patients to the codes assigned.)*

I agree to permit the use of the remaining blood and urine sample for future studies

YES ……. NO…….

Your coded blood and urine samples may be shared with other investigators for related studies. These investigators will not know your identity.

I agree to have my coded blood and urine samples shared with other investigators for related studies.

YES ……. NO…….

Patient's Participation:

I have read and understood all aspects of the research study and all my questions have been answered. I voluntarily agree to be a part of this research study and I know that I can contact Dr. Hani Tamim at 01350000 extension: 5453 or any of his/her designee involved in the study in case of any questions. If I felt that my questions have not been answered, I can contact the Institutional Review Board for human rights at 01350000 extension: 5445. I understand that I am free to withdraw this consent and discontinue participation in this project at any time, even after signing this form, and it will not affect the care I might receive at AUBMC. I also understand that my participation may be ended by investigator at anytime. I know that I will receive a copy of this signed informed consent.

_____ _____

Name of patient or Legal Representative or Parent/Guardian — Signature

_____

Date & Time

_____ _____

Witness's Name — Signature

_____

Date & Time

Investigator's Statement:

I have reviewed, in detail, the informed consent document for this research study with _____ _____ (name of patient, legal representative, or parent/guardian) the purpose of the study and its risks and benefits. I have answered all the patient's questions clearly. I will inform the participant in case of any changes to the research

_____ _____

Name of Investigator or designee — Signature

_____

Date & Time

Institutional Review Board
American University of Beirut
17 FEB 2014
APPROVED

APPENDIX III

DATA COLLECTION FORM (ARABIC)

تقييم مستويات الBPA وارتباطها بالحالة الصحية بين السكان اللبنانيين

الاسم:	**الحروف الأولى للإسم:**	رقم المشارك:
رقم الهاتف:		التاريخ:

العوامل الديموغرافية:

تاريخ الميلاد:	الجنس: □ذكر □ أنثى
الحالة الاجتماعية: □ متزوج □ أعزب □ أرمل □ مطلق □ خاطب	

الاجتماعية والاقتصادية:

هل كنت مقيم خارج لبنان خلال العام الماضي : نعم كلا	
إذا كانت الإجابة بنعم، المكان _____ المدة _____	
مكان الإقامة _____	
طبيعة العمل _____	
ما هو دخلك في الأسرة	□ <600$ □ 600-999$ □ 1000-2000 $ □ >2000$ □ لا أعلم □ رفضت الإجابة
ما هو أعلى مستوى تعليمي أكملته؟	□ لم ألتحق بالمدرسة □ المرحلة الإبتدائية □ المرحلة المتوسطة □ المرحلة الثانوية □ دبلوم تعليم تقني/فني □ شهادة جامعية □ رفضت الإجابة
ما هو عدد الاشخاص الذين يسكنون في منزلكم (بما في ذلك الأقارب, أفراد العائلة أو الخدم الذين يسكنون معك بشكل جزئي)؟	
كم عدد الغرف في منزلكم (باستثناء المطبخ والحمامات والممرات والكراج والشرفات المفتوحة)؟	

تاريخ التدخين			
السجائر	هل تدخن(ي) السجائر حاليا ؟	□ نعم □ كلا	إذا كان الجواب نعم، كم سيجارة في اليوم؟_____ منذ متى؟_____
	إذا لا، هل أنت مدخن(ة) سجائر سابق(ة)؟	□ نعم □ كلا	إذا كان الجواب نعم، متى توقّفت؟_____
النرجيلة / الشيشة	هل تدخن(ي) النرجيلة حاليا ؟	□ نعم □ كلا	إذا كان الجواب نعم، كم نرجيلة في اليوم؟_____ منذ متى؟_____
	إذا لا، هل أنت مدخن(ة) نرجيلة سابق(ة)؟	□ نعم □ كلا	إذا كان الجواب نعم، متى توقّفت؟_____
الكحول			
هل تشرب الكحول حاليا؟		□ نعم □ كلا	إذا كانت الإجابة نعم، حدد النوع_____ كم كوب في اليوم؟_____ منذ متى؟_____
هل كنت تشرب الكحول سابقا		□ نعم □ كلا	إذا كان الجواب نعم، متى توقّفت؟_____
القهوة			
هل تشرب القهوة حاليا؟		□ نعم □ كلا	إذا كان الجواب نعم، كم كوب في اليوم؟_____
النشاط البدني			
خلال السبعة أيام الماضية، كم مرة مارست الأنشطة البدنية القوية مثل رفع الأوزان الثقيلة، والتمارين الرياضية، أو ركوب الدراجات بسرعة لفترة لا تقل عن 10 دقائق أو أي نشاط يتطلب الجهد البدني الشاق ويسبب صعوبة بالتنفّس)؟			_____ أيام في الأسبوع □ لم أمارس الأنشطة البدنية القوية كم من الوقت قضيت على المعدل لممارسة الأنشطة البدنية القوية؟ _____ساعات _____ دقائق؟ خلال ال 3 أشهر الماضية، كم عدد الأسابيع التي مارست بها الأنشطة البدنية القوية؟ _____ أسابيع
خلال السبعة أيام الماضية ، كم مرة مارست الأنشطة البدنية المعتدلة مثل رفع الأوزان الخفيفة، أو ركوب الدراجات، أو ممارس رياضة التنس أو أي نشاط يتطلب الجهد البدني المعتدل ويسبب صعوبة خفيفة بالتنفّس (لا تشمل المشي) ؟			_____ أيام في الأسبوع □ لم أمارس الأنشطة البدنية المعتدلة كم من الوقت قضيت على المعدل لممارسة الأنشطة البدنية المعتدلة ؟ _____ساعات _____ دقائق؟ خلال ال 3 أشهر الماضية، كم عدد الأسابيع التي مارست بها الأنشطة البدنية المعتدلة ؟ _____ أسابيع
خلال السبعة أيام الماضية ، كم مرة مارست رياضة المشي لفترة لا تقل عن 10 دقائق؟ و هذا يشمل المشي في المنزل و مكان العمل و المشي للتنقل اليومي أو الرياضة أو المتعة			_____ أيام في الأسبوع □ لم أمارس الأنشطة البدنية المعتدلة كم من الوقت قضيت على المعدل لممارسة رياضة المشي؟ _____ساعات _____ دقائق؟ خلال ال 3 أشهر الماضية، كم عدد الأسابيع التي مارست رياضة المشي؟ _____ أسابيع
خلال السبعة أيام الماضية ، ما هي الفترة الزمنية التي أمضيتها جالسا؟ و هذا يشمل الجلوس وراء مكتب أو خلال زيارة الأصدقاء أو الجلوس للقراءة أو مشاهدة التلفاز أو السفر على متن حافلة			_____ساعات _____ دقائق؟ خلال ال 3 أشهر الماضية، كم عدد الأسابيع التي اتبعت فيها هذا الكم من الوقت جالسا ؟ _____ أسابيع

التّاريخ الطبي:

مرض الشريان التاجي:

هل لديك أي من أفراد الأسرة الذين تم تشخيصهم بمرض الشريان التاجي أو ماتوا فجأة؟	□ نعم □ كلا إذا كان الجواب نعم حدد من:_____	في أي سن: _____
هل قيل لكم من قبل طبيب أنكم أصبتم بنوبة قلبية؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد متى:_____
هل خضعت لعملية تمييل (قسطرة) شرايين القلب؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد متى:_____
هل تم وضع رصور (الدعامة)؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد متى:_____
هل خضعت لعملية جراحية لتغيير شرايين القلب؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد متى:_____

ارتفاع ضغط الدم:

هل قيل لكم من قبل طبيب أو أحد العاملين في مجال الرعاية الصحية أن لديكم ارتفاع ضغط الدم؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد متى:_____
هل خضعت لقياس ضغط الدم من قبل الطبيب أو أحد مقدمي الرعاية الصحية؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد متى:_____ حدد النتيجة:_____
هل تخضعون لأي علاج لارتفاع ضغط الدم؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد النوع: □ تعديل نمط الحياة □ الأدوية:_____

داء السكري:

هل قيل لكم من قبل طبيب أو أحد العاملين في مجال الرعاية الصحية أنكم تعانون من ارتفاع نسبة السكر في الدم أو من مرض السكري؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد متى:_____
هل خضعت لقياس نسبة السكر في الدم من قبل طبيب أو العاملين في مجال الرعاية الصحية؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد متى:_____ حدد النتيجة:_____
هل تخضعون لأي علاج لارتفاع السكر في الدم أو لمرض السكري؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد النوع: □ تعديل نمط الحياة □ الأدوية:_____

ارتفاع مستوى الدهون في الدم:

هل قيل لكم من قبل طبيب أو أحد العاملين في مجال الرعاية الصحية أنكم تعانون من ارتفاع نسبة الكولسترول أو الدهون الثلاثية؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد متى:_____
هل خضعت لقياس الكولسترول من قبل طبيب أو العاملين في مجال الرعاية الصحية؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد متى:_____ حدد النتيجة:_____
هل تخضعون لأي علاج لارتفاع ارتفاع مستوى الدهون في الدم؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد النوع: □ تعديل نمط الحياة □ الأدوية:_____

مرض الغدة الدرقية:

هل قيل لكم من قبل طبيب أو أحد العاملين في مجال الرعاية الصحية أنكم تعانون من مرض الغدة الدرقية؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد متى:_____ حدد طبيعة المرض:_____
هل خضعت لقياس هرمونات الغدة الدرقية من قبل طبيب أو العاملين في مجال الرعاية الصحية؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد متى:_____ حدد النتيجة:_____
هل تخضعون لأي علاج لمرض الغدة الدرقية؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد النوع: □ تعديل نمط الحياة □ الأدوية:_____
هل لديك أي من أفراد الأسرة الذين تم تشخيصهم بمرض الغدة الدرقية؟ (أب، أم، اخ، أخت، جد، جدة)	□ نعم □ كلا	إذا كان الجواب نعم حدد من:_____

تاريخ أمراض السرطان:

هل قيل لكم من قبل طبيب أو أحد العاملين في مجال الرعاية الصحية أنكم تعانون من مرض السرطان ؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد متى:_____ حدد طبيعة المرض:_____
هل تخضعون لعلاج كيميائي أو أي علاج آخر لمرض السرطان؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد النوع: _____
هل لديك أي من أفراد الأسرة الذين تم تشخيصهم بمرض السرطان؟ (أب، أم، اخ، أخت، جد، جدة)	□ نعم □ كلا	إذا كان الجواب نعم حدد من:_____ حدد طبيعة المرض:_____

تاريخ الكسور:

هل عانيت من أيّ كسر في العظم؟	□ نعم □ كلا
إذا كان الجواب نعم	حدد أين: _____ العمر عند حصول الكسر:_____ كيف تم الكسر؟ (الوقوع من إرتفاع، حادث سير) _____

أمراض أخرى:

هل قيل لكم من قبل طبيب أو أحد مقدمي الرعاية الصحية أن لديك أي من التالي:		
السكتة الدماغية	□ نعم □ كلا	إذا كان الجواب نعم، حدد متى:_____
التهاب المفاصل	□ نعم □ كلا	إذا كان الجواب نعم، حدد متى:_____
التهاب الشعب الهوائية المزمن أو انتفاخ الرئة	□ نعم □ كلا	إذا كان الجواب نعم، حدد متى:_____
أمراض الكبد	□ نعم □ كلا	إذا كان الجواب نعم، حدد متى:_____

هل تعاني من أمراض أخرى؟

زيارة طبيب الأسنان:

هل قمت بزيارة طبيب الأسنان في العام الماضي؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد متى:_____
هل تم وضع الحشوات في العام الماضي ؟	□ نعم □ كلا	إذا كان الجواب نعم، حدد متى:_____

الأدوية: (إذا لم تتوفر الأدوية الرجاء الاتصال بالمشترك)

الاسم (العلامة التجارية و الاسم العام)	الجرعة	تاريخ بدأ الاستعمال

مراجعة عامة:

هل شعرت بتغيير في الوزن خلال ال 3 أشهر الماضية؟		□ الوزن مستقر □ وزن مفقود:_____كلغ □ وزن مكتسب:_____ كلغ
للنساء فقط	متى كانت آخر دورة شهرية؟_____	
	هل أنت في مرحلة: □ قبل انقطاع الطمث □ بعد انقطاع الطمث	إذا في مرحلة قبل انقطاع الطمث: □ الدورة الشهرية منتظمة □ الدورة الشهرية غير منتظمة
هل تعانين من:	□ حب الشباب □ الشعرانية	

عادة النوم

1 - كم ساعة تنام في الليل في أيام الأسبوع؟											
4 ساعات أو أقل		5 إلى 6 ساعات		6 إلى 7 ساعات		7 إلى 8 ساعات		8 إلى 9 ساعات		9 ساعات أو أكثر	
2 - كم ساعة تنام في الليل في أيام عطلة نهاية الأسبوع ؟											
4 ساعات أو أقل		5 إلى 6 ساعات		6 إلى 7 ساعات		7 إلى 8 ساعات		8 إلى 9 ساعات		9 ساعات أو أكثر	
3 - هل تشعر أنك لا تحصل على قسط كاف من النوم؟											
أبدا		نادرا (يوم واحد في الشهر)		أحيانا (2-4 أيام في الشهر)		كثيرا (5-15 يوم في الشهر)		تقريبا دائما (16-30 يوم في الشهر)			
4 – هل تواجه او صعوبة خلودك عند مصاعب للنوم ؟											
أبدا		نادرا (يوم واحد في الشهر)		أحيانا (2-4 أيام في الشهر)		كثيرا (5-15 يوم في الشهر)		تقريبا دائما (16-30 يوم في الشهر)			
5 - هل تستيقظ خلال الليل وتجد صعوبة في العودة إلى النوم؟											
أبدا		نادرا (يوم واحد في الشهر)		أحيانا (2-4 أيام في الشهر)		كثيرا (5-15 يوم في الشهر)		تقريبا دائما (16-30 يوم في الشهر)			
6 - هل تستيقظ في الصباح الباكر جدا وتكون غير قادر على متابعة النوم؟											
أبدا		نادرا (يوم واحد في الشهر)		أحيانا (2-4 أيام في الشهر)		كثيرا (5-15 يوم في الشهر)		تقريبا دائما (16-30 يوم في الشهر)			
7 - هل قال لك الطبيب أن لديك حالة توقف التنفس أثناء النوم؟											
		نعم		لا		لا أعرف					
8 -هل تشخر؟											
		نعم		لا		لا أعرف					
9 -إذا كنت تشخر, كيف يمكن أن تصف ارتفاع صوت شخيرك؟											
د .مرتفع جدا يمكن سماعه من الغرف المجاورة		ج .أعلى من الكلام		ب .بنفس درجة ارتفاع الكلام		أ. أعلى بقليل من صوت التنفس					
10 - إذا كنت تشخر, كم مرة يتكرر شخيرك؟											
ه .لا يحدث		د .مرة إلى مرتين بالشهر		ج .مرة إلى مرتين بالأسبوع		ب. 3- 4 مرات بالأسبوع		أ .تقريبا كل يوم			
11 - إذا كنت تشخر, هل سبق وأن سبب شخيرك الإزعاج للآخرين؟											
				لا أعرف		لا		نعم			
12 - هل لا حظ أي شخص أنك توقف التنفس أثناء النوم؟											
ه .لا يحدث		د .مرة إلى مرتين بالشهر		ج .مرة إلى مرتين بالأسبوع		ب. 3- 4 مرات بالأسبوع		أ .تقريبا كل يوم			
13 - كم مرة تشعر بالتعب أو الإرهاق عند الاستيقاظ من النوم؟											
ه .لا يحدث		د .مرة إلى مرتين بالشهر		ج .مرة إلى مرتين بالأسبوع		ب. 3- 4 مرات بالأسبوع		أ .تقريبا كل يوم			
14 - هل تحس بالتعب أو الإرهاق أثناء ساعات اليقظة؟											
ه .لا يحدث		د .مرة إلى مرتين بالشهر		ج .مرة إلى مرتين بالأسبوع		ب. 3- 4 مرات بالأسبوع		أ .تقريبا كل يوم			
15 - هل سبق أن نعست أو نمت خلال قيادة السيارة أو الانتظار؟											
		نعم		لا							
16 - إذا كانت الإجابة نعم، كم مرة يحدث هذا؟											
ه .لا يحدث		د .مرة إلى مرتين بالشهر		ج .مرة إلى مرتين بالأسبوع		ب. 3- 4 مرات بالأسبوع		أ .تقريبا كل يوم			

إستفتاء حول وتيرة إستهلاك الطعام

الاسم:	الحروف الاولى للإسم:	رقم المشارك:

إستبيان وتيرة إستهلاك الطعام. يرجى منك التفكير بالنمط الغذائي الخاص بك الذي اتّبعته خلال **العام السابق**. الرجاء تحديد الكمية المتناولة عادةً **في اليوم** أو **الأسبوع** أو **الشهر** لكل من المواد الغذائية التالية

Code	الطعام	مرجع حجم الحصّة	حجم الحصّة	في اليوم	في الأسبوع	في الشهر	نادراً/أبداً
	مثال: أرز، أبيض، مطبوخ	Side A/ Page 5	1/2 A 11		3		
	جبن (غني بالدسم/صفراء)	حصة واحدة = مثلث/مربع	3 B1, thick 2	1			
	بقول: عدس، فاصوليا، حمّص، الخ، مطبوخة	Side A or B Side A/Page 4	1.5 cups		1		
1	**الخبز والحبوب**						
1.1	خبز أبيض	رغيف خبز عربي كبير/					
		رغيف خبز عربي وسط/					
		خبز فرنجي (baguette)					
		توست وسط					
1.2	خبز أسمر أو مصنوع من القمح الكامل	رغيف خبز عربي كبير/					
		رغيف خبز عربي وسط/					
		خبز فرنجي (baguette)					
		توست وسط					
1.3	تنور / مرقوق	رغيف					
1.4	حبوب الفطور، عادي/نخالة/ سكر	Side A					
		(علبة صغيرة 35g)					
1.5	منتوجات الكعك	Finger size: small/long Round kaak: small/medium Page 13					
1.6	أرز، أبيض، مطبوخ	Side A/ Page 5					
1.7	معكرونة، سادة، مطبوخة	Side A/ Page 5					
1.8	قمح، كامل، مطبوخ/برغل	Side A/ Page 5					
1.9	أرز/ معكرونة مصنوع من القمح الكامل	Side A/ Page 5					
2	**مشتقّات الحليب**						
2.1	حليب قليل الدسم (٢ % دهون)	Side A					
2.2	حليب كامل الدسم	Side A					
2.3	لبن قليل الدسم /خالٍ من الدسم	Side A					
		عيران					
2.4	لبن كامل الدسم	Side A					

Code	الطعام	مرجع حجم الحصّة	حجم الحصّة	في اليوم	في الأسبوع	في الشهر	نادراً/أبداً
		عيران					
2.5	جبن (غني بالدسم/صفراء)	حصة واحدة = مثلث/مربع Side A or B					
2.6	جبن (قليل الدسم/لايت/بيضاء)	حصة واحدة = مثلث/مربع Side A or B					
2.7	لبنه، عادي	Side A					
2.8	لبنه، لايت/ خالية الدسم	Side A					
3	**الفاكهة والعصائر**						
3.1	الحمضيّات: برتقال ,غريفون	حبّة واحدة وسط / Side A					
3.2	فاكهة ذات اللون الأصفر أو البرتقالي الداكن (درّاق، خوخ، الخ)	حبّة واحدة وسط / Side A					
3.3	فراولة	10 فراولة/ Side A					
3.4	عنب	10 عنب/ Side A					
3.5	فاكهة أخرى: موز، / تفاح، طازج	حبّة واحدة وسط					
3.6	فاكهة مجفّفة: زبيب ، تمر مشمش	زبيب (1 ملعقة طعام)، تمر/ مشمش (حبّة واحدة)					
3.7	عصير فاكهة طازج	Side A					
3.8	مشروبات بطعم الفاكهة: تنكة/بلاستيك	Side A/تنكة					
3.9	مشروبات بطعم الفاكهة: ممعبّأة في زجاجات /كرتونة	كرتونة / زجاجة صغيرة Side A					
3.10	فاكهة معلّبة	Peach/ apricot = ½ fruit, Pineapple = 1 slice					
4	**الخضار**						
4.1	سلطة خضراء: خس، فلفل أخضر، خيار،نعنع..	Side A/ Page 8					
4.2	خضار ذات اللون الأخضر أو الأصفر الداكن (سبانخ، هندبة، ملوخيّة، جزر...)	Side A/ Page 4					
4.3	بندورة، طازجة، حجم وسط	10 cherry/ حبّة واحدة					
4.4	ذرة / بازلاء خضراء، مطبوخة	Side A/ Page 4					
4.5	ذرة / بازلاء خضراء، معلّبة	Side A/ Page 4					
4.6	بطاطا مشويّة/ مسلوقة/ مهروسة	Side A/ حبّة واحدة					
4.7	قرع، كوسى، باذنجان/ مطبوخ	Side A/ 1 med. stuffed					
4.8	قرنبيط/ ملفوف/ بروكولي	Side A/ Page 4					
4.9	خضار أخرى معلّبة (بالميتو- فطر-هليون)	Side A/ Page 4					
4.10	عصير خضار طازج: بندورة/ جزر	Side A					
5	**اللحوم وبدائلها**						
5.1	بقول: عدس، فاصوليا، حمّص..مطبوخة/ غير معلبة	Side A/ Page 4					
5.2	بقول معلّبة (فول/ فاصوليا ...) تنك-زجاج	Side A/ Page4					

Code	الطعام	مرجع حجم الحصّة	حجم الحصّة	في اليوم	في الأسبوع	في الشهر	نادراً/أبداً
5.3	مكسّرات وبذور: فول سوداني، لوز/جوز ، بذور دوّار الشمس	Side A/ small bag Page 4					
5.4	لحم أحمر (بقر، عجل، غنم)	Side A– مفروم					
		Steak -Side B/ Thickness					
5.5	دواجن	ساق/فخذ/صدر/جوانح Thickness/Side B					
5.6	سمك/ ثمار البحر طازج	Side B/Thickness					
		قريدس: 1 وسط					
		كالماري: 1 وسط					
		كراب: 1 أصبع					
5.7	سمك، معلّب (تونا، سردين)	تنكة كبيرة/ تنكة صغيرة Page 19					
5.8	بيضة، كاملة	١ بيضة					
5.9	لحوم الأعضاء (كبد، كلاوي، نخاع)	Side B/ Thickness					
5.10	لحوم باردة: مرتديلا، جانبون، سلامي، حبش، الخ	شريحة واحدة Side B/ Thickness					
5.11	سجق، مقانق- غير معلّب	حجم مقانق-Side B/ Thickness					
5.12	سجق، مقانق، هوت دوغ - معلّب	حجم مقانق-Side B/ Thickness حجم هوت دوغ					
6	**الدهون والزيوت**						
6.1	زيت نباتي: ذرة/ دوّار الشمس/ صويا	Side A					
6.2	زيت زيتون (يتضمن مع الزعتر)	Side A					
6.3	زيتون	1 حبة					
6.4	زبدة	Side A					
6.5	سمن	Side A					
6.6	مايونيز	Side A					
6.7	طحينة	Side A					
7	**الحلويات**						
7.1	كيك، كوكيز، دونات، مافن، كرواسان	Page 14, 15, 16 Side B/ Thickness					
7.2	بوظة	1 scoop/ Page 9 /1 stick					
7.3	لوح شوكولا	1 شوكولا وسط					
7.4	سكر، عسل، مربّى، دبس, كريمة شوكولا chocolate spread	Side A					
7.5	حلويات عربيّة، بقلاوة، معمول، كنافه	Thickness /Side B كنافه مع كعك					
8	**المشروبات**						
8.1	مشروبات غازيّة، عادي	Side A/ 1 can (330 mL)					

Code	الطعام	مرجع حجم الحصّة	حجم الحصّة	في اليوم	في الأسبوع	في الشهر	نادراً/أبداً
8.2	مشروبات غازيّة ، دايت	Side A/ 1 can (330 mL)					
8.3	قهوة تركية	Side A					
8.4	قهوة/نسكافيه أو شاي	Side A					
8.5	شراب الشوكولا أو الكاكاو الساخن	Side A					
8.6	بيرة، عادي	Side A/ 1 bottle					
8.7	نبيذ: أحمر، أبيض، أو وردي	Side A					
8.8	الخمور: ويسكي، فودكا، جين، رَم	Side A					
8.9	مياه	Side A/ bottle (0.5 L)					
9	**مأكولات أخرى**						
9.1	مناقيش، زعتر، جبنة	منقوشة كبيرة / bouchee صغيرة					
9.2	بطاطا مقليّة	Side A / Page 4					
9.3	رقائق البطاطا	XS/S/M/L/XL Page 20					
9.4	فلافل دون خبز	1 فلافل، حجم وسط					
9.5	سندويش شاورما	سندويش، حجم وسط					
9.6	برغر (لحمة، دجاج، سمك)	Side B /1 medium					
9.7	بيتزا	Side B/ Thickness					
9.8	حساء معلّب	Side A/ Page 3					
9.9	كاتشب	Side A					
9.10	خردل	Side A					

10.1. كم مرة تتبل طعامك مع صلصة الطماطم المكونة **من الطماطم والبصل والثوم مع زيت الزيتون؟**
---------- عدد مرات باليوم / الأسبوع / الشهر؟

10.2. هل تستهلك لحوم الدجاج أو الديك الرومي بدلا من اللحم الأحمر: البقر، العجل، لحم الخنزير، همبرغر، أو السجق؟
------ نعم ------ لا

هل هناك أي أطعمة أخرى غير تلك المذكورة أعلاه تتناولها **عادةً مرة في الأسبوع على الأقل؟**

مثال: ***باتيه، صلصة الكريمه، شوفان، coffee creamer, energy drink*** الخ (لا تشمل التوابل الجافّة). لا تسجّل الأطعمة التي تم ذكرها في القسم السابق.

أطعمة أخرى تتناولها عادةً مرة في الأسبوع على الأقل	حجم الحصّة الإعتيادي	حصّة في الأسبوع

إستفتاء حول العادات الغذائيّة

1- هل تعلم ما هو ثنائي الفينول أ (BPA) ؟	□ نعم □ كلا
2- هل أنت على علم بوجود زجاجات بلاستيكية/تابروير خالية من BPA؟	□ نعم □ كلا

		دائما 6-7 x/week	معظم الوقت 4- 5x/week	مرات قليلة 2-3 x/week	نادرا 1x/week to 2x/month	أبدا/ كلا	لا أعرف
3	هل تخزّن الأطعمة في حاويات بلاستيكيّة؟						
4	هل تسخّن الأطعمة في حاويات بلاستيكيّة؟						
5	هل تتأكّد من أنّ الحاويات البلاستيكيّة التي تستخدمها خالية من مادّة ال BPA؟						
6	هل تسخّن الأطعمة المغلّفة بنايلون لاصق؟						
7	هل تشرب المياه المعبّأة في قناني بلاستيكيّة؟						
	7.1 من المياه المعبأة في زجاجات البلاستيك: ---------- أكواب / يوم 7.2 من مبرد المياه: ---------- أكواب / يوم						
8	هل تعيد إستخدام قناني المياه البلاستيكيّة؟						
9	هل تشرب من قناني مياه قد تركتها في سيّارتك؟						
10	هل تتناول الطعام خارج المنزل؟ (في المطاعم، في الحانات التي تقدّم وجبات خفيفة، الخ)						
11	كم مرّة في الأسبوع تقوم بشراء الوجبات السريعة والجاهزة (delivery)؟						
12	هل تشتري المشروبات الغازيّة المعبّأة في علب تنك و في قناني بلاستيكيّة؟						
13	هل تستهلك معجون الطماطم/ رب البندورة المعلبة؟						

المأخوذ الغذائي خلال الأربع وعشرين ساعة الأخيرة

نرجو منك أن تتذكر ما تناولته من طعام أو شراب في الأمس منذ نهوضك في الصباح وحتى اليوم التالي.

التاريخ:----/----/----

اليوم في الأسبوع:----------

الوقت	الطعام الذي تناولته	الكمية	طريقة التحضير

هل كان الأمس يوما عاديا؟
- نعم
- لا، حدد: _____

- متى كانت آخر مرة تناولت فيها الطعام؟ _____

Physical Exam Form

Name of the participant: ---------- Initials:---------- Study ID number: ----------

		Results النتائج	Healthy ranges النطاقات الصحية
Body weight (kg الوزن			
Height (cm): الطول			
BMI: مؤشر البدانة			*18.5-24.9 kg/m²*
Waist circumference (cm): قياس دائرة الخصر			نساء *<80 cm*, رجال *<94 cm*
Body fat (kg): نسبة الدهون في الجسم			نساء *<32%;* رجال *<25%*
Muscle mass (kg): نسبة العضل في الجسم			نساء *24-30 %:* رجال *33-40%*
Waist to hip ratio: قياس محيط الأوراك			نساء *<0.9*, رجال *<0.85*
Heart rate: قياس نبض القلب			*60-100 bpm*
Blood Pressure – Measurement # 1 قياس ضغط الدم 1			
Systolic blood pressure (mmHg):	العالي		*120 mmHg*
Diastolic blood pressure(mmHg):	الواطي		*80 mmHg*
Blood Pressure – Measurement # 22 قياس ضغط الدم			
Systolic blood pressure (mmHg):	العالي		*120 mmHg*
Diastolic blood pressure(mmHg):	الواطي		*80 mmHg*

Time of urine collection	
Time of blood withdrawal	

APPENDIX IV

DATA COLLECTION FORM (ENGLISH)

Assessment of BPA levels and their association with the health status among Lebanese population

Name:	**Initials:**	**Study ID number:**
Tel number:		**Date:**

Demographic Factors:

Date of birth:	**Gender:** □ Males □ Females
Marital status: □ Married □ Single □ Widow □ Divorced □ Engaged	

Socioeconomic:

Have you lived outside Lebanon for the past year: □ No □ Yes	
If yes, where_____ and for how long _____	
Which area do you live?	
What do you work?	
What is your income per family:	□ <600$ □ 600- 999.9$ □ 1000-2000$ □ >2000$ □ I don't know/ Not sure □ I prefer not to answer
What is your highest level of education?	□ No schooling □ Primary school □ Intermediate school □ Secondary school □ Technical diploma □ University degree □ I prefer not to answer
What is the total number of individuals living in your house? (Including relatives, family members and maids that frequently live with you on a semi-permanent basis)	
How many rooms are there in your house? (Excluding kitchens, bathrooms, hallways, balconies, and garage)	

Lifestyle:

Smoking history			
Cigarette	Do you currently smoke cigarettes?	□ No □ Yes	If yes, how many cigarettes/day? Since when?
	If no, are you a previous cigarette smoker?	□ No □ Yes	If yes, when did you stop?
Narghileh	Do you currently smoke narghileh?	□ No □ Yes	If yes, how many narghileh/day? Since when?
	If no, are you a previous narghileh smoker?	□ No □ Yes	If yes, when did you stop?
Alcohol			
Do you currently drink alcohol?		□ No □ Yes	
		If yes specify type? Since when?	How many glasses/week?
Previous drinker?		□ No □ Yes	If yes, when did you stop?
Coffee			
Do you currently drink coffee?		□ No □ Yes If yes how many cups/day?	
Physical activity			
During the last 7 days, on how many days did you do **vigorous** physical activities like heavy lifting, aerobics, or fast bicycling for at least 10 minutes (or any activity that take hard physical effort and make you breathe harder than normal)?		---------- days/week □ None - How much time in total did you usually spend on one of those days doing vigorous physical activities? _____ hours _____ minutes? - How many weeks did you spend doing vigorous physical activities during the last 3 months? ----------weeks	
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 tennis or any activity that take hard physical effort and make you breath harder than normal)? Do not include walking.		---------- days/week □ None - How much time in total did you usually spend on one of those days doing moderate physical activities? _____ hours _____ minutes? -How many weeks did you spend doing moderate physical activities during the last 3 months? ----------weeks	
During the last 7 days, on how many days did you **walk** for at least 10 minutes at a time? This includes walking at work and at home, walking to travel from place to place, and any other walking that you did solely for sport, exercise or leisure.		---------- days/week □None - How much time in total did you usually spend walking on one of those days? _____ hours _____ minutes? -How many weeks did you spend walking during the last 3 months? ----------weeks	
During the last 7 days, how much time in total did you usually spend sitting on a week day? This includes time spent sitting at a desk, visiting friends, reading traveling on a bus or sitting or lying down to watch television.		_____ hours _____ minutes? -How many weeks have you been spending the same time in terms of sitting during the last 3 months? ----------weeks	

Medical History:

Coronary artery disease:

Do you have any family member who has been diagnosed with coronary artery disease or died suddenly?	□ No □ Yes If yes: specify who	At what age:
Have you been told by a doctor that you had a heart attack?	□ No □ Yes If yes when:	
Did you undergo cardiac catheterization?	□ No □ Yes If yes when:	
Was a stent placed?	□ No □ Yes If yes when:	
Did you have coronary heart bypass surgery?	□ No □ Yes If yes when:	

Hypertension:

Have you been told by a doctor or a health care worker that you have high blood pressure?	□ No □ Yes If yes when:
Have you had your blood pressure measured by a doctor or a health care worker?	□ No □ Yes If yes when? What was it?
Are you taking any treatment for high blood pressure?	□ No □ Yes If yes specify: □ Life style modifications □ Drugs:

Diabetes Mellitus:

Have you been told by a doctor or a health care worker that you have raised blood sugar or diabetes?	□ No □ Yes If yes when:
Have you had your blood sugar measured by a doctor or a health care worker?	□ No □ Yes If yes when? What was it?
Are you taking any treatment for high blood sugar or diabetes?	□ No □ Yes If yes specify: □ Life style modifications □ Drugs:

Dyslipidemia:

Have you been told by a doctor or a health care worker that you have raised cholesterol or triglycerides?	□ No □ Yes If yes when:
Have you had your cholesterol measured by a doctor or a health care worker?	□ No □ Yes If yes when? What was it?
Are you taking any treatment for dyslipidemia?	□ No □ Yes If yes specify: □ Life style modifications □ Drugs:

Thyroid disease:

Have you ever been told by a doctor or ahealth care worker that you have thyroid disease?	□ No □ Yes If yes when? What was the disease?
Have you had your thyroid hormones measured by a doctor or a health care worker?	□ No □ Yes If yes when? What was it?
Are you taking any thyroid drug?	□ No □ Yes If yes specify:
Do you have any family history of thyroid disease? (Parents, siblings and grandparents)	□ No □ Yes If yes specify who:

Cancer history:

Have you ever been told by a doctor or ahealth care worker that you have cancer?	□ No □ Yes If yes when? What was the disease?
Are you taking any chemotherapy or other drug for cancer?	□ No □ Yes If yes specify
Do you have any family history of cance? (Parents, siblings and grandparents)	□ No □ Yes If yes specify the disease: Specify who:

Fracture history:

Did you ever sustain a fracture?	□No □Yes
If yes:	Where? Age at onset? How did it happen? (fall from height, accident…)?

Other diseases:

Have you been told by a doctor or a health care worker that you have any?	
Stroke?	□No □Yes If yes when:
Arthritis?	□No □Yes If yes when:
Chronic bronchitis or emphysema?	□No □Yes If yes when:
Liver disease?	□No □Yes If yes when:

Do you have any other illnesses?

Dentist visits:

Have you visited any dentist in the past year?	□ No □ Yes If yes when:
Did you have any fillings done in the past year?	□ No □ Yes If yes when:

Medications (if not brought, call the participant later)

Name (brand and generic)	Dose	Date started

Review of system:

Do you have any weight changes during the last 3 months?		□ Stable weight □ Lost weight How many Kgs? □ Gained weight How many Kgs?
For women:	When was your last menstrual period?	
	Are you□ premenopausal □ postmenopausal	If premenopausal do you have □ Regular menses □ Irregular menses
	Do you have? □ Acne □ Hirsutism	

Sleep Habits and Berlin questionnaires

1- How many hours do you sleep per night on weekdays?					
4 hrs or less	5 to 6 hrs	5 to 7 hrs	7 to 8 hrs	8 to 9 hrs	9 hrs or more
2- How many hours do you sleep per night on weekends?					
4 hrs or less	5 to 6 hrs	5 to 7 hrs	7 to 8 hrs	8 to 9 hrs	9 hrs or more
3- Do you feel that you are not getting enough sleep?					
Never	Rarely (1 / month)	Sometimes (2-4 / month)	Frequently (5-15 /month)	Almost Always (16-30 / month)	
4- Do you have Trouble falling asleep?					
Never	Rarely (1 / month)	Sometimes (2-4 / month)	Frequently (5-15 /month)	Almost Always (16-30 / month)	
5- Do you wake up during the night and have difficulty resuming sleep?					
Never	Rarely (1 / month)	Sometimes (2-4 / month)	Frequently (5-15 /month)	Almost Always (16-30 / month)	
6- Do you wake up too early in the morning and be unable to resume sleep?					
Never	Rarely (1 / month)	Sometimes (2-4 / month)	Frequently (5-15 /month)	Almost Always (16-30 / month)	
7- Did your doctor tell you that you have sleep apnea?					
Yes	No				
8- Do you snore?					
Yes	No	Don't Know			
9- If you snore, your snoring is?					
a. Slightly louder than breathing	b. As loud as talking	c. Louder than talking	d. Very loud-can be heard in adjacent rooms		
10- If you snore, how often do you snore?					
a. Nearly every day	b. 3-4 times a week	c. 1-2 times a week	d. 1-2 times a month	e. Never or nearly never	
11- If you snore, has your snoring ever bothered other people?					
Yes	No	Don't Know			
12- Has anyone noticed that you quit breathing during sleep?					
a. Nearly every day	b. 3-4 times a week	c. 1-2 times a week	d. 1-2 times a month	e. Never or nearly never	
13- How often do you feel tired or fatigued after you sleep?					
a. Nearly every day	b. 3-4 times a week	c. 1-2 times a week	d. 1-2 times a month	e. Never or nearly never	
14- During your waking time do you fee tired, fatigued or not up to par?					
a. Nearly every day	b. 3-4 times a week	c. 1-2 times a week	d. 1-2 times a month	e. Never or nearly never	
15-Have you ever nodded off or fallen asleep while driving a vehicle?					
Yes	No				
16- If yes, how often does this occur?					
a. Nearly every day	b. 3-4 times a week	c. 1-2 times a week	d. 1-2 times a month	e. Never or nearly never	

FOOD FREQUENCY QUESTIONNAIRE

Name of the participant: ---------- Initials:---------- Study ID number: ----------

Please think about your eating patterns during the past year. Please indicate your usual intake of each of the following food items per day, week, or month. Please be as precise as you can in your recall.

Code	Food item	Reference Portion	Serving Size	Day	Week	Month	Rarely/Never
	Examples:						
	Rice, white, cooked	*A side*	*½ A 11*		*3*		
	Cheese, regular	*B side/ Thickness*	*B1 / Th. 2*	*4*			
	Legumes, canned (beans, peas)	*Side A/ Page 4*	*1.5 cups*		*2*		
1	**Bread and Cereals**						
1.1	Bread, white	1 large Arabic loaf					
		1 medium Arabic loaf					
		1 French baguette					
		1 pain de mie/ toast					
1.2	Bread, brown	1 large Arabic loaf					
		1 medium Arabic loaf					
		1 French baguette					
		1 pain de mie/ toast					
1.3	Traditional breads(markouk/tannour)	1 loaf					
1.4	Breakfast cereals, regular/ sugar coated/ chocolate/ bran	Side A					
		Carton (35 g)					
1.5	Kaak	Finger size Small round / Page 13					
1.6	Rice, white, cooked	Side A/ Page 5					
1.7	Pasta/ Noodles, plain, cooked	Side A/ Page 5					
1.8	Wheat/ Bulgur, cooked	Side A/ Page 5					
1.9	Rice/Pasta/Cereals, whole grain	Side A / Page 5					
2	**Dairy Products**						
2.1	Milk, skim/low-fat (0-2%)	Side A					
2.2	Milk, whole-fat	Side A					
2.3	Yogurt, fat-free/low-fat	Side A					
		Bottled ayran					
2.4	Yogurt, whole-fat	Side A					
		Bottled ayran					

2.5	Cheese, regular / yellow	Side A Side B / Thickness Cube/ triangular portion					
2.6	Cheese, low fat / white	Side A Side B / Thickness Cube/ triangular portion					
2.7	Labneh, regular	Side A					
2.8	Labneh, low fat	Side A					
3	**Fruits and Fruit Juices**						
3.1	Citrus orange/ grapefruit	Side A / 1 medium					
3.2	Peach, plum, prunes	Side A / 1 medium					
3.3	Strawberries	Side A / 10 strawberries					
3.4	Grapes	Side A / 10 grapes					
3.5	Banana/ Apples	Side A / 1 medium					
3.6	Dried Fruits	Raisins= 1 tbsp Dates: 1 portion Apricots: 1 portion					
3.7	Fruit juice, fresh	Side A					
3.8	Fruit juice, canned	1 can					
3.9	Fruit juice, bottled	1 bottle/ carton					
3.10	Fruits, canned	Peach/ apricot = ½ fruit Pineapple = 1 slice					
4	**Vegetables**						
4.1	Salad, green: lettuce, mint, cucumber, green pepper, rocket, purslane, etc.	Side A/ Page 8					
4.2	Dark green or deep yellow (spinach, Swiss Chard, Jew's mellow, carrots..)	Side A/ Page 4					
4.3	Tomatoes, fresh	1 medium / 10 cherry					
4.4	Corn / Green peas, fresh	Side A/ Page 4					
4.5	Corn/ Green peas, canned	Side A/ Page 4					
4.6	Potatoes, baked / boiled/ mashed	Side A / 1 medium					
4.7	Zucchini/ Eggplants, cooked	Side A/5 med. stuffed					
4.8	Cauliflower/ Cabbage/ Broccoli	Side A/ Page 4					
4.9	Other canned vegetables (Mushroom, palmetto, asparagus, etc.)	Side A/ Page 4					
4.10	Vegetable juice, fresh	Side A					
5	**Meat and Meat Alternatives**						
5.1	Legumes: lentils, beans, chickpeas, etc., dried, cooked	Side A/ Page 4					
5.2	Legumes, canned (beans, peas)	Side A/ Page 4					

5.3	Nuts & seeds: walnuts, peanuts, almonds, sunflower seeds, etc.	Side A/ Page 4 Pre-packed small bag						
5.4	Red meat, beef/ lamb/goat	Side A/ Ground Steak - Side B/ Thickness						
5.5	Poultry	Leg/thigh/breast/wings Side B						
5.6	Fish/ Seafood, fresh	Side B/ Thickness Shrimp: 1 medium Calamari: 1 medium Crab: 1 medium						
5.7	Fish, canned (tuna, sardines)	1 large can/ 1 small can Page 19						
5.8	Eggs	1 medium						
5.9	Organ meats (liver, kidneys, brain)	Side B/ Thickness						
5.10	Luncheon meats (mortadelle, turkey, salami, ham, etc.)	Side B/ Thickness Regular slice						
5.11	Sausages, makanek, uncanned	Side B/ Thickness Makanek size						
5.12	Sausages, makanek, hotdogs, canned	Hotdog size Makanek size Side B/ Thickness						
6	**Added Fats and Oils – Salads/ Cooking / Fries**							
6.1	Vegetable oil, corn/ sunflower/ soya	Side A						
6.2	Olive oil (including with thyme)	Side A						
6.3	Olives	5 olives						
6.4	Butter	Side A						
6.5	Ghee	Side A						
6.6	Mayonnaise	Side A						
6.7	Tahini	Side A						
7	**Sweets and Desserts**							
7.1	Cakes / Cookies/ Doughnuts / Muffins/ Croissant / Biscuits	Side B / Thickness Page 14-15-16						
7.2	Ice cream	1 scoop/ 1 stick/ Page 9						
7.3	Chocolate bar	1 medium						
7.4	Sugar, honey, jam, molasses, chocolate spread	Side A						
7.5	Arabic sweets Baklava, maamoul, kneife	Side B						

8	**Beverages**						
8.1	Soft drink, regular	Side A / 1 can (330 mL)					
8.2	Soft drink, diet	Side A / 1 can (330 mL)					
8.3	Turkish coffee	Side A					
8.4	Instant coffee / Tea	Side A					
8.5	Cocoa / Hot chocolate	Side A					
8.6	Beer	Side A / 1 bottle					
8.7	Wine, red / white/ blush	Side A					
8.8	Liquor, whiskey/ vodka/ gin/ rum	Side A					
8.9	Water	Side A / Bottle (0.5 L)					
9	**Miscellaneous**						
9.1	Manaeesh, zaatar/ cheese	1 regular / 1 bouché Page 17- 18					
9.2	French fries	Side A Page 4					
9.3	Potato chips / Tortilla	XS/ S/ M/ L/ XL bag Page 20					
9.4	Falafel, without bread	1 medium falafel					
9.5	Shawarma	1 medium sandwich					
9.6	Burgers (beef, chicken, fish)	1 medium burger					
9.7	Pizza	Side B / Thickness					
9.8	Canned/ Pre-packed soups	Side A / Page 3					
9.9	Ketchup	Side A					
9.10	Mustard	Side A					

10.1. How many times do you ***season your food with a tomato-based sauce*** (tomato, onion, garlic and simmered with olive oil)?
---------- number of times per day / week / month?

10.2. Do you actually consume chicken or turkey meat ***instead of*** veal, pork, hamburger, or sausage?
------ Yes ------ No

11. Are there any other foods/supplements that you regularly consume **[at least once per week]** and that were not mentioned in the FFQ list above?

Food Item	Usual serving size	Frequency of intake per week

Dietary Habits Questionnaire

1. Do you know what Bisphenol A (BPA) is? ----- No ----- Yes
2. Are you aware of BPA free bottles / plastic containers (Tupperware)? ----- No ----- Yes

		Always (6-7 times/week)	Most of the times (4-5 times/week)	Few times (2-3 times/week)	Rarely (1x/week to 2x/month)	Never	Don't know
3	Do you store foods in plastic containers?						
4	Do you heat foods in plastic containers?						
5	Do you make sure that the plastic containers you use are BPA-free?						
6	Do you heat foods that are wrapped in cling film?						
7	Do you drink bottled water?						
	7.1 From plastic- bottled water: ---------- cups/day 7.2 From water cooler: ---------- cups/day						
8	Do you reuse bottled water?						
9	Do you drink from bottles you left in your car?						
10	Do you eat outside home (snacks, restaurants, bars)?						
11	Do you order delivery foods?						
12	Do you purchase soft drinks in cans and/or plastic bottles?						
13	Do you consume canned tomato paste?						

24-Hours Dietary Recalls

Date: (dd/mm/yyyy) ----/----/--------

Day of the week: ----------

Time	Food eaten	Amount	Method of preparation

Was yesterday a usual eating day?

- Yes
- No, please specify ----------

- When was the last meal taken?

Lab work data collection

Name of the participant: ---------- Initials:---------- Study ID number:----------

Test	Unit	Result
Hba1c		
LDL		
SGPT		
Urinary creat		
FBS		
HDL		
GGT		
Spot microalbumin		
Fasting insulin		
Triglycerides		
CRP		
Creatinine		
Total cholesterol		
TSH		
25OHvit D		
Cortisol		
C-peptide		
Prolactin		
Leptin		

Physical Exam Form

Name of the participant: ---------- Initials:---------- Study ID number: ----------

		Results النتائج	Healthy ranges النطاقات الصحية
Body weight (kg	الوزن		
Height (cm):	الطول		
BMI:	مؤشر الكتلة		*18.5-24.9 kg/m²*
Waist circumference (cm):	قياس دائرة الخصر		*نساء <80 cm, رجال <94 cm*
Body fat (kg):	نسبة الدهون في الجسم		*نساء <32%; رجال <25%*
Muscle mass (kg):	نسبة العضل في الجسم		*نساء 24-30 %; رجال 33-40%*
Waist to hip ratio:	قياس محيط الأورك		*نساء <0.9, رجال <0.85*
Heart rate:	قياس نبض القلب		*50-100 bpm*
Blood Pressure – Measurement # 1	قياس ضغط الدم 1		
Systolic blood pressure (mmHg):	العالي		*120 mmHg*
Diastolic blood pressure(mmHg):	الواطي		*80 mmHg*
Blood Pressure – Measurement # 22	قياس ضغط الدم		
Systolic blood pressure (mmHg):	العالي		*120 mmHg*
Diastolic blood pressure(mmHg):	الواطي		*80 mmHg*

Time of urine collection	
Time of blood withdrawal	

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