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NONCOMMUNICABLE DISEASE RISK AND NUTRIENT ADEQUACY AMONG UNIVERSITY STAFF IN LEBANON: A STUDY USING THE GLOBAL DIET QUALITY SCORE AND THE HEALTHY EATING INDEX

by
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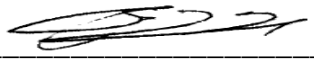

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ABSTRACT

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Background: Since October 2019, Lebanon has been grappling with a multifaceted crisis characterized by political and economic instability, leading to a surge in poverty due to rising inflation and a shift towards lower-quality diets. This crisis has exacerbated poor dietary habits and the prevalence of non-communicable diseases (NCDs), emphasizing the importance of identifying dietary deficiencies. Utilizing tools like the Global Diet Quality Score (GDQS) and Healthy Eating Index (HEI) becomes crucial for the development of evidence-based strategies aimed at enhancing diet quality and alleviating the burden of NCDs on the population and the healthcare system in Lebanon.
Objectives: This study aimed to evaluate the dietary quality of non-academic staff aged 24 to 49 at the American University of Beirut (AUB) in Lebanon using the GDQS and HEI. Additionally, the study sought to pinpoint the specific food groups responsible for driving consumption patterns associated with NCD risk, leading to lower GDQS and HEI scores, while also exploring potential gender differences in these patterns.

Methods: To examine the role of diet as a risk factor for NCDs in university staff in Lebanon, we recruited a convenient sample of 200 AUB non-academic staff (comprising 100 males and 100 females) aged between 24 and 49 years. This sample represented more than 20% of the staff population. Diet quality assessment was conducted using two metrics: the GDQS, which considers both nutrient adequacy and NCD risk factors, and the HEI, which evaluates nutrient quality and how well dietary choices align with recommended nutritional guidelines. A total GDQS score ≥ 23 is an indicator of low risk of both suboptimal diet and NCDs development. A score <15 is an indicator of high risk, and a score of ≥ 15 and 23 is an indicator of moderate risk. Whereas HEI scores of (0-50), (51-80) & (81-100) indicated respectively low, moderate and high adherence to nutritional guidelines. Data on dietary intake were collected using a specialized application developed by INTAKE to provide a standardized, efficient, user-friendly, and cost-effective method for gathering information on food consumption. Face-to-face interviews collected a multi-component questionnaire, including sociodemographic information, lifestyle factors, consumption drivers, self-reported anthropometric measurements, and 24-hour dietary recalls. Dietary intake data were analyzed using the Nutritionist Pro software, with data processing conducted using the Statistical Package for the Social Sciences (SPSS; version 25). For all statistical analyses, P-values less than 0.05 indicated statistical significance.

Results: The mean total GDQS score for AUB non-academic staff was 18.46 ± 4.39. Only 15% of participants achieved a high GDQS score, indicating a low risk of adverse health outcomes, while 59.5% scored at a moderate level, suggesting a moderate risk, and 25.5% achieved a low GDQS score, indicating a high risk for NCDs. Inadequate consumption of fruits, dark green leafy vegetables, deep orange vegetables, legumes, nuts and seeds, whole grains, liquid oils, and fish and shellfish emerged as key contributors to low GDQS scores. The three most frequently reported barriers to consuming healthy foods were adherence to past eating habits, high cost, and a dislike of taste and texture. The overall HEI score for AUB non-academic staff was 51.6 ± 12.54, with only 1% achieving a high HEI score, 53.5% attaining a moderate score, and 45.5% scoring low. Insufficient consumption of whole fruits, green beans, whole grains, dairy, total protein foods, and seafood and plant proteins were identified as determinants of low HEI scores.

Conclusion: The study revealed that a small proportion of AUB non-academic staff had high GDQS. No significant gender differences were observed in GDQS scores or categories, and sociodemographic, lifestyle, and BMI characteristics did not appear to impact GDQS scores significantly. The primary barriers to consuming healthy foods were rooted in past eating habits, high costs, and taste preferences. Conversely, enjoying the taste and texture of unhealthy foods emerged as the primary facilitator of their consumption, followed by past eating habits and a tendency to overlook their adverse health effects. A noteworthy portion of AUB non-academic staff also achieved moderate HEI scores, with no significant gender disparities. These findings underscore the need for strategies aimed at promoting healthier eating habits and reducing NCD risk factors to mitigate adverse health consequences and the burden of NCDs.

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ABBREVIATIONS

DQ: Diet Quality

NCD: Non-Communicable Diseases

HEI : Healthy Eating Index

BMI: Body Mass Index

GDQS: Global Diet Quality Score

LMIC: Low And Middle-Income Countries

CVD: Cardiovascular Diseases

WHO: World Health Organization

EMR: Eastern Mediterranean Region

Dgas: Guidelines For Americans

PDQS: Prime Diet Quality Score

ANOVA: Analysis of Variance

SPSS: Statistical Package for the Social Sciences

CHAPTER 1

INTRODUCTION

Lebanon is facing a multifactorial crisis that began in October 2019, characterized by political and economic instabilities. Since then, Lebanese individuals have experienced significant and increasingly complex pressures, leading to a drastic increase in poverty rates. The inflation that the country is currently experiencing is having a negative impact on the quality of life and purchasing power of the Lebanese people. In fact, the rise in food prices has compelled people to focus strictly on necessities and shift towards lower-quality diets (Guechati & Mustapha, 2022). However, diet quality (DQ) is recognized as a major threat to global public health (Angulo et al.). Additionally, a lower socioeconomic status is associated with the development of non-communicable diseases (NCDs), particularly because socially disadvantaged people tend to have poor dietary habits (World Health Organization, 2023b). In fact, in Lebanon, 91% of deaths are attributable to NCDs (World Health Organization, 2018).

Poor dietary habits constitute a significant societal concern. Eating patterns that prioritize food quality and adequacy should be considered to reduce the risk of diet-related chronic diseases and nutrient deficiencies (Global Nutrition Report, 2020). In Lebanon, modifiable risk factors for NCDs are continually increasing. Simultaneously, efforts to address the burden of NCDs in Lebanon are scarce. The Ministry of Public Health introduced a national NCD prevention and control plan (NCD-PCP) in 2016. However, its implementation has been unsuccessful (Zablith et al.). Therefore, it is

critical to identify gaps in dietary habits among the Lebanese population to reduce the growing NCD burden. Consequently, the use of the Global Diet Quality Score (GDQS) among Lebanese adults provides valuable insights into the factors and obstacles influencing sufficient nutrient intake. This information can serve as a foundation for evidence-based approaches to mitigate the increasing impact of NCDs and enhance diet quality and nutrient sufficiency.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview on malnutrition

Malnutrition is defined as excess or deficiency in nutrient intake, hindered nutrient utilization and imbalanced status of essential nutrients (World Health Organization, 2020).

Malnutrition includes two distinct categories of health conditions: firstly, undernutrition, which includes wasting, stunting, and micronutrient deficiencies. Secondly, overweight, obesity, and NCDs. It is estimated that approximately one in three individuals globally may experience one form or another of malnutrition. Malnutrition is correlated with an elevated likelihood of developing various diseases, including CVD, specific types of cancer, and infections, posing a substantial burden on healthcare and aged-care systems. (Viasus et al., 2022).

2.2.1 Obesity

Obesity is defined as an excessive adiposity that consequently leads to the development of many chronic diseases such as type 2 diabetes, and coronary heart disease. In 2016, more than 1.9 billion adults were overweight, out of these, more than 600 million individuals were obese. It is known that genetics constitute a major risk factor for increased body weight, but also, environmental factors, behavioral factors, and socioeconomic status (and many more) do have an impact on individuals' health and body composition. The multifactorial pathogenesis of obesity has been longly provoking a global burden. Especially because obesity is characterized by a cascade of

metabolic abnormalities that start with excessive visceral fat deposition and end up with chronic health problems and many serious NCDs.

The escalating burden of overweight and obesity and its coexistence with nutrition deficiencies and malnutrition may cause serious public health implications (Leppäniemi et al., 2023)

2.2.2 NCDs

NCDs are defined as non-contagious chronic diseases of complex etiology and multiple risk factors (Global Nutrition Report, 2020). They are considered a major public health concern, constituting 74% of all deaths globally. Genetic, environmental, physiological, and behavioral factors are recognized as major causative agents of NCDs (World Health Organization, 2023b). NCDs exhibit a higher occurrence in low and middle-income countries (LMIC) where they stand as the primary contributors to both morbidity and mortality (Mansour et al., 2020), accounting for 86% of premature deaths in LMICs. NCDs include cardiovascular diseases (CVDs), diabetes, cancers, and chronic respiratory diseases. they affect individuals from all age categories (World Health Organization, 2023b).

Modifiable behavioral risk factors of NCDs that were prioritized by the World Health Organization (WHO) include tobacco and alcohol use, physical inactivity, and unhealthy diets. The latter are characterized by high fat and sodium intakes and low fruits and vegetables intakes (CDC, 2013). These also promote the development of hypertension, hyperglycemia, hyperlipidemia, and increased body weight which are all referred to as metabolic risk factors that increase the risk of NCDs. (World Health Organization, 2023b)

2.2.3 Undernutrition

Undernutrition refers to an inadequate consumption of both energy and essential nutrients (Dent et al., 2023). Worldwide, more than 122 million people are experiencing hunger. Poverty increases both the likelihood of experiencing undernutrition and the potential consequences associated with it. Adequate food quality and quantity are both essential to avoid the malnutrition state. Malnutrition may be manifested as protein-energy malnutrition and deficiencies in micronutrients. These conditions lead to elevated healthcare expenditures, diminished productivity, and slows economic growth, thereby sustaining a cycle of poverty and compromised health (World Health Organization, 2020). Globally, access to healthy diets has decline. In fact, 42 percent of the population, are facing challenges in affording a healthy diet in the year 2021 (world Health Organization, 2023a).

2.2.4 The Coexistence of Dual Form of Malnutrition

The coexistence of different forms of malnutrition within most countries was acknowledged at the Rome declaration on nutrition in November 2014. This matter represents a societal and economic threat to the countries' development, especially the ones in the Eastern Mediterranean Region (EMR) that are typically suffering from the double burden of malnutrition. Noting that the prevalence of undernutrition is considerably high in these countries, which comes back unexclusively to the unstable political, environmental, and economic situations. These major drivers exacerbate dietary imbalances that contribute to energy deficit, inadequate protein intakes and micronutrient deficiencies.

In parallel, obesity burden and its related NCDs continues to grow at an alarming rate in the EMR. The growing epidemic of overweight and obesity is seen as a major public health concern given the positive association existing between obesity and NCDs, especially that more than 50% of annual deaths in the EMR are attributed to NCD burden. Moreover, the prevalence of overweight and obesity amongst adults in this region is respectively 27% and 24%.

Adult obesity in the EMR is driven by modifiable behaviors that include increased energy intake and fat intake, increased consumption of fast foods and sugar-sweetened beverages, reduced intake of fruits and vegetables, increased portion sizes, sedentary lifestyle and many more. Thus, the immediate implementation of robust policies securing access to healthy food based on the nutrition situation of each country should be considered. (Nasreddine et al., 2018)

In fact, strategies focusing on making healthy food items such as fruits, vegetables, whole grains, low fat dairy products more affordable are scarce. This matter limits the consequences of other policies that focus on reducing the provision of unhealthy foods, resulting in reduced outcomes. Thus, programmes that coherently address overweight and underweight in LMIC should be effectively integrated for enhanced results (Lancet, 2017).

2.2 Dietary indices

Dietetic interventions are often used to expend a great deal of efforts on promoting weight loss and maintaining negative energy balance. However, the composition of healthy diets does not depend anymore on simply counting calories,

rather there have been calls to measure DQ and composition from a different kind of perspective.

This challenging transition induced the development of indices that systematically assess DQ, measure meal scores, and highlight the association between eating patterns and NCDs (Bullock et al., 2022). In fact, recently, there was a substantial demand for establishing assessment tools capable of evaluating DQ (Colby et al., 2020). Thus, many indices were developed to systematically review the occurrence of nutrient inadequacies and diet related NCDs. Some aim to assess the quality of individual meals others evaluate the overall quality of the diet, or specific behaviors patterns (ie. Physical activity) others aim to design, monitor and evaluate the adherence to nutrition policies and guidelines (Bullock et al., 2022).

The development of this variety of indices comes back to the objectives that the researchers are interested in evaluating. However, due to the diversity of dietary patterns existing worldwide, it is somewhat complicated to generalize a single proper healthy index and eating discipline that applies to all populations (Bullock et al., 2022).

Dietary indices should be designed with the aim of minimizing both the effort required from survey respondents and the workload placed on researchers conducting the assessments (Colby et al., 2020).

Mostly, dietary indices are designed to assess the diet quality of adults, while some have been constructed specifically for children and adolescents. Usually, dietary indices are based either on dietary patterns (i.e Mediterranean Diet) or on dietary guidelines (i.e Healthy Eating Index (HEI)) (Kourlaba & Panagiotakos, 2009).

Quite remarkable similarities and disparities exist between different diet indices. In fact, their components may be either nutrients or food groups or a combination of

both. However, some can include a wider and more detailed variety of components. For instance, most food metrics are composed of 9-10 components, but some have been constructed on only 4 components, other may include up to 25 food groups. Moreover, their cut-offs, scoring methods and contribution of each dietary component to the total score are particular to each (Kourlaba & Panagiotakos, 2009).

2.2.1 HEI

The HEI generates a comprehensive score that serves as an indicator of the overall quality of dietary habits (Krebs-Smith et al., 2018). It was developed by the USDA in 1995 aiming to monitor changes in American diets' quality and to measure the extent to which the food consumed complies with dietary guidelines for Americans (DGAs). It is one of the main dietary indices, widely used in various types of nutrition research (ie. Epidemiological, and interventional studies) (Hueda, 2017).

In fact, the HEI has been employed in nearly 300 academic publications, serving as a valuable tool to assess food consumption patterns, food availability, distribution, and marketing strategies. Researchers have leveraged the HEI to explore both prospective and cross-sectional connections between dietary quality and health outcomes, including the risk of mortality from CVD, some types of cancer and other diseases. Furthermore, it has been instrumental in characterizing the dietary quality of the broader U.S. population and has shed light on dietary patterns within specific demographic subgroups (Krebs-Smith et al., 2018).

Since the DGAs undergo updates every 5 years, the HEI is also being reviewed every 5 years to align with the DGAs updates. The most recent version of the HEI is HEI-2020. The update process from HEI-2015 to HEI-2020 led to no changes in terms

of components and scoring method. However, the naming convention is reflective of its parallelism with the most recent 2020-2025 DGA.

The most recent update, led to the development of a separate HEI-toddlers, which was newly designed for toddlers aged 12 to 23 months. Previously, the HEI was created for the ages of 2 and above (Shams-White et al., 2023).

2.2.2 HEI components

HEI consists of 13 components divided into adequacy components vs moderation components. The adequacy components are the foods encouraged to eat for a better health, they consist of 9 food groups and include total fruits (Includes 100% fruit juice.), whole fruits (Includes all forms except juice), total vegetables, greens and beans, whole grains, dairy (Includes all milk products, such as fluid milk, yogurt, and cheese, and fortified soy beverages), total protein foods, seafood and plant proteins (Includes seafood, nuts, seeds, soy products (other than beverages), and beans, peas, and lentils) fatty acids. Conversely, the moderation components are the foods encouraged to limit for a better health, they consist of 4 food groups and include refined grains, sodium, added sugars and saturated fats (National Cancer Institute, 2023).

2.2.3 HEI scoring

The scoring method of the HEI-2020 is based on a density basis out of 1000kcal, except for fatty acids, which are based on a ratio of (PUFAs + MUFAs) to SFAs (National Cancer Institute, 2023).

To determine the Healthy Eating Index (HEI) using a 24-hour dietary recall, several essential steps must be followed:

- Collect detailed information on all foods and beverages consumed by the

individual during the 24-hour period.

- Group the food items into the appropriate categories specified by the HEI mentioned previously.
- Calculate the component scores based on amount of each food group consumed. Some food groups provide a total maximum point of 5, others 10. The maximum points assigned for each HEI component can be found in Table 1.
  Noting that intakes between the minimum and maximum standards are scored proportionately. The HEI provides distinct component scores, which, when analyzed collectively to reveal a pattern of quality across various dimensions.
- The total HEI score can be obtained by adding up the scores of all components to get a maximum score of 100, with higher scores indicating a healthier diet (National Cancer Institute, 2023).

2.2.4 HEI interpretation

HEI scores can be categorized as low, intermediate, or high.

- Low HEI Score (0-50): An HEI score falling within this range is indicative of a diet that inadequately conforms to the DGAs. This could imply a diet high in less nutritious foods, such as sugary snacks, processed items, and saturated fats, while being deficient in vital nutrients and food categories like fruits, vegetables, whole grains, and lean proteins.
- Intermediate HEI Score (51-80): A score in this range suggests a moderate level of compliance with DGAs. It signifies that there is room for dietary enhancement but also acknowledges the presence of some health-conscious choices.

- High HEI Score (81-100): A score within this range reflects a diet that closely adheres to the DGAs. It signifies a diet characterized by abundant consumption of fruits, vegetables, whole grains, lean proteins, and a limited intake of added sugars, saturated fats, and sodium. Such a diet is considered healthful (Kennedy et al., 1999).

Table 1 HEI-2020 dietary components, constituents, and scoring standards

Component	Dietary Constituents	Maximum points	Standard for maximum score	Standard for minimum score of zero
Adequacy:				
Total Fruits	Total Fruits	5	≥0.8 cup equiv. per 1,000 kcal	No Fruits
Whole Fruits	Citrus, Melons, Berries + Other Intact Fruits	5	≥0.4 cup equiv. per 1,000 kcal	No Whole Fruits
Total Vegetables	Total Vegetables + Legumes (Beans and Peas) in cup equivalents	5	≥1.1 cup equiv. per 1,000 kcal	No Vegetables
Greens and Beans	Dark Green Vegetables + Legumes (Beans and Peas) in cup equivalents	5	≥0.2 cup equiv. per 1,000 kcal	No Dark Green Vegetables or Legumes
Whole Grains	Whole Grains	10	≥1.5 oz equiv. per 1,000 kcal	No Whole Grains
Dairy	Total Dairy	10	≥1.3 cup equiv. per 1,000 kcal	No Dairy
Total Protein Foods	Total Meat, Poultry, and Seafood (including organ meats and cured meats) + Eggs + Nuts and Seeds + Soy + Legumes (Beans and Peas) in oz equivalents	5	≥2.5 oz equiv. per 1,000 kcal	No Protein Foods
Seafood and Plant Proteins	Seafood (high in omega-3) + Seafood (low in omega-3) + Soy + Nuts and Seeds + Legumes (Beans and Peas) in oz equivalents	5	≥0.8 oz equiv. per 1,000 kcal	No Seafood or Plant Proteins
Moderation:				
Refined Grains	Refined Grains	10	≤1.8 oz equiv. per 1,000 kcal	≥4.3 oz equiv. per 1,000 kcal
Added Sugars[1]	Added Sugars	10	≤6.5% of energy	≥26% of energy
Sodium[2]	Sodium	10	≤1.1 gram per 1,000 kcal	≥2.0 grams per 1,000 kcal
Saturated Fats	Total Saturated Fatty Acids	10	≤8% of energy	≥16% of energy
Fatty Acids[3]	(Total Monounsaturated Fatty Acids + Total Polyunsaturated Fatty Acids)/Total Saturated Fatty Acids	10	(PUFAs + MUFAs)/SFAs ≥2.5	(PUFAs + MUFAs)/SFAs ≤1.2

cup eq.=cup equivalents; oz. eq.=ounce equivalents; g=grams; mg=milligrams

[1] * = teaspoon equivalents are converted to kcal in the scoring process.

[2] ** = sodium is converted from mg to g in scoring process.

[3] *** = fatty acids are calculated in grams but converted to energy in the scoring process.

2.3 GDQS

2.3.1 GDQS development

Despite their popularity, indices that assess diet quality usually require advanced data provision, generally unavailable in limited-resource settings. Additionally, available food metrics are unable to sensitively assess diet quality in various dimensions, such as in simultaneously measuring adequate nutrient intake and NCD-risk development. Therefore, a two-year research initiative was launched in 2018 by Intake- Center for dietary assessment aiming to design an uncomplicated, inexpensive to collect and analyze, yet a robust diet metric that addresses the gap of the previously developed ones. A team from Harvard university was chosen by Intake to carry out this research initiative, which ended up with identifying the GDQS. The initial basis used for the GDQS development was the Prime Diet Quality Score (PDQS). Doing so, PDQS underwent modifications in terms of food groups, scoring methods and refinement of candidate metrics (Bromage et al., 2021).

2.3.2 GDQS metric design

The GDQS, which is intended to be used at the population level, is fully food based, thus its analysis does not require any food composition tables. It consists of 25 metric components which are expanded food groups that are recognized as potential determinants of NCD-risk development and/or nutrient inadequacies existence. These components compromise 16 healthy food groups, which include citrus fruits, deep orange fruits, other fruits, dark green leafy vegetables, cruciferous vegetables, deep orange vegetables, other vegetables, legumes, deep orange tubers, nuts and seeds, whole grains, liquid oils, fish and shellfish, poultry and game meat, low fat dairy and lastly, eggs. Consuming any of these food items contributes positively to the GDQS score.

Two food groups are seen as unhealthy when consumed excessively, which include high fat dairy products and red meat. Hence, they positively contribute to the GDQS score until consumed excessively.

On the other hand, the GDQS comprises 7 unhealthy food groups which include processed meat, refined grains and baked goods, sweets and ice cream, sugar sweetened beverages, juice, white roots and tubers, purchased deep fried foods. The lower consumption of any of these food items, the higher points given (Bromage et al., 2021).

Assigning points contributing to the GDQS score is based on the quantity consumed (in grams per day) of each food group in the 24 hours reference period. Detailed information about the amounts and categorization of each food consumed along with their points assigned is available in table 2. The ranges are categorized into low, medium, and high quantity of consumption, except for the high fat dairy food group, which has an additional category labelled as Very high.

The possible score range of the GDQS is between 0 and 49. A total GDQS score above or equal to 23 is an indicator of low risk of both suboptimal diet quality and NCD development. A GDQS score below 15 is an indicator of a high risk. Whereas a GDQS score of ≥15 and 23 is an indicator of moderate risk (Intake – Center for Dietary Assessment, 2021).

2.3.3 GDQS sub metrics

In specific conditions, such as in when the consumption of healthy and unhealthy food groups relatively is targeted, 2 GDQS sub metrics can be calculated.

The GDQS positive, which can be ranged between 0 and 32, is the overall score of all 16 healthy food groups included in the GDQS. And the GDQS negative, which

can be ranged between 0 and 17, is the overall score of all 7 unhealthy food groups included in the GDQS.

Table 2: Categorization and scoring of GDQS food groups

Inclusion in Metrics	Scoring Classification	Food Group	Categories of Consumed Amounts (g/day)				Points Assigned			
			Low	Middle	High	Very High	Low	Middle	High	Very High
GDQS and GDQS+	Healthy	Citrus fruits	<24	24–69	>69		0	1	2	
		Deep orange fruits	<25	25–123	>123		0	1	2	
		Other fruits	<27	27–107	>107		0	1	2	
		Dark green leafy vegetables	<13	13–37	>37		0	2	4	
		Cruciferous vegetables	<13	13–36	>36		0	0.25	0.5	
		Deep orange vegetables	<9	9–45	>45		0	0.25	0.5	
		Other vegetables	<23	23–114	>114		0	0.25	0.5	
		Legumes	<9	9–42	>42		0	2	4	
		Deep orange tubers	<12	12–63	>63		0	0.25	0.5	
		Nuts and seeds	<7	7–13	>13		0	2	4	
		Whole grains	<8	8–13	>13		0	1	2	
		Liquid oils	<2	2–7.5	>7.5		0	1	2	
		Fish and shellfish	<14	14–71	>71		0	1	2	
		Poultry and game meat	<16	16–44	>44		0	1	2	
		Low-fat dairy	<33	33–132	>132		0	1	2	
		Eggs	<6	6–32	>32		0	1	2	
GDQS and GDQS–	Unhealthy in excessive amounts	High-fat dairy* (in milk equivalents)	<35	35–142	>142–734	>734	0	1	2	0
		Red meat	<9	9–46	>46		0	1	0	
	Unhealthy	Processed meat	<9	9–30	>30		2	1	0	
		Refined grains and baked goods	<7	7–33	>33		2	1	0	
		Sweets and ice cream	<13	13–37	>37		2	1	0	
		Sugar-sweetened beverages	<57	57–180	>180		2	1	0	
		Juice	<36	36–144	>144		2	1	0	
		White roots and tubers	<27	27–107	>107		2	1	0	
		Purchased deep fried foods	<9	9–45	>45		2	1	0	

* Hard cheese should be converted to milk equivalents using a conversion factor of 6.1 when calculating total consumption of high-fat dairy for the purpose of assigning a GDQS consumption category. Refer to Annexes 2, 3, and 4, respectively, for details on how to apply this conversion factor appropriately, according to whether a quantitative 24-hour dietary recall survey, a FFQ, or the GDQS app was used to collect the data.

Reference: Table adapted from Table 3 in Bromage S, Batis C, Bhupathiraju SN, Fawzi WW, Fung TT, Li Y, Deitchler M, Angulo E, Birk N, Castellanos-Gutiérrez A, Fang T, He Y, Matsuzaki M, Zhang Y, Moursi M, Gicevic S, Holmes MD, Isanaka S, Kinra S, Sachs SE, Stampfer MJ, Stern D, Willett WC. Development and validation of a novel food-based Global Diet Quality Score. Manuscript submitted in February 2021 for publication consideration in a *Journal of Nutrition* Supplement: "The Global Diet Quality Score (GDQS): A New Method to Collect and Analyze Population-Based Data on Diet Quality".

2.3.4 GDQS application

To Facilitate the incorporation of GDQS into worldwide monitoring systems and regular surveys conducted in LMICs, a GDQS user-friendly data collection application was created. This application does not necessitate extensive trainings for interviewers, and the entire interview process typically lasts no more than an average of 10 minutes per respondent.

There is a comprehensive master database integrated into the GDQS app that contains an extensive list of foods and ingredients, categorized into their respective GDQS food groups. Additionally, the GDQS app's data collection process includes data on the quantity of each food group consumed by the respondent. This data is gathered when the respondent is asked during the interview to compare the volume of food consumed for each GDQS food group to a set of ten 3D cubes, each having specific dimensions. These cubes have been designed to define consumption categories (low, moderate or high) for various GDQS food groups. The GDQS app automatically assigns each respondent to the appropriate consumption category based on the data provided by the respondents.

The data collection process within the GDQS app takes seven distinct steps (shown in figure 1), each step corresponds to a different stage of the interview with the respondent. This application has been purposefully designed to capture all information efficiently and comprehensively on reported food ingredients or mixed dishes in a quick and efficient way (Bromage et al., 2021).

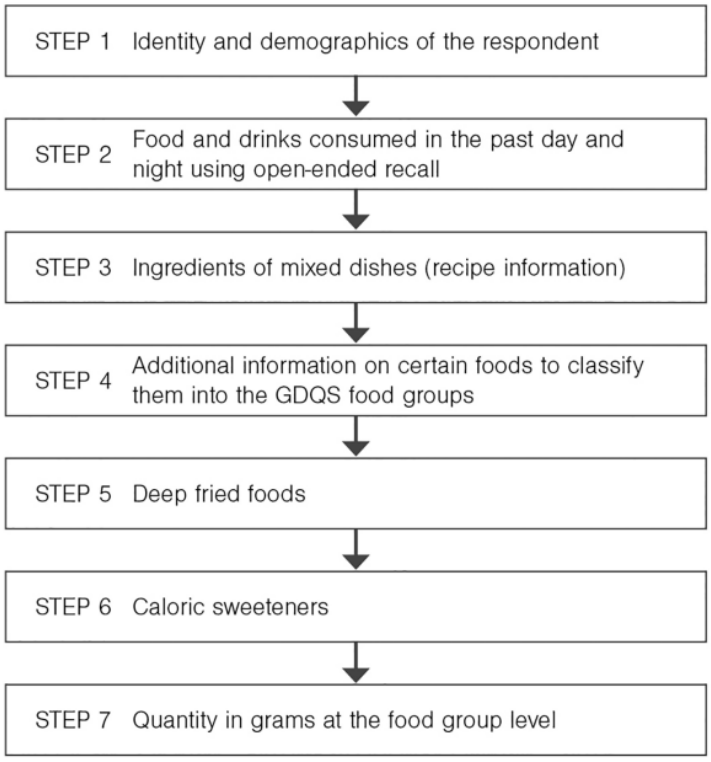

Figure 1: GDQS application data collection steps

2.4 Significance and Objectives of the Study

2.4.1 Research questions:

- What is the current diet quality (GDQS) among university staff in Lebanon?
- What are the food groups that are driving a low GDQS score?
- What are the current drivers of consumption of food groups contributing to a low GDQS?
- What is the current HEI among university staff in Lebanon?
- What are the food groups that are driving a low HEI score?
- Were there any differences in diet quality among university staff in Lebanon between HEI and GDQS?

2.4.2 Research objectives:

The primary objective of this research is to assess the diet quality of Lebanese university non academic staff aged 24 to 49 at AUB by employing both the GDQS and HEI. The study also seeks to identify the specific food groups responsible for lower GDQS and HEI scores, compare them between genders and investigate the drivers of food consumption associated with NCD risk, which contribute to the overall lower scores.

CHAPTER 3

METHODOLOGY

3.1 Study Design and Population

This study was implemented in 2 phases. Phase 1 was a dietary survey of AUB non-academic staff students aged between 24 and 49 years based on GDQS. Phase 2 was a secondary analysis of dietary of AUB non-academic staff based on the HEI.

3.2 Data collection

A convenient sample of 200 AUB non-academic staff (consisting of 100 males and 100 females) were recruited for the study. The sample included more than 20% of the population. Inclusion criteria required that participants were Lebanese AUB non-academic staff aged between 24 and 49 years old. Academic staff, and anyone outside the chosen age range were excluded from this study.

A graduate student specializing in nutrition underwent training with the aim of standardizing interviewing methods and reducing any potential interviewer bias. Following this training, the qualified interviewer conducted in-person interviews at the AUB campus, with each interview lasting approximately 10 minutes. Furthermore, the interviewer held certification from the Collaborative Institutional Training Initiative (CITI) for conducting research involving human subjects, in accordance with the Institutional Review Board requirements of AUB, prior to beginning of the study.

During the data collection process, the interviewer approached AUB non-academic staff who had given their consent and were available for participation.

The interviewer provided a concise explanation of the study's objectives to the participants and assured them that their participation was entirely voluntary. Participants were informed that they had the freedom to withdraw from or discontinue their participation at any point without facing any consequences, and their affiliation with AUB would remain unaffected.

Data collection involved the utilization of a multi-component questionnaire administered by the interviewer, the GDQS App, and a set of 3D cubes.

3.3 Multi component questionnaire

The multi-component questionnaire consisted of 7 parts: 1) Personal and household information, 2) Anthropometric measurements, 3) Alcohol consumption, 4) Smoking, 5) Physical activity, 6) Dietary Assessment: 24-hour dietary recall and 7) Drivers of consumption harmful and protective foods. It was available in the English (appendix 3) and Arabic (appendix 4) languages.

1) Personal and household information:

   This part was used to determine the sociodemographic data. The questions included are: gender (male, female), age (years), living arrangement (living at parental home, living in student residence, living at their own home), place of residence (urban area or rural area), job title, marital status (single, married, divorced, widowed), educational level (illiterate, primary education, elementary, secondary, technical, university and higher education), total family members number who usually sleep in that house, and how many

rooms are there in the house other than the kitchen, bathroom, parking, and open-air balcony. Socioeconomic status was assessed using the crowding index. Crowding index was calculated as the total number of persons in the household divided by the total number of rooms, excluding the kitchen, bathrooms, and balconies. Crowding index was coded into 2 categories: <1 Person/Room and ≥1 Person/Room.

2) Anthropometric measurements:

   The participants were asked to self-report their height in cm and weight in kg. The body mass index (BMI) was determined through self-reported weight and height. BMI is calculated by dividing the weight in kilograms by the height in meters squared. BMI was classified into underweight, normal weight, overweight and obesity.

3) Alcohol consumption:

   This part asks about alcohol consumption. It presents two options regarding alcohol status: individuals can either be currently consuming alcohol or non-drinkers or past drinkers.

4) Smoking:

   This part asks about smoking. It presents two options regarding smoking status: individuals can either be currently smokers or non- smokers or past smokers.

5) Physical activity:

   This part is about physical activity. This part consists of 2 questions. The first question is “How often do you Exercise?”. The answer choices are: 1- never or very rarely, 2- less than once a week, 3- once a week, 4- two or

three times a week, 5- more than three times a week. The second question is "How many hours/minutes per day do you Exercise?". The answer choices are: 1- Don't exercise, 2- less than 30 minutes, 3- 30 minutes, 4- 1-2 hours, 5- more than 2 hours.

6) Dietary Assessment:

   Participants were asked to recall their food and beverage consumption from the day before, starting from the moment they woke up until the following morning. They were required to provide details regarding the type of food, amount, location of eating, and time of consumption. Subsequently, the 24-hour recall information was input into the Nutritionist Pro software, which was used to evaluate micronutrient intake based on the food items consumed.

7) Drivers of consumption harmful and protective foods:

   this part asks about the drivers of consumption of harmful and protective foods where multiple answers for each question could be chosen.

   The first question is "What sorts of things makes it harder to consume Fruits?" and the possible answers are: I don't like the taste/ texture; High cost; I don't know the health benefits; Not available at home; Not available at local markets; Past eating habits (Not used to eating fruits frequently); High spoilage rate; None, no barriers, I eat fruits frequently; and Others.

   The second question is "What sorts of things make it harder to consume Vegetables?" and the possible answers are: I don't like the taste/ texture; High cost; I don't know the health benefits; Not available at home; Not available at local markets; Past eating habits (Not used to eating vegetables

frequently); High spoilage rate, None, no barriers, I eat vegetables frequently; and Others.

The third question is “What sorts of things makes it harder to consume Low-Fat Dairy products?” and the possible answers are: I don’t like the taste/ texture; High cost; I don’t know the health benefits; Not available at home; Not available at local markets; Past eating habits (Not used to eating low-fat dairy products frequently); Lactose intolerance; None, no barriers, I eat low-fat dairy products frequently; and Others.

The fourth question is “What sorts of things makes it harder to consume Deep Orange Tubers (carrots)?” and the possible answers are: I don’t like the taste/ texture; High cost; I don’t know the health benefits; Not available at home; Not available at local markets; Past eating habits (Not used to eating deep orange tubers frequently); High spoilage rate; None, no barriers, I eat deep orange tubers frequently; and Others.

The fifth question is “What sorts of things makes it harder to consume Whole Grains?” and the possible answers are: I don’t like the taste/ texture; High cost; I don’t know the health benefits; Not available at home; Not available at local markets; Past eating habits (Not used to eating whole grains frequently); I am unable to identify whole grain products; None, no barriers, I eat whole grains frequently; and Others.

The sixth question is “What sorts of things make it easier to consume Refined Grains (White bread, pasta, rice…)?” and the possible answers are: I like the taste/ texture; Low cost; I don’t know the adverse health effects; Available at home; Available at local markets; Past eating habits (Used to

eating refined grains frequently); TV, internet, social media ads; None, no facilitators, I 34 don't eat refine grains frequently; and Others.

The seventh question is "What sorts of things makes it easier to consume Sweets and Ice cream?" and the possible answers are: I like the taste/ texture; Low cost; I don't know the adverse health effects; effects; Available at home; Available at local markets; Past eating habits (Used to eating sweets and ice-creams frequently); Convenient (easy to prepare, eat, long shelf life...); TV, internet, social media ads; None, no facilitators, I don't eat sweets and ice cream frequently; and Others.

The eighth question is "What sorts of things makes it easier to drink Sugar Sweetened Beverages?" and the possible answers are: I like the taste/ texture; Low cost; I don't know the adverse health effects; Available at home; Available at local markets; Past eating habits (Used to drinking sugar sweetened beverages frequently); Convenient (easy to prepare, eat, long shelf life...); TV, internet, social media ads; None, no facilitators, I don't drink sugar sweetened beverages frequently; and Others.

The ninth and final question is "What sorts of thing makes it easier to consume Red Meat?" and the possible answers are: I like the taste/ texture; I don't know the adverse health effects; Available at home; Available at local markets; Past eating habits (Used to eating red meat frequently); None, no facilitators, I don't eat red meat frequently; and Others. Options presented were chosen by searching the literature for the most common drivers and barriers of eating behavior

3.3 Nutritionist Pro Software

Dietary assessment in this study relied on the use of single 24-hour dietary recalls. To analyze the dietary intake data, we utilized the Nutritionist Pro software, specifically version 8.1.0 developed by Axxya Systems in 2023. In this software, we employed the USDA database for conducting our dietary analysis. In cases involving composite, mixed, and traditional Lebanese dishes, we supplemented the Nutritionist Pro software with standardized recipes sourced from local food composition databases. This additional data allowed us to estimate daily intakes of energy (in kcal) as well as macro- and micro-nutrients. Furthermore, the food items consumed by participants were categorized into 25 GDQS food groups for further analysis.

3.4 Ethical approval

The study was approved by the Institutional Review Board of the American university of Beirut on 16th December 2022. A written informed consent for participation in English (appendix 1) or Arabic (Appendix 2) languages was obtained from participants prior to participation. Data collection was carried out between February 2023 and June 2023.

3.5 Statistical analysis

Descriptive statistics were used to summarize participants' characteristics. Frequencies (n) and percentages (%) were calculated to assess the distribution of categorical variables, means and standard deviations (SD) were calculated for continuous variables.

Independent t sample tests were used to compare means of total GDQS, GDQS+, GDQS – between males and females. Chi squared test was used to examine

the difference in GDQS categories (low, moderate and high) distribution between males and females.

Due to the low percentage of subjects with high total GDQS score, total GDQS score levels were dichotomized into 2 categories: low total GDQS score, and moderate to high total GDQS score. Frequencies and proportions were used to represent subjects with low, moderate, high, and very high intake for each GDQS food group for gender, and for subjects with low and subjects with moderate to high total GDQS score. The differences between groups were examined using chi- squared test and 2 sample z-test for proportion.

To analyze the food drivers of eating behaviors, the frequencies and proportions for the perceived barriers to consumption of healthy food groups and the perceived facilitators to consumption of unhealthy food groups were calculated, Microsoft Excel (version; 16.67) was used to represent them in bar charts.

BMI was dichotomized into 2 categories: BMI <25 and BMI ≥ 25. The mean differences in total GDQS, GDQS+ and GDQS- scores between two groups or more than two groups were tested by independent samples t-test and one-way analysis of variance (ANOVA) with Bonferroni corrections, respectively.

The association between GDQS score levels (low, moderate, and high) and socio-demographic, lifestyle and BMI characteristics were examined using chi-squared test.

Independent t sample tests were used to compare means of total HEI scores between males and females. Chi squared test was used to examine the difference in HEI categories (low, moderate and high) distribution between males and females.

Due to the low percentage of subjects with high HEI score, HEI score levels were dichotomized into 2 categories: low HEI score, and moderate to high HEI score. Frequencies and proportions were used to represent subjects with low, moderate and high intake for each HEI component, for gender, and for subjects with low and subjects with moderate to high HEI score. The differences between groups were examined using chi- squared test and 2 sample z-test for proportion. The Statistical Package for the Social Sciences (SPSS; version 25) was used for all computations. For all statistical analyses, P-values less than 0.05 indicated statistical significance.

CHAPTER 4

RESULTS

4.1 Characteristics of the study sample

Table 3 Socio-demographic, anthropometric and lifestyle characteristics in the sampleof AUB non-academic staff

Variable	females (n=100)	males (n=100)	P value	Total (n=200)
Socio-demographic Characteristics				
Age (years), mean (SD)	37.39 ±7.38	38.25 ±7.41	0.412	37.82 ±7.39
Living Arrangement, *n* (%)			0.25	
Living at parental home	18	26		44 (22)
Living in student residence	1	0		1 (0.5)
Living at their own home	81	74		155 (77.5)
Place Residence, *n* (%)			0.635	
Urban area	74	71		145 (72.5)
Rural area	26	29		55 (27.5)
Marital status, *n* (%)			0.502	
Single	28	26		54 (27)
Married	64	69		133 (66.5)
Divorced	6	5		11 (5.5)
Widowed	2	0		2 (1)
Educational level, *n* (%)			**0**	
Elementary	17[b]	41		58 (29)
Secondary	11	18		29 (14.5)
Technical	7[b]	17		24 (12)
University and higher education	65[b]	24		89 (44.5)
Crowding index, *n* (%)			**0.002**	
<1 Person/Room	60[b]	38		98 (49)
≥1 Person/Room	40[b]	62		102 (51)
Lifestyle Characteristics				
Alcohol Consumption status, *n* (%)			0.203	
Drinker	23	31		54 (27)
Non-Drinker/Past Drinker	77	69		146 (73)
Smoking Status, *n* (%)			**0.007**	
Current Smoker	33[b]	52		85 (42.5)
Non-Smoker/Past smoker	67[b]	48		115 (57.5)
Physical Activity Frequency, *n* (%)			0.179	

Never or very rarely	61	48		109 (54.5)
Less than once a week	6	6		12 (6)
Once a week	3	8		11 (5.5)
Two or three times a week	21	21		42 (21)
More than three times a week	9	17		26 (13)
Physical Activity duration, *n (%)*			0.101	
low	69	56		125 (62.5)
moderate	30	40		70 (35)
high	1	4		5 (2.5)
Anthropometric Characteristic				
Weight (Kg), mean (SD)	64.25 ±9.59	84.46 ±12.61	**0.018**	74.36 ±15.08
Height (cm), mean (SD)	164.23 ±5.5	176.6 ±7.14	**0.011**	170.42 ±8.87
Body mass index (BMI), mean (SD)	23.6 ±3.41	27.05 ±4.28	0.189	25.45 ±3.87
BMI Classification, *n* (%)			**0.0001**	
Underweight	3	0		3 (1.5)
Normal	54[b]	29		83 (41.5)
Overweight	38[b]	52		90 (45)
Obese	5b	19		24 (12)
Overweight & Obese	43	71		114 (57)

*p-value is derived from Pearson Chi-Square for categorical variables and from independent samples T-test for continuous variables.

Numbers in bold face indicate statistical significance (p-value <0.05) b superscripts are statistically significant at p-value <0.05 using comparison of column proportions (z-test) for categorical variables

Table 3 provides an overview of the socio-demographic, lifestyle and anthropometric, characteristics of the study sample, comprising 200 AUB non-academic staff (100 males and 100 females) with ages ranging from 24 to 49 years, as well as a comparison of these characteristics between both sexes.

Starting with the socio-demographic characteristics, the mean age of the participants was 37.82 years, with a standard deviation of 7.39. A significant proportion

of the sample resided in their own home (76.4%), their homes being located in urban settings (72.5%). Additionally, most of the participants were married (66.5%). Concerning their educational level, most of them hold a university and higher education degree (44.5%). Over half of the participants (51%) experienced living conditions with a household crowding index of at least 1 person per room, which is reflective of a relatively lower socioeconomic status (Melki et al., 2004).

Concerning the lifestyle characteristics, the majority were categorized as either non-drinkers or past drinkers (73%), and as non-smokers or past smokers (57.5%). Regarding physical activity, most of the participants (54.5%) were never or very rarely engaged in any type of physical exercise, and the majority (62.5%) had a low duration of physical exercise.

Concerning the anthropometric characteristics, the study sample had an approximate weight of 74.36 kg (±15.08), height of 170.42 cm (±8.87), and a body mass index (BMI) of 25.45kg/m2 (±3.87). A predominant number of participants (45%) fell within the overweight BMI range.

4.2 Evaluation of diet quality using GDQS and GDQS food groups consumption of study sample

Table 4 Comparison of Means of Total GDQS, GDQS+, and GDQS- scores between males and females in the sample of AUB non-academic staff and their categorization between low, moderate, and high total GDQS

	Females (n=100)	**Males (n=100)**	**p Value***	**Total (n=200)**
Total GDQS Score mean (SD)	18.44±4.57	18.49±4.22	0.585	18.46±4.39
GDQS^{+} Score, mean (SD)	7.68±3.72	7.78 ±3.41	0.458	7.76±3.56
GDQS^{-} Score mean (SD)	10.75±2.47	10.66±2.27	0.721	10.70 ±2.37

Total GDQS score levels, *n* (%)				
Low (<15)	27 (27)	24(24)	0.842	51 (25.5)
Moderate (>=15 & <23)	58 (58)	61(61)		119 (59.5)
High (>=23)	15 (15)	15(15)		30 (15)

*p-value is derived from Pearson Chi-Square for categorical variables and from independent samples T-test for continuous variables.

The table illustrates a comparison of mean scores for total GDQS, GDQS+, and GDQS- as well as the proportions of individuals categorized under low, moderate, and high total GDQS scores among females and males, and total subjects included in the AUB non-academic staff sample. Firstly, it reveals that males have higher total GDQS (18.49) and GDQS+ (7.78) mean scores. On the other hand, in GDQS- mean scores, females presented higher scores (10.75) than males.

In terms of the distribution of total GDQS score levels, a larger proportion of females falling into the "Low" total GDQS score category (27%) compared to males (24%). Conversely, a greater percentage of males fall under the "moderate" total GDQS score category (61% for males, 58% for females). Equal proportions of males and females (15% each) fall into the "Moderate" total GDQS score category. None of the differences between males and females scores showed significance at 5% level.

In the total sample, mean values for total GDQS, GDQS+, and GDQS- scores were 18.46±4.39, 7.76±3.56, and 10.70±2.37, respectively. Most of the participants (59.5%) exhibited moderate GDQS score levels, while 25.5 % had low GDQS scores, and 15% demonstrated high GDQS score levels.

Table 5 The percentages of subjects with low, moderate, high & very high intake category of each GDQS food group in the sample of AUB non-academic staff

	Category of intake			
GDQS food groups	Low	Moderate	High	
		***n* (%)**		
GDQS+ (Healthy):				
Citrus Fruits	191(95.5)	2(1)	7(3.5)	---
Deep Orange Fruits	190(95)	6(3)	4(2)	---
Other Fruits	94(47)	21(10.5)	85(42.5)	---
Dark Green Leafy Vegetables	153(76.5)	13(6.5)	34(17)	---
Cruciferous Vegetables	157(78.5)	4(2)	39(19.5)	---
Deep Orange Vegetables	190(95)	2(1)	8(4)	---
Other Vegetables	29(14.5)	47(23.5)	124(62)	---
Legumes	138(43.5)	4(1.3)	58(18.3)	---
Deep Orange Tubers	162(81)	17(8.5)	21(10.5)	---
Nuts and Seeds	177(88.5)	0(0)	23(11.5)	---
Whole Grains	137(68.5)	3(1.5)	60(30)	---
Liquid Oils	20(10)	21(10.5)	159(79.5)	---
Fish, Shellfish	176(88)	0(0)	24(12)	---
Poultry Game Meat	131(65.5)	1(0.5)	68(34)	---
Low Fat Dairy	189(94.5)	3(1.5)	8(4)	---
Eggs	170(85)	0(0)	30(15)	---
GDQS- (Unhealthy in excessive amounts):				
High Fat Dairy	44(22)	28(14)	62(31)	66(33)
Red Meat	130(65)	10(5)	60(30)	
GDQS- (Unhealthy):				
Processed Meat	173(86.5)	0(0)	27(13.5)	---
Refined Grains, Baked Goods	16(8)	1(0.5)	183(91.5)	---
Sweets, Ice cream	103(51.5)	14(7)	83(41.5)	---
Sugar Sweetened Beverages	175(87.5)	1(0.5)	24(12)	---
Juice	184(92)	5(2.5)	11(5.5)	---
White Roots Tubers	135(67.5)	10(5)	55(27.5)	---
Purchased, Deep Fried Foods	189(94.5)	0(0)	11(5.5)	---

Table 5 illustrates the categorization of participants, including both the frequency and the corresponding percentages, into distinct intake categories (namely

low, moderate, and high) for various food groups included in the GDQS, as determined by their GDQS point values.

In terms of healthy food groups, the majority of the study sample displayed a low intake for the following categories: citrus fruits (95.5%), deep orange fruits (95%), other fruits (47%), dark green leafy vegetables (76.5%), cruciferous vegetables (78.5%), deep orange vegetables (95%), legumes (43.5), deep orange tubers (81%), nuts and seeds (88.5%), whole grains (68.5%), fish and shellfish (88%), poultry and game meat (65.5%), low-fat dairy (94.5%) and eggs (85%).

In contrast, the study sample exhibited a high intake of other vegetables (62%) and liquid oils (79.5%) contributing to a increased GDQS+ score among the healthy food groups. Turning to the unhealthy food groups contributing to the GDQS- score, the study sample demonstrated a high intake of refined grains and baked goods (91.5%). In parallel, low intakes of processed meat (86.5%), sweets and ice cream (51.5%), sugar sweetened beverages (87.5%), juice (92%), white roots and tubers (67.5%) and purchased deep fried food (94.5%) were marked.

Finally, when considering unhealthy food groups that contribute to a higher GDQS- score when consumed excessively, the majority of the study sample displayed a high intake (31%) and very high intake (33%) of high-fat dairy, with a comparatively low intake of red meat (65%).

4.3 Determination of the food groups contributing to a low GDQS score

INSERT TABLE 6 (=table A) HERE

Table 6 Comparison of the percentage of subjects with low, moderate, and high intake category of each food group between subjects with low and subjects with moderate/high total GDQS score.

category of intake		Low Total GDQS (n=51)	Moderate/High Total GDQS (n=149)	P value
			n (%)	
GDQS+ (Healthy)				
citrus fruits				0.199
	low	51(100)$_a$	140(94)$_a$	
	moderate	0(0)$_a$	2(1.3)$_a$	
	high	0(0)$_a$	7(4.7)$_a$	
Deep Orange Fruits				0.165
	low	51(100)$_a$	139(93.3)$_a$	
	moderate	0(0)$_a$	6(4)$_a$	
	high	0(0)$_a$	4(2.7)$_a$	
Other Fruits				**0.026**
	low	32(61.7)$_a$	62(41.6)$_a$	
	moderate	5(9.8)$_a$	16(10.7)$_a$	
	high	14(28.5)$_a$	71(47.7)$_b$	
Dark Green Leafy Vegetables				**0.001**
	low	47(92.2)$_a$	106(71.1)$_b$	
	moderate	4(7.8)$_a$	9(6)$_a$	
	high	0(0)$_a$	34(22.8)$_b$	
Cruciferous Vegetables				0.5
	low	40(78.5)$_a$	117(78.5)$_a$	
	moderate	2(3.9)$_a$	2(1.3)$_a$	
	high	9(17.6)$_a$	30(20.1)$_a$	
Deep Orange Vegetables				**0.037**
	low	46(90.2)$_a$	144(96.6)$_a$	
	moderate	2(3.9)a	0(0)$_b$	
	high	3(5.9)$_a$	5(3.4)$_b$	
Other Vegetables				0.274
	low	10(19.6)$_a$	19(12.8)$_a$	
	moderate	14(27.5)$_a$	33(22.1)$_a$	
	high	27(52.9)$_a$	97(65.1)$_a$	
Legumes				**0.0001**
	low	49(96.1)$_a$	89(59.7)$_b$	

	moderate	0(0)$_a$	4(2.7)$_a$	
	high	2(3.9)$_a$	56(37.6)$_b$	
Deep Orange Tubers				
	low	43(84.3)$_a$	119(79.9)$_a$	0.445
	moderate	5(9.8)$_a$	12(8.1)$_a$	
	high	3(5.9)$_a$	18(12.1)$_a$	
Nuts and Seeds				**0.003**
	low	51(100)$_a$	126(84.6)$_b$	
	moderate	0(0)$_a$	0(0)$_a$	
	high	0(0)$_a$	23(15.4)$_b$	
Whole Grains				**0.04**
	low	42(82.4)$_a$	95(63.8)$_b$	
	moderate	0(0)$_a$	3(2)$_a$	
	high	9(17.6)$_a$	51(34.1)$_b$	
Liquid Oils				**0.015**
	low	10(19.6)$_a$	10(6.7)$_b$	
	moderate	7(13.7)$_a$	14(9.4)$_a$	
	high	34(66.7)$_a$	125(83.9)$_b$	
Fish, Shellfish				**0.04**
	low	49(96.1)$_a$	127(85.2)$_b$	
	moderate	0(0)$_a$	0(0)$_a$	
	high	2(3.9)$_a$	22(14.8)$_b$	
Poultry Game Meat				0.595
	low	36(70.6)$_a$	95(63.8)$_a$	
	moderate	0(0)$_a$	1(0.7)$_a$	
	high	15(29.4)$_a$	53(35.5)$_a$	
Low Fat Dairy				0.136
	low	51(100)$_a$	138(92.6)$_a$	
	moderate	0(0)$_a$	3(2)$_a$	
	high	0(0)a	8(5.3)$_a$	
Eggs				0.097
	low	47(92.2)$_a$	123(82.6)$_a$	
	moderate	0(0)$_a$	0(0)$_a$	
	high	4(7.8)$_a$	26(17.4)$_a$	
GDQS- (Unhealthy in excessive amounts):				
High Fat Dairy				0.367
	low	12(23.6)$_a$	34(22.8)$_a$	

	moderate	8(15.7)$_a$	19(12.8)$_a$	
	high	11(21.5)$_a$	51(34.2)$_a$	
	very high	20(39.2)$_a$	45(30.2)$_a$	
red meat				0.519
	low	37(72.6)$_a$	95(63.8)$_a$	
	moderate	2(3.9)$_a$	8(5.3)$_a$	
	high	12(23.5)$_a$	46(30.9)$_a$	
GDQS- (Unhealthy):				
Processed Meat				**0.0001**
	low	35(68.6)$_a$	138(92.6)$_b$	
	moderate	0(0)$_a$	0(0)$_a$	
	high	16(31.4)$_a$	11(7.4)$_b$	
Refined Grains, Baked Goods				0.151
	low	1(1.9)$_a$	15(10.1)$_a$	
	moderate	0(0)$_a$	1(0.7)$_a$	
	high	50(98.1)$_a$	133(89.3)$_a$	
Sweets, Ice cream				**0.001**
	low	16(31.4)$_a$	87(58.3)$_b$	
	moderate	2(3.9)$_a$	12(8.1)$_a$	
	high	33(64.7)$_a$	50(33.6)$_b$	
Sugar Sweetened Beverages				0.205
	low	43(84.3)$_a$	132(88.6)$_a$	
	moderate	1(1.9)$_a$	0(0)$_a$	
	high	7(13.8)$_a$	17(11.4)$_a$	
Juice				**0.035**
	low	45(88.2)$_a$	139(93.2)$_a$	
	moderate	0(0)$_a$	5(3.4)$_a$	
	high	6(11.8)$_b$	5(3.4)$_a$	
White Roots Tubers				0.011
	low	26(50.9)$_b$	109(73.2)$_b$	
	moderate	3(5.9)$_a$	7(4.7)$_a$	
	high	22(43.1)$_a$	33(22.1)$_a$	
Purchased, Deep Fried Foods				**0.0001**
	low	42(82.4)$_a$	147(98.7)$_b$	
	moderate	0(0)$_a$	0(0)$_a$	
	high	9(17.6)$_a$	2(1.3)$_b$	

Notes: Numbers in bold face indicate statistical significance (p-value <0.05)
a ,b superscripts are statistically significant at p-value <0.05 using comparison of column proportions (z-test) for categorical variables

In table 6, the research participants were categorized into two distinct groups: individuals with low GDQS scores and those with high/moderate GDQS scores. Within each of these groups, participants were further classified into low, moderate, and high intake categories for various food groups based on their GDQS scores for each respective food group. The table displays the disparities in the proportions of participants with low, moderate, high, and very high intake of each food group between those with low GDQS scores and those with high/moderate GDQS scores. The statistical significance of the differences between these groups is indicated by the provided Pearson Chi-Square values.

Concerning the healthy food groups (GDQS+), individuals with a low total GDQS score exhibited significantly reduced consumption compared to those with moderate/high total GDQS scores for other fruits, dark green leafy vegetables, deep orange vegetables, legumes, nuts and seeds, whole grains, liquid oils and fish and shellfish.

Concerning the unhealthy food groups (GDQS-), individuals with a low total GDQS score exhibited significantly high consumption compared to those with moderate/high total GDQS scores for processed meat, sweets and ice cream, juice, white root tubers and purchased deep fried foods.

4.4 The association of sociodemographic, anthropometric and lifestyle characteristic with diet quality (GDQS)

Table 7 Mean GDQS, GDQS+ and GDQS- scores according to socio-demographic, lifestyle, and BMI characteristics in the sample of AUB non-academic staff

	Total GDQS mean± SD	**P Value**	**GDQS+ mean± SD**	**P Value**	**GDQS- mean± SD**	**P Value**
Living Arrangement		0.909		0.976		0.754
Living at parental home	18.74±3.92		7.81±3.51		10.94±2.65	
Living in student residence						
Living at their own home	18.41±4.55		7.75±3.6		10.66±2.31	
Place Residence		0.495		0.969		0.549
Urban area	18.4±4.38		7.75±3.62		10.65±2.45	
Rural area	18.72±4.5		7.85±3.46		10.88±2.19	
Marital Status		0.236		0.46		0.454
Single	8.41±3.5		11±2.7		19.41±4.11	
Married	7.55±3.65		10.55±2.24		18.1±4.58	
Divorced	7.28±3.07		10.91±2.43		18.19±3.27	
Widowed	8.75±1.07		12.5±0.71		21.25±1.77	
Educational Level		0.242		0.546		0.326
Elementary	19.16±4.09		8.26±3.37		10.9±2.15	
Secondary	18.77±4.18		7.94±3.54		10.83±2.41	
Technical	17.03±4.59		7.15±3.57		9.88±2.46	

University and higher education	18.35±4.58		7.58±3.72		10.78±2.48	
Crowding index		0.225		0.716		0.835
<1 Person/Room	18.5±4.06		7.79±3.51		10.72±2.36	
≥1 Person/Room	18.47±4.73		7.77±3.65		10.71±2.4	
Alcohol Consumption status		0.692		0.244		0.351
Drinker	18.93±4.61		8.3±3.84		10.63±2.73	
Non-Drinker/Past Drinker	18.33±4.33		7.59±3.46		10.74±2.24	
Smoking Status		0.216		0.781		0.274
Current Smoker	18.06±4.62		7.78±3.67		10.29±2.64	
Non-Smoker/Past smoker.	18.8±4.23		7.77±3.51		11.03±2.12	
Physical Activity Frequency		0.876		0.578		0.928
<2 times per week	18.43±4.31		7.75±3.55		10.69±2.37	
>=2 times per week	18.59±4.6		7.83±3.64		10.77±2.4	
Physical Activity duration		0.541		0.944		0.407
<1 hour a week	18.56±4.37		7.83±3.57		10.74±2.39	
>=1 hour a week	15.5±5		5.9±3.53		9.6±1.68	
BMI		0.638		0.654		0.862
<25	18.51±4.38		7.56±3.5		10.96±2.44	

≥25	18.47±4.43	7.94±3.63	10.53±2.32

p-value is derived from independent samples t-test and ANOVA for all continuous variables.

Table 7 presents the variations in mean scores for total GDQS, GDQS+, and GDQS- based on different sociodemographic, lifestyle, and BMI characteristics.

There were no statistically significant differences in al mean GDQS scores across all the examined variables. Namely, living arrangement, place of residence, marital status, educational level, crowding index alcohol consumption, smoking status, physical activity (frequency and duration) and BMI did not have any influence on Mean GDQS, GDQS+ and GDQS- scores in AUB non-academic staff sample.

Table 8: *Distribution of socio-demographic, lifestyle, and BMI characteristics according to high, moderate, and low total GDQS score in the sample of AUB non-academic staff.*

	Low total GDQS (n=149)	**Moderate/High total GDQS (n=51)** ***n* (%)**	**P-Value***
Living Arrangement			0.566
Living at parental home	35(23.5)$_a$	9(17.6)$_a$	
Living in student residence	1(0.7)$_a$	0(0)$_a$	
Living at their own home	113(75.8)$_a$	42(82.4)$_a$	
Place Residence			0.993
Urban area	108(72.5)$_a$	37(72.5)$_a$	
Rural area	41(27.5)$_a$	14(27.5)$_a$	
Marital Status			0.144
Single	46(30.9)$_a$	8(15.7)$_a$	

Married	93(62.4)$_a$	40(78.4)$_a$	
Divorced	8(5.4)$_a$	3(5.9)$_a$	
Widowed	2(1.3)$_a$	0(0)$_a$	
Educational Level			0.523
Elementary	47(31.5)$_a$	11(21.6)$_a$	
Secondary	21(14.1)$_a$	8(15.7)$_a$	
Technical	16(10.7)$_a$	8(15.7)$_a$	
University and higher education	65(43.6)$_a$	24(47.1)$_a$	
Crowding index	73(49)$_a$	25(49)$_a$	0.997
<1 Person/Room	76(51)$_a$	26(51)$_a$	
≥1 Person/Room			
Alcohol Consumption status	40(26.8)$_a$	14(27.5)$_a$	0.933
Drinker	109(73.2)$_a$	37(72.5)$_a$	
Non-Drinker/Past Drinker			
			0.038
Smoking Status	57(38.3)$_a$	28(54.9)$_a$	
Current Smoker	92(61.7)$_b$	23(45.1)$_b$	
Non-Smoker/Past smoker.			
Physical Activity Frequency			0.646
<2 times per week	97(65.1)$_a$	35(68.6)$_a$	
>=2 times per week	52(34.9)$_a$	16(31.4)$_a$	
Physical Activity duration			0.451
<1 hour a week	146(98)$_a$	49(96.1)$_a$	
>=1 hour a week	3(2)$_a$	2(3.9)$_a$	
BMI			0.982
<25	64(43)$_a$	22(43.1)$_a$	
≥25	85(57)$_a$	29(56.9)$_a$	

*p-value is derived from Pearson Chi-square for all categorical variables.

Numbers in bold face are statistically significant (p-value <0.05)

Table 8 illustrates the classification of the research sample into two groups based on their total GDQS scores: low and moderate/ high and it explores the association between sociodemographic, lifestyle and BMI characteristics with the various GDQS score components. However, it's important to note that none of these variables displayed any statistically significant differences at the 5% significance level.

4.5 Drivers of Eating Behaviors

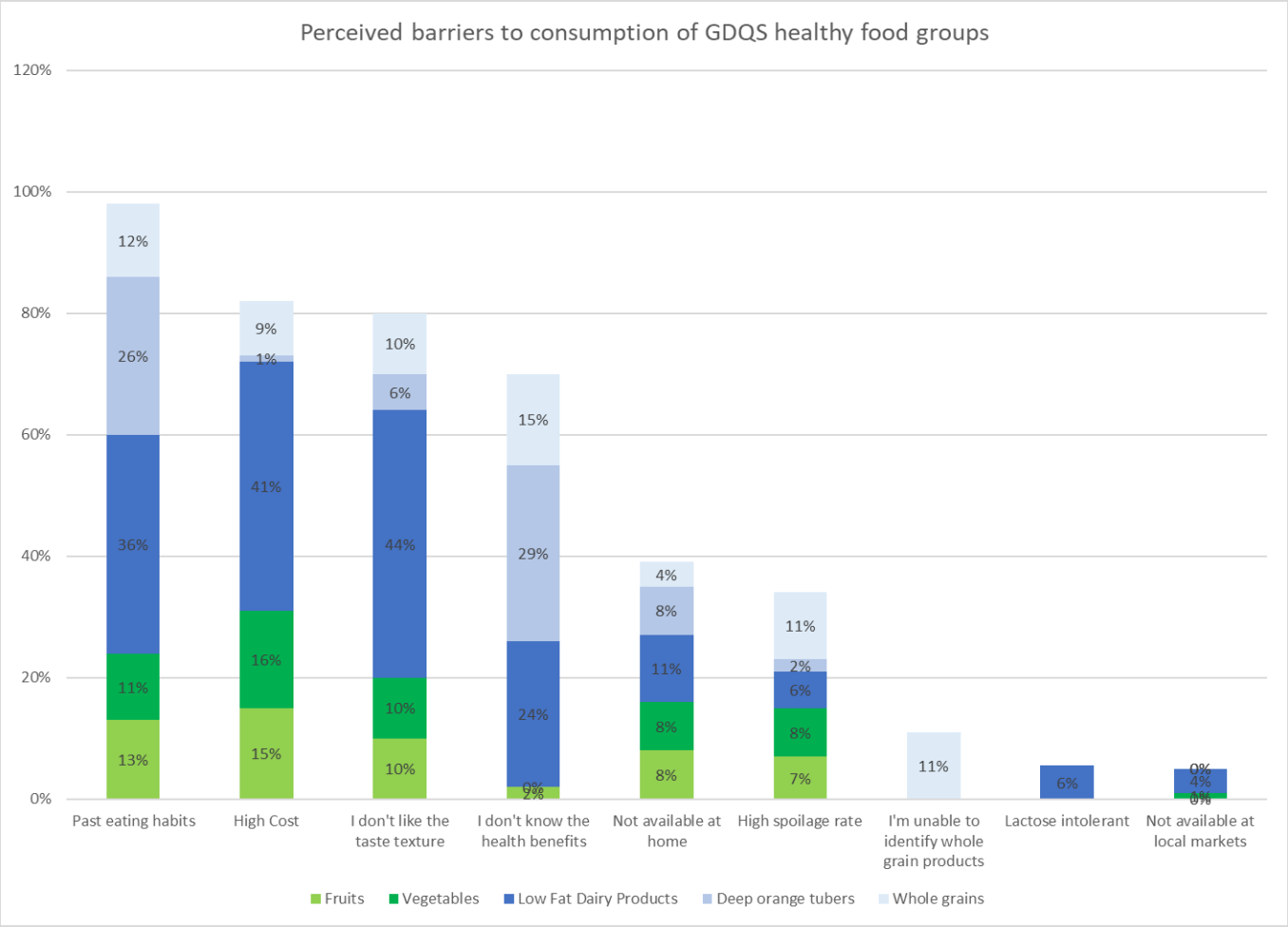

Figure 2 Perceived barriers to consumption of healthy food groups

Table 9 Perceived barriers to consumption of healthy food groups

Perceived Barriers	Fruits	Vegetables	Low Fat Dairy	Deep orange tubers	Whole grains
			n(%)		
I don't like the taste/texture	22(11)	20(10)	88(44)	12(6)	19(9.5)
High Cost	33(16.5)	32(16)	81(40.5)	2(1)	17(8.5)
I don't know the health benefits	4(2)	0(0)	47(23.5)	58(29)	29(14.5)

Not available at home	18(9)	16(8)	22(11)	16(8)	7(3.5)
Not available at local markets	0(0)	1(0.5)	8(4)	0(0)	0(0)
Past eating habits	29(14.5)	21(10.5)	72(36)	51(25.5)	24(12)
High spoilage rate	15(7.5)	15(7.5)	11(5.5)	3(1.5)	0(0)
Lactose intolerant	0(0)	0(0)	20(10)	0(0)	0(0)
I'm unable to identify whole grain products	0(0)	0(0)	0(0)	0(0)	22(11)

Figure 2 and table 9 provide insights into the barriers perceived by individuals when it comes to consuming various healthy food groups, including fruits, vegetables, low-fat dairy, deep orange tubers, and whole grains. Among these, the most frequently reported barriers were adherence to past eating habits, high cost, not liking taste and texture, a lack of awareness regarding their health benefits, unavailability of these items at home, high spoilage rate (notably for vegetables, fruits, and deep orange tubers), difficulty in identifying specific products (pertaining exclusively to whole grains), lactose intolerance (primarily affecting low-fat dairy products). and limited availability at local markets.

When considering fruits, the predominant barriers reported included "high cost" (16.5 %), followed by "past eating habits" (14.5%), "I don’t like the taste/ texture" (11%), "not available at home" (9%), "high spoilage rate" (7.5%) and "I don't know the health benefits" (2%).

For vegetables, the primary barriers to consumption were associated with "High cost" (16%), "Past eating habits" (10.5%), "I don’t like the taste/ texture" (10%), "not available at home" (8%), "high spoilage rate" (7.5%),and "not available at local markets" (0.5%).

In the case of low-fat dairy products, key barriers included " I don’t like the taste/ texture " (44%), "High cost" (40.5%), "Past eating habits" (36%), "I don't know the health benefits" (23.5%), "not available at home" (11%), "Lactose intolerant" (10%), "high spoilage rate" (5.5%), and "not available at local markets" (4%).

When looking at deep orange tubers, individuals cited "I don't know the health benefits" (29%), "Past eating habits" (25.5%), "not available at home" (8%)," I don’t like the taste/ texture " (6%), "high spoilage rate" (1.5%) and "High cost" (1%).

Lastly, regarding whole grains, the most common obstacle was "I don't know the health benefits" (14.5%), followed by "Past eating habits" (12%), "I'm unable to identify whole grain products" (11%), "I don't know the health benefits" (9.5%), "high cost" (8.5%), "not available at home" (3.5%).

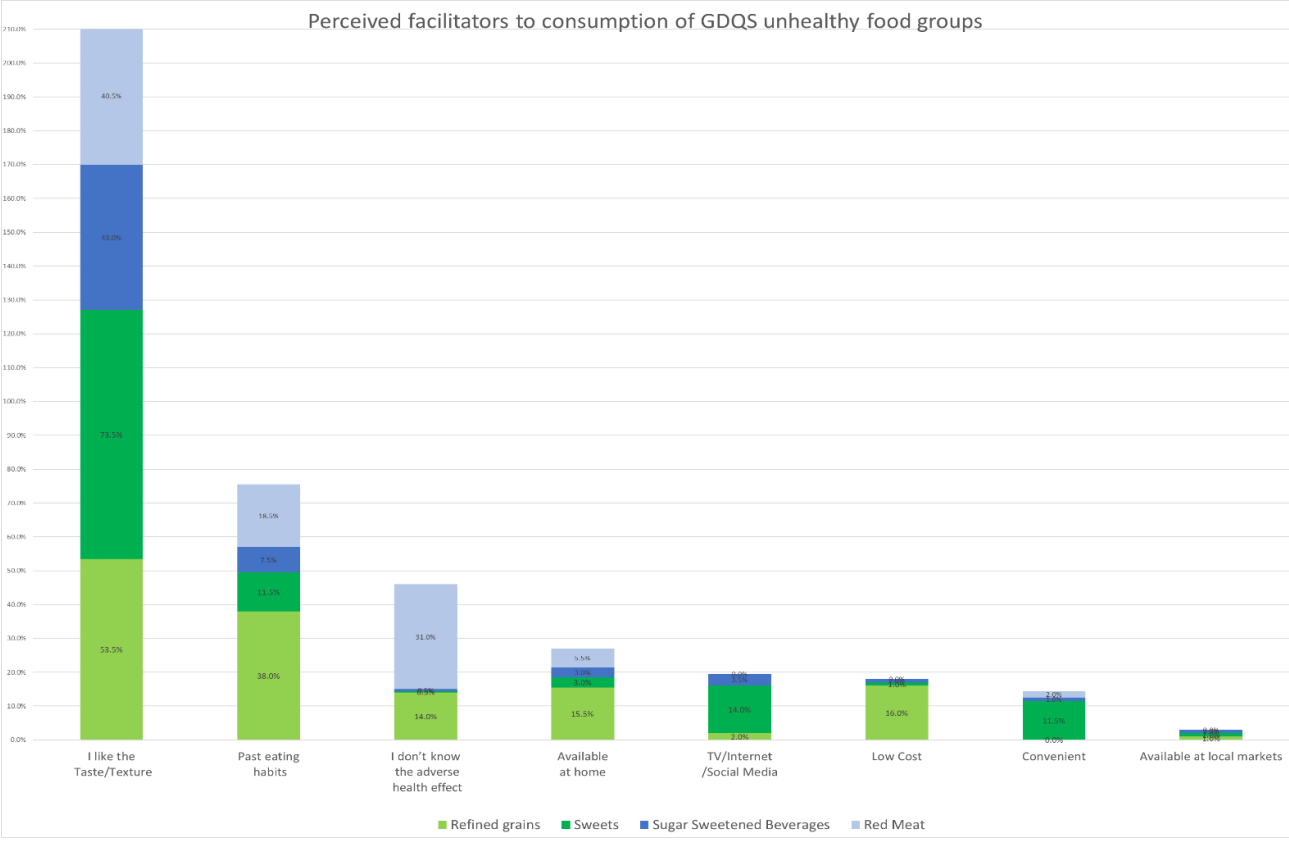

Figure 4 Perceived facilitators to consumption of unhealthy food groups

Table 4 Perceived facilitators to consumption of unhealthy food groups

Perceived Facilitators	Refined Grains	Sweets and Ice Cream	Sugar Sweetened Beverages	Red Meat
			n(%)	
I like the tase/texture	107(53.5)	147(73.5)	86(43)	81(40.5)
Low Cost	32(16)	2(1)	2(1)	0(0)
I don't know the adverse health effect	28(14)	1(0.5)	1(0.5)	62(31)
Available at home	31(15.5)	6(3)	6(3)	11(6)
Available at local markets	2(1)	2(1)	2(1)	0(0)
Past eating habits	76(38)	23(11.5)	15(8)	37(19)
Convenient	0(0)	23(11.5)	2(1)	0(0)
Tv/Internet/Social Media	4(2)	28(14)	7(4)	0(0)

Figure 3 and table 10 delineate the factors perceived as facilitators to consumption of unhealthy food groups, namely refined grains, sweets and ice-cream, sugar-sweetened beverages, and red meat. Among these, the most frequently cited facilitators included a preference for taste and texture, past eating habits, a lack of awareness regarding their adverse health effects, the availability of these items at home, the influence of TV/ internet/ social media, affordability and convenience (the last three being applicable to refined grains, sweets, and sugar-sweetened beverages), followed by lastly availability at local markets.

The enjoyment of taste and texture served as the first major facilitator for all GDQS unhealthy food groups. For red meat consumption, denying the adverse health effects was the second major driver. Past eating habits were the second major driver for refined grains and sugar sweetened beverages. The influence of TV, internet, and social media was the second major driver for Sweets.

For refined grains, the most commonly reported facilitators to eating were “I like the taste/texture” (53.5%), “Past eating habits” (38%), “low cost” (16%), “Available at home” (15.5%), “I don’t know the adverse health effects” (14%), “TV, internet, social media…” (2%), and finally “available at local markets” (1%).

For sweets and ice creams, the most commonly reported facilitators were “I like the taste/texture” (73.5%), %), “TV, internet, social media…” (14%), “Convenient “(11.5%), “Past eating habits” (11.5%), “Available at home” (3%), “low cost” (1%), “available at local markets” (1%).

For sugar sweetened beverages, the most commonly reported facilitators to eating refined grains were “I like the taste/texture” (43%), “Past eating habits” (8%), “TV, internet, social media…” (4%), “Available at home” (3%),“low cost” (1%),“Convenient“ (1%),“available at local markets” (1%), and finally “I don’t know the adverse health effects”(0.5%).

For red meat, the most reported facilitators to eating refined grains were “I like the taste/texture” (40.5%), “I don’t know the adverse health effects” (31%), “Past eating habits” (19%),“I don’t know the adverse health effects” (6%).

4.6 Differences in GDQS food groups of females and males in the AUB non-academic staff sample

Table 11 The percentage of subjects with low, moderate, and high intake category of each food group and their comparison between females and males

Category of intake	**Females**	**Males**	**pearson Chi-square**
GDQS+ (Healthy)			
citrus fruits			0.335
low	97(97)a	94(94)a	
moderate	0(0)a	2(2)a	
high	3(3)a	4(4)a	
Deep Orange Fruits			0.158
low	96(96)a	94(94)a	

moderate	1(1)a	5(5)a	
high	3(3)a	1(1)a	
Other Fruits			0.14
low	45(45)a	49(49)a	
moderate	7(7)a	14(14)a	
high	48(48)a	37(37)a	
Dark Green Leafy Vegetables			0.129
low	80(80)a	73(73)a	
moderate	3(3)a	10(10)b	
high	17(17)a	17(17)a	
Cruciferous Vegetables			0.13
low	80(80)a	77(77)a	
moderate	0(0)a	4(4)b	
high	20(20)a	19(19)a	
Deep Orange Vegetables			0.771
low	96(96)a	94(94)a	
moderate	1(1)a	1(1)a	
high	3(3)a	5(5)a	
Other Vegetables			0.065
low	11(11)a	18(18)a	
moderate	19(19)a	28(28)a	
high	70(70)a	54(54)b	
Legumes			0.952
low	70(70)a	68(68)a	
moderate	2(2)a	2(2)a	
high	28(28)a	30(30)a	
Deep Orange Tubers			0.713
low	83(83)a	79(79)a	
moderate	7(7)a	10(10)a	
high	10(10)a	11(11)a	
Nuts and Seeds			0.268
low	86(86)a	91(91)a	
moderate	0(0)	0(0)	
high	14(14)a	9(9)a	
Whole Grains			0.816
low	68(68)a	69(69)a	
moderate	1(1)a	2(2)a	
high	31(31)a	29(29)a	
Liquid Oils			0.267
low	10(10)a	10(10)a	
moderate	14(14)a	7(7)a	
high	76(76)a	83(83)a	
Fish, Shellfish			0.384
low	90(90)a	86(86)a	
moderate	0(0)	0(0)	
high	10(10)a	14(14)a	
Poultry Game Meat			0.569
low	67(67)a	64(64)a	

moderate	0(0)a	1(1)a	
high	33(33)a	35(35)a	
Low Fat Dairy			
low	92(92)a	97(97)a	0.291
moderate	2(2)a	1(1)a	
high	6(6)a	2(2)a	
Eggs			0.428
low	83(83)a	87(87)a	
moderate	0(0)	0(0)	
high	17(17)a	13(13)a	
High Fat Dairy			0.277
low	21(21)a	25(25)a	
moderate	12(12)a	15(15)a	
high	28(28)a	34(34)a	
very high	39(39)a	26(26)b	
red meat			**0.017**
low	65(65)a	67(67)a	
moderate	1(1)a	9(9)b	
high	34(34)a	24(24)a	
GDQS- (Unhealthy):			
Processed Meat			0.147
low	90(90)a	83(83)a	
moderate	10(10)a	17(17)a	
high			
Refined Grains, Baked Goods			0.172
low	5(5)a	11(11)a	
moderate	0(0)a	1(1)a	
high	95(95)a	88(88)a	
Sweets, Ice cream			0.177
low	56(56)a	47(47)a	
moderate	40(40)a	43(43)a	
high	4(4)a	10(10)a	
Sugar Sweetened Beverages			0.605
low	88(88)a	87(87)a	
moderate	0(0)a	1(1)a	
high	12(12)a	12(12)a	
Juice			0.855
low	91(91)a	93(93)a	
moderate	3(3)a	2(2)a	
high	6(6)a	5(5)a	
White Roots Tubers			**0.002**
low	67(67)a	68(68)a	
moderate	0(0)a	10(10)b	
high	33(33)a	22(22)a	
Purchased, Deep Fried Foods			
low	94(94)a	95(95)a	0.756
moderate	0(0)	0(0)	

high	6(6)a	5(5)a

Notes: Numbers in bold face indicate statistical significance (p-value <0.05)

a ,b superscripts are statistically significant at p-value <0.05 using comparison of column proportions (z-test) for categorical variables

Table 11 presents a comparison of the percentage of subjects with different GDQS intake categories (low, moderate, high and very high) of various food groups between female subjects and male subjects. The statistical significance of the differences between these groups is indicated by the provided Pearson Chi-Square values.

There is a significantly higher percentage of subjects with moderate intake of red meat and white root tubers in males.

4.7 Evaluation of diet quality using HEI and HEI food groups consumption of study sample

Table 12 Comparison of Mean of HEI score and the percentages of subjects with low, moderate, and high HEI score between males and females in the sample of AUB non-academic staff

	female	male	total (n=200)	p value
Total HEI Score Points, mean (SD)	53.01±11.88	50.18±13.08	51.6 ± 12.54	0.111
Total HEI score, n (%)				0.102
low	38(38)	53(53)	91(45.5)	
moderate	61(61)	46(46)	107 (53.5)	
high	1(1)	1(1)	2(1)	

p-value is derived from Pearson Chi-Square for categorical variables and from independent samples T-test for continuous variables.

Table 12 displays the comparison of means of HEI scores and their standard deviation along with the percentages of subjects with low, moderate, and high HEI score between males and females in the sample of AUB non-academic staff.

In the total sample, the total HEI score was 51.6 with a standard deviation of 12.54..Males had a total HEI score of 50.18 and females had a total HEI score of 53.01. This difference was not significant at the 5% level. Most of the participants (53.5%) possessed a moderate HEI score, while 45.5 % had a HEI score categorized as low, and 1% had a high HEI score.

4.8 HEI food groups categorization into standard minimum, moderate and standard maximum score of each HEI food group in the sample of AUB non-academic staff

Table 13 The percentages of subjects with standard minimum, moderate and standard maximum score of each HEI food group in the sample of AUB non-academic staff

	Category of intake n(%)		
Adequacy:	min	mod	max
Total Fruits	194(97)	2(1)	4(2)
Whole Fruits	91(45.5)	20(10)	89(44.5)
Total Vegetables	14(7)	2(1)	184(92)
Greens and Beans	153(76.5)	6(3)	41(20.5)
Whole grains	146(73)	38(19)	16(8)
Dairy	44(22)	0(0)	156(78)
Total Protein Foods	164(82)	19(9.5)	17(8.5)
Seafood and Plant Proteins	143(71.5)	15(7.5)	42(21)
Moderation:			
Refined Grains	114(57)	55(27.5)	31(15.5)
Sodium	37(18.5)	102(51)	61(30.5)
Added Sugars	11(5.5)	0(0)	189(94.5)
Saturated Fats	22(11)	105(52.5)	73(36.5)
Fatty Acids	37(18.5)	72(36)	91(45.5)

Table 13 outlines the categorization of participants into different intake groups, specifically, the standard *minimum, moderate and standard maximum* based on their adherence to recommended intake levels of various food categories as determined by the HEI. Noting that the individuals that received Consumption score levels between the standard minimum and standard maximum were classified as Moderate.

Within the study population, a larger proportion presented a high maximum intake of the following: total vegetables (92%), dairy products (78%), added sugars (94.5%), and fatty acids (45.5%).

Conversely, there was a higher adherence to the minimum intake levels for total fruits (97%), whole fruits (45.5%), greens and beans (76.5%), whole grains (73%), total protein foods (82%), seafood and plant-based proteins (71.5%), and refined grains (57%).

Lastly, there was a higher adherence to the moderate intake levels for Sodium (51%) and saturated fats (52.5%).

4.9 Determination of the food groups contributing to a low HEI score

Table 14 Comparison of the percentage of subjects with low, moderate, and high intake category of each food group between subjects with low and subjects with moderate/high total HEI score.

	Category of intake n(%)		
Adequacy:	min (n=91)	mod/high (n=109)	p value
Total Fruits			0.057
Min	89(97.8)$_a$	105(96.3)$_a$	
Mod	2(2.2)$_a$	0(0)$_a$	
Max	0(0)$_a$	4(3.7)$_a$	
Whole Fruits			**0.037**
Min	50(54.9)$_a$	41(37.6)$_b$	
Mod	6(6.6)$_a$	14(12.8)$_a$	
Max	35(38.5)$_a$	54(49.5)$_a$	
Total Vegetables			0.06
Min	10(11)$_a$	4(3.7)$_b$	
Mod	0(0)$_a$	2(1.8)$_a$	
Max	81(89)$_a$	103(94.5)$_a$	
Green beans			**0.003**
Min	79(86.8)$_a$	74(67.9)$_b$	
Mod	3(3.3)$_a$	3(2.8)$_a$	
Max	9(9.9)$_a$	32(29.4)$_b$	
Whole grains			**0.0001**
Min	82(90.1)$_a$	64(58.7)$_b$	
Mod	8(8.8)$_a$	30(27.5)$_b$	
Max	1(1.1)$_a$	15(13.8)$_b$	
Dairy			**0.0001**
Min	32(35.2)$_a$	12(11)$_b$	

Mod	0(0)	0(0)	
Max	59(64.8)$_a$	97(89)$_b$	
Total Protein Foods			**0.004**
Min	83(91.2)$_a$	81(74.3)$_b$	
Mod	6(6.6)$_a$	13(11.9)$_a$	
Max	2(2.2)$_a$	15(13.8)$_b$	
Seafood and Plant Proteins			**0.001**
Min	77(84.6)$_a$	66(60.6)$_b$	
Mod	4(4.4)$_a$	11(10.1)$_a$	
Max	10(11)$_a$	32(29.4)$_b$	
Moderation:			
Refined Grains			**0.007**
Min	61(67)$_a$	53(48.6)$_b$	
Mod	23(25.3)$_a$	32(29.4)$_a$	
Max	7(7.7)$_a$	24(22)$_b$	
Sodium			**0.002**
Min	26(28.6)$_a$	10(9.2)$_b$	
Mod	41(45.1)$_a$	61(56)$_a$	
Max	24(26.4)$_a$	37(33.9)$_a$	
Added Sugars			0.531
Min	0(0)	0(0)	
Mod	4(4.4)$_a$	7(6.4)$_a$	
Max	87(95.6)$_a$	102(93.6)$_a$	
Saturated Fats			**0.0001**
Min	19(20.9)$_a$	3(2.8)$_b$	
Mod	50(54.9)$_a$	55(50.5)$_a$	
Max	20(22)$_a$	51(46.8)$_b$	
Fatty Acids			**0.0001**
Min	32(35.2)$_a$	5(4.6)$_b$	
Mod	36(39.6)$_a$	36(33)$_a$	
Max	23(25.3)$_a$	68(62.4)$_b$	

Notes: Numbers in bold face indicate statistical significance (p-value <0.05)

a ,b superscripts are statistically significant at p-value <0.05 using comparison of column proportions (z-test) for categorical variables

In this table, the research participants were categorized into two distinct groups: individuals with low HEI scores and those with high/moderate HEI scores (Due to the low number of participants having a high HEI score).

Within each of these groups, participants were further classified into low, moderate, and high intake categories for various food groups based on their HEI scores for each respective food group. The table displays the disparities in the proportions of participants with low, moderate, high, and very high intake of each food group between those with low HEI scores and those with high/moderate HEI scores. The statistical significance of the differences between these groups is indicated by the provided Pearson Chi-Square values.

Concerning the adequacy food groups, individuals with a low HEI score exhibited significantly reduced consumption compared to those with moderate/high total HEI scores for whole fruits, green beans, whole grains, dairy, total protein foods and seafood and plant proteins.

Concerning the moderation food groups, individuals with a low HEI score exhibited significantly high consumption compared to those with moderate/high total HEI scores for refined grains, sodium, saturated fats and fatty acids.

4.10 Differences in HEI scores food groups of females and males in the AUB non-academic staff sample

Table 15 The percentage of subjects with low, moderate, and high intake category of each food group and their comparison between females and males

	Category of intake		
Adequacy:	males (n=100)	females (n=100)	p value
Total Fruits			
Min	95(95)$_a$	99(99)$_a$	0.214
Mod	2(2)$_a$	0(0)$_a$	
Max	3(3)$_a$	1(1)$_a$	
Whole Fruits			0.295
Min	40(40)$_a$	51(51)$_a$	
Mod	11(11)$_a$	9(9)$_a$	
Max	49(49)$_a$	40(40)$_a$	
Total Vegetables			0.305
Min	6(6)$_a$	8(8)$_a$	
Mod	0(0)$_a$	2(2)$_a$	
Max	94(94)$_a$	90(90)$_a$	
Green beans			0.679
Min	79(79)$_a$	74(74)$_a$	
Mod	3(3)$_a$	3(3)$_a$	
Max	18(18)$_a$	23(23)$_a$	
Whole grains			0.632
Min	70(70)$_a$	76(76)$_a$	
Mod	21(21)$_a$	17(17)$_a$	
Max	9(9)$_a$	7(7)$_a$	
Dairy			0.733
Min	23(23)$_a$	21(21)$_a$	
Mod	0(0)$_a$	0(0)$_a$	
Max	77(77)$_a$	79(79)$_a$	
Total Protein Foods			0.13
Min	81(81)$_a$	83(83)$_a$	
Mod	13(13)$_a$	6(6)$_a$	
Max	6(6)$_a$	11(11)$_a$	
Seafood and Plant Proteins			0.964
Min	71(71)$_a$	72(72)$_a$	
Mod	8(8)$_a$	7(7)$_a$	

Max	21(21)$_a$	21(21)$_a$	
Moderation:			
Refined Grains			0.067
Min	56(56)$_a$	58(58)$_a$	
Mod	23(23)$_a$	32(32)$_a$	
Max	21(21)$_a$	10(10)$_b$	
Sodium			0.354
Min	22(22)$_a$	14(14)$_a$	
Mod	49(49)$_a$	53(53)$_a$	
Max	29(29)$_a$	32(32)$_a$	
Added Sugars			0.121
Min	0(0)$_a$	0(0)$_a$	
Mod	3(3)$_a$	8(8)$_a$	
Max	97(97)$_a$	92(92)$_a$	
Saturated Fats			**0.004**
Min	13(13)$_a$	9(9)$_a$	
Mod	61(61)$_a$	44(44)$_b$	
Max	24(24)$_a$	47(47)$_b$	
Fatty Acids			**0.023**
Min	23(23)$_a$	14(14)$_a$	
Mod	41(41)$_a$	31(31)$_a$	
Max	36(36)$_a$	55(55)$_b$	

Notes: Numbers in bold face indicate statistical significance (p-value <0.05)
a ,b superscripts are statistically significant at p-value <0.05 using comparison of column proportions (z-test) for categorical variables

Table 15 presents a comparison of the percentage of subjects with different HEI intake categories (low, moderate, high and very high) of various food groups between female subjects and male subjects. The statistical significance of the differences between these groups is indicated by the provided Pearson Chi-Square values. There is a significantly higher percentage of subjects with moderate and high intakes of saturated fats in females. Also a significantly higher percentage of subjects with high intakes of fatty acids in females.

4.11 Difference between HEI scores and GDQS scores of AUB non academic staff

Table 16 Percentages of subjects at low, moderate and high score between HEI and GDQS

	Scoring Method n(%)		p value
	GDQS	HEI	
Total score levels			
Low	51(25.5)	91(45.5)	0.815
Moderate	118(59)	107(53.5)	
High	31(15.5)	2(1)	

p-value is derived from Pearson Chi-Square for categorical variables and from independent samples T-test for continuous variables.

Table 16 presents the percentages of subjects categorized at low, moderate and high score levels using two different scoring methods: HEI and GDQS. No significant difference is seen in the percentages of subjects in all categories. The percentage of subjects with a low total score was higher in HEI (45.5%) than in GDQS (25.5%), and the percentage of subjects with a moderate total score was higher in GDQS (59%) than in HEI (53.5), and lastly, the percentage of subjects with a high total score was higher in GDQS (15.5 %) than in HEI (1%) .

CHAPTER 5

DISCUSSION

5.1 Major findings of the study

This study evaluated the quality of diet in relation to nutrient adequacy and NCDs using the GDQS and HEI among university non-academic staff aged 24 to 49 in Lebanon.

In fact, this research identified the food groups that contributed to a low GDQS score in the total sample, and it presented a comparison of the different intake categories (low, moderate, high and very high) of various food groups between female subjects and male subjects.

It also checked whether socio-demographic, lifestyle and BMI characteristics have any influence on GDQS scores.

Moreover, it investigated the factors influencing the consumption of the various GDQS food groups.

The GDQS was used as a straightforward metric to capture two dimensions of diet quality: risk of NCDs and nutrient adequacy. This metric does not require food composition tables, making it easier to use.

The study also identified the food groups that contributed to a low HEI score., presented a comparison of the different intake categories (low, moderate, high and very high) of various food groups between female subjects and male subjects.

The research was carried out among university non-academic staff, using the GDQS, which was initially created and validated for non-pregnant, non-lactating

women of reproductive age. However, the GDQS has been applied to men in previous research. Noting that, ensuring proper nutrition for adults is crucial to help in averting or postponing the onset of NCD development risk factors and disorders, especially in a population, such as in Lebanon, that is undergoing a nutritional insecurity linked to an economic crisis (Melki et al., 2004).

The study showed that mean values for total GDQS, GDQS+, and GDQS- scores were 18.46±4.39, 7.76±3.56, and 10.70±2.37, respectively.

These findings align with a study performed in India on age reproductive women, where the mean values for total GDQS, GDQS+, and GDQS- scores were 23±3.6, 11.8±4, and 11.3±1.4, respectively (Mika Matsuzaki et al., 2021). Another study performed on Thai adults showed that the mean values for total GDQS in men 19.6±4.6 and in women 19.4±4.9 (Bromage et al., 2023).

Most of the participants (59.5%) exhibited moderate GDQS score levels, while 25.5 % had low GDQS scores, and 15% demonstrated high GDQS score levels. It also revealed that males have very slightly higher total GDQS (18.49) and GDQS+ (7.78) mean scores compared to females that have total GDQS (18.44) and GDQS+ (7.68) mean scores. On the other hand, in GDQS- mean scores, females slightly presented higher scores (10.75) than males (10.66).

The results of our study are in line with the results of a study conducted in Lebanon between May 2008 and August 2009 that analyzed the dietary data among Lebanese adults aged 24-49 years and was derived from the National Nutrition and Non-Communicable Disease Risk Factor Survey. In fact, the 2008 study had found that the mean total GDQS score is 17.84 ±4.25, where most of the participants (65.3%)

exhibited moderate GDQS score levels, while 24% had low GDQS scores, and 10.8% demonstrated high GDQS score levels.

In terms of the distribution of total GDQS score levels in our sample, a larger proportion of females fall into the "Low" total GDQS score category (27%) compared to males (24%). Conversely, a greater percentage of males fall under the "moderate" total GDQS score category (61% for males, 58% for females). Equal proportions of males and females (15% each) fall into the "Moderate" total GDQS score category.

Most of the study sample displayed a low intake for the following categories: citrus fruits, deep orange fruits, other fruits, dark green leafy vegetables, cruciferous vegetables, deep orange vegetables, legumes, deep orange tubers, nuts and seeds, whole grains, fish and shellfish, poultry and game meat, low-fat dairy, and eggs.

Understanding the individuals decision-making process regarding food is essential for reshaping the existing food system and to promote people's healthiness (Chen & Antonelli, 2020). In this study, the three most frequently reported barriers to consumption of healthy food groups were adherence to past eating habits followed by high cost and not liking taste and texture.

When considering past eating habits, these are long-established core dietary patterns, thus, it takes a degree of effort and time to effect a meaningful change in their course. These habits are usually related to the general stability of dietary intake behaviors (Mela, 1999).

Besides, concerning high cost, it can be said that upon financial stress, unstable political situation, or when there is any compromise in government services, nutrition inequalities are aggravated. Increased food prices and devalued currency may initiate detrimental coping mechanisms such as omitting specific food groups from the diet or

skipping meals. This may create long term adverse side effects (Global Nutrition Report, 2020).

In literature, two major unsurmountable obstacles that determine food choices and limit access to nutritious and healthy food include, but not limited to, diet cost and affordability. The influence of these factors should be highly considered in LMIC when implementing nutrition education policies that target behavior change in terms of drivers of food choice (Herforth & Nations, 2020).

Lastly, regarding not liking taste and texture, it should be mentioned that food choices are usually regulated by sensory and immediate hedonic dimensions. Aversions and expression sensory dislikes, as well as the connections between sensory characteristics and the regulation of food intake are often a result of personal experiences or past eating habits. Thus, sensory preferences may be a proximate, rather than a true root cause that drives food choices (Mela, 1999).

Thus, this study highlights the need for multifold action that help enhancing healthy food groups consumption to ultimately enhance health promotion and NCDs prevention.

In fact, a better financial status may help with the prevention of obesity, especially because it is associated with an improved food purchasing power in terms of quality in addition to a greater capability in engaging in sports activities and leisure time. While knowledge on the other hand may help with adapting behaviors associated with healthier practices. Thus, when combined, wealth and education will shape health-conscious outcomes leading to behavior change and shaping of a coherent lifestyle (Chamieh et al., 2015).

On the other hand, the study sample exhibited a high intake of other vegetables and liquid oils.

Somewhat, these findings align with the findings of a study conducted in rural Bangladesh that assessed diet quality in men and women, where both men and women exhibited low intakes of all healthy GDQS food groups except for other vegetables and fish (Coleman et al., 2023).

The high consumption of liquid oils is related to the fact that the primary choice for added fat among Lebanese is olive oil. The prevalent use of olive oil in Lebanon is due to its abundance and wide production in the country (Karam et al., 2022).

Turning to the unhealthy food groups contributing to the GDQS- score, the study sample demonstrated a high intake of refined grains and baked goods.

This finding aligns with a study performed on urbanizing South Indian population, where all females consumed increased amounts of refined grains and baked goods. (M. Matsuzaki et al., 2021)

The enjoyment of taste and texture served as the first major facilitator for all GDQS unhealthy food groups, followed by past eating habits and denying the adverse health effect.

Low intakes of processed meat, sweets and ice cream, sugar sweetened beverages, juice, white roots and tubers and purchased deep fried food were marked. In fact, processed meat, in the first place is associated with CVD, diabetes and some forms of cancer (Alshahrani et al., 2019), thus the low intake of processed meat is beneficial.

Secondly, excess free sugar intake, particularly in the form of sugar-sweetened beverages, or juice and sweets and ice cream contribute to obesity and nutrition-related

NCDs (Angulo et al., 2021). Thus, the reduced intake of these food groups is beneficial in terms of NCDs prevention.

When considering unhealthy food groups that contribute to a higher GDQS-score when consumed excessively, most of the study participants displayed a very high intake of high-fat dairy, and a low intake of red meat.

the high intake of high fat dairy products is linked to several adverse health effects due to its high content of saturated fatty acids. A higher SFA intake may result in elevated levels of low-density lipoprotein cholesterol (LDL), consequently raising the risk of CVDs (Lordan et al., 2018).

The HEI is originally developed for the American population, as a tool for evaluating adherence to DGAs, however it was previously applied to many non-American populations. In this study, the total HEI score was 51.6 ± 12.54, with 53.5% of the participants having a moderate HEI score, while 45.5 % having a HEI score categorized as low, and 1% having a high HEI score. Our results align with the results of a study performed on Iranian individuals in 2022 showed a total HEI score of 50.4 ± 14.2 (Vahid et al., 2022). In the 2008/2009 survey, it was shown that the total HEI score was 45.66 ±13.02 with 35% of the participants having a moderate HEI score, and 63.8 % having a HEI score categorized as low.

While a moderate score is not necessarily bad, it indicates that there are areas where dietary choices could be enhanced. Especially in the HEI components that had a low consumption which were total fruits, whole fruits, greens and beans, whole grains, total protein foods, seafood and plant-based proteins, and refined grains.

In our cohort there was a high maximum intake of the following HEI components total vegetables, dairy products, added sugars, and fatty acids. Lastly, there was a higher adherence to the moderate intake levels for Sodium, and saturated fats.

5.2 Strengths and limitations

This study has several strengths. In fact, the recalls were conducted by a licensed dietitian who underwent training before gathering data, with the aim of reducing the possibility of interviewing bias. Also, the GDQS has undergone extensive testing and validation across diverse countries with differing dietary habits, NCDs prevalence, and economic status. This testing has confirmed its capacity to correlate with both nutrient sufficiency and NCDs. Lastly, using the GDQS application and nutritionist professional which are specialized software for dietary assessment and analysis improve accuracy and efficiency in calculations.

This study has several strengths. In fact, the recalls were conducted by a licensed dietitian who underwent training before gathering data, with the aim of reducing the possibility of interviewing bias. Also, the GDQS has undergone extensive testing and validation across diverse countries with differing dietary habits, NCDs prevalence, and economic status. This testing has confirmed its capacity to correlate with both nutrient sufficiency and NCDs. Lastly, using the GDQS application and nutritionist professional which are specialized software for dietary assessment and analysis improve accuracy and efficiency in calculations.

Concerning the limitations, using a convenient sample may limit external validity, as the sample may not be reflective of the diversity present in the broader population. Also, in our analysis, it is worth noting that the utilization of Pearson Chi-Square to compare GDQS and HEI food groups between subjects with different score categories and gender might be a limitation, and a more robust approach could involve employing binary logistic regression for a more comprehensive examination of the associations. Moreover, the analysis of diets was done using a single-day 24-h recall which is susceptible to random error caused by the day-to-day fluctuations in food intake. In addition, there may be bias in self-reported data from 24-hour recall assessments, especially memory bias, in fact, participants may have difficulty in accurately recalling what they ate over the past 24 hours, and they may forget certain items consumed, also some have faced difficulty in choosing the 3D corresponding to the quantity they ate. Also, respondents may provide answers that they believe are socially acceptable or that align with perceived dietary norms, rather than accurately reflecting their actual food consumption, these are referred to as social desirability bias. This can lead to overreporting of healthy foods and underreporting of unhealthy ones. Or vice versa, participants tended to exaggerate in reporting lower quantities or unhealthy food thinking that they would get any compensation after the interview. Additionally, the restriction to just 5 healthy and 5 unhealthy food groups in the questionnaire may limit the thorough evaluation of food choice drivers, possibly overlooking some GDQS food groups that extend beyond the designated categories. Lastly, non academic staff had tight schedules, they wanted to finish the interview in the fastest way in order to resume working.

CHAPTER 6

CONCLUSION

This research revealed that a significant portion of AUB non academic staff displayed a moderate GDQS score. Moreover, no significant difference was shown between females and males in terms of total GDQS, GDQS+, and GDQS- as well as the proportions of individuals categorized under low, moderate, and high total GDQS scores. None of the sociodemographic, lifestyle and BMI characteristics showed any effect on the GDQS score and its sub metrics. The three most frequently reported barriers to consumption of healthy food groups were adherence to past eating habits followed by high cost and not liking taste and texture.

The enjoyment of taste and texture served as the first major facilitator for all GDQS unhealthy food groups followed by past eating habits and denying the adverse health effect.

This study also revealed that a significant portion of AUB non academic staff displayed a moderate HEI score. Moreover, no significant difference was shown between females and males in terms of HEI score as the proportions of individuals categorized under low, moderate, and high HEI.

Thus, adequate approaches that focus on the promotion of healthier eating habits and contribute to the reduction NCDs risk factors should be implemented to eventually help in controlling adverse health consequences and NCDs burdens.

APPENDIX 1

(ENGLISH CONSENT FORM)

Consent to Participate in a Research Study

Title: "The drivers of consumption of foods associated with noncommunicable disease risk among Lebanese adults using the Global Diet Quality Score"

Principle Investigator:
Dr Nahla Hwalla – Professor Faculty of Agricultural and Food Sciences - AUB

Co-Investigators:
Dr Lara Nasreddine – Professor Faculty of Agricultural and Food Sciences - AUB

Dr Samer Kharroubi - Associate Professor Faculty of Agricultural and Food Sciences - AUB

Karen Zoghbi – Student - Faculty of Agricultural and Food Sciences - AUB
Najwa Mourad - Student Faculty of Agricultural and Food Sciences - AUB

Address:
Department of Nutrition and Food Sciences- American University of Beirut - Bliss Street

Phone:
(01) 350000 Ext: 4443

Site Where the Study will be Conducted:

American University of Beirut, Faculty of Agricultural and Food Sciences, Department of Nutrition and Food Sciences

You are being invited to participate in a study entitled: "The drivers of consumption of foods associated with noncommunicable disease risk among Lebanese adults using the Global Diet Quality Score", conducted by the American University of Beirut, and which will include 585 participants: 385 university male students recruited from AUB; and 200 non academic staff (100 males and 100 females), not belonging to upper administration positions recruited from AUB.

Please take time to read the following information carefully before you decide whether you want to participate in this study or not. This statement describes the objectives, procedures, benefits, risks, discomforts, and precautions related to the study. Alternative procedures, if any, available to you, as well as your right to withdraw from the study at any time are also described. Please feel free to ask any questions if you need any clarification about what is stated in this form or if you need any additional information.

1) **Purpose of the Research Study and Overview of Participation:**

In Lebanon, unhealthy diets are among the recognized modifiable risk factors for several noncommunicable disease (NCDs) including diabetes, cardiovascular disease, and certain types of cancer. Understanding the drivers of eating behaviors and assessing the diet quality of the

population is important in order to select the most effective interventions aiming to promote healthy eating behaviors and thus mitigating NCDs.

The Global Diet Quality Score (GDQS) is an entirely food-based metric, consisting of 25 food groups. The GDQS provide a simple, standardized metric appropriate for population-based measurement of diet quality globally.
Studies exploring the drivers of eating behaviors and assessing the diet quality among young adults are scarce in Lebanon. Moreover, the current economic crisis that our country is facing has forced people to change their food choices by shifting from varied and nutritious consumptions to lower quality diets. To make our sample homogeneous in terms of socio-economic status, we have decided not include staff belonging to upper administrative positions, since this category of staff do not belong to the low-to-middle income category that we are targeting in our study. By stating upper administrative positions, we are excluding the President, deans, vice presidents and heads of administrative units. Therefore, this study aims to explore the drivers of consumption of harmful and protective foods and to assess the diet quality among 585 participants: 385 university male students recruited from AUB; and 200 non-academic staff (100 males and 100 females), not belonging to upper administration positions recruited from AUB.

2) Recruiting strategy:

Participation in this study is completely voluntary and an informed consent will be sought from eligible students and non-academic staff who have the right to accept or decline participation on their own. Their consent will be obtained during the screening stage. The recruitment methodology, approved by the ethical board, will be performed in two stages:

- Stage 1 – Screening Stage: Flyers will be posted around AUB. Subjects who are interested to participate in the study will be invited to visit the Department of Nutrition and Food Sciences at AUB, at a specific date and time. The subject will be briefed about the study, its objectives, and methodology, in private. Eligibility of the participant will be confirmed based on age, nationality, if they live in Lebanon. This screening stage will require around 5 minutes of your time. The screening stage will continue until a minimum of 585 adults have been recruited.

After signing the informed consent and ensuring your eligibility for participation, data collection will start right away after the screening stage, however if you prefer to meet later for data collection, you will then be contacted to set a date and time convenient for you to meet or visit the Department.

- Stage 2 – Recruitment Stage: The recruitment stage requires a total of 585 adults, that will be selected based on specific sampling and recruitment protocols.

3) Project Description and Duration:

If you decide to participate in this study, you will be invited to visit the Department of Nutrition and Food Sciences at AUB, on a date and time that is convenient for you.

During your visit at FAFS, or any other convenient place on AUB campus, you will be asked to stay for a face-to-face interview that would take approximately 60 minutes for data collection.

In case face-to-face data collection was not feasible at the time of project initiation, interviews will be done via zoom meetings.

Data will be obtained through the application of an interviewer-administrated questionnaire. This questionnaire includes questions about your demographic, socioeconomic, lifestyle factors, anthropometric measurements, 24-hour dietary recall (24-HR) and determinants of your eating behaviors for certain food groups.

The collection of 24-HRs will be conducted for the assessment of diet quality. You will be given the 2D Food Portion Visual, along with the necessary instructions, in order to facilitate the collection of the 24-HRs. The 24-HRs consist of remembering what you consumed as foods/drinks in the previous 24 hours. They will be administered by trained nutritionists.

4) **Risks and Discomforts:**

Although any study may be associated with any unforeseeable risk, this study has minimal risk and no major risks results from the participation in this study. None of the data collection measures bare any long-term or short-term hazards. The only possible concerns may include discomfort or stress when asked certain questions such as socioeconomic status. You may feel uncomfortable participating in weight and height measurements. To minimize the risks, questions will be asked individually rather than in a group interview context where you may not want to disclose any information and if any of the questions make you feel uncomfortable, you are not required to answer. You are free to skip any questions and refrain from answering. Moreover, all collected data and results will be kept strictly confidential and measures will be taken to ensure no breach of privacy.

Considering the COVID-19 situation, all the necessary safety measures (masks, gloves, preventive gear...), will be ensured at all times at the Department of Nutrition and Food Sciences (according to the IRB guidance document).

5) **Potential Benefits:**

By participating in this study, you will be contributing to science. All findings will be conveyed to you by the end of the study.

There are benefits from participation in this study whereby you will learn about your diet quality score and what food items appear to contribute to the score and increase risk of NCDs.

Moreover, since the study aims to understand drivers of eating behavior and the diet quality among Lebanese adults, this study will inform the design of future interventions and policies aiming to promote healthy eating behaviors.

There are no anticipated expenses for you to pay if you participate in the study.

If you don't want to take part in the study anymore for a reason of your own, then the study investigators will terminate your participation.

6) Other ways to reach the aim of the study:

There is no other way to reach the aim of the study.

7) Confidentiality:

All procedures will take place in a private room to ensure your privacy. The investigators are committed to preserve anonymity of the participant, to keep the results confidential, and to give results only to the participant involved. If you agree to participate, all collected data will be kept strictly confidential and measures will be taken to ensure no breach of your privacy. Also, all participants will be assigned by random identifiers to further assure the confidentiality of records. A sheet will be prepared whereby each ID will be linked to the name of the participant. All data used for research purposes, however, will be based on the IDs only.

Only the members of the research group will have access to the data that will only be used for research purposes. Records will be monitored, without violating confidentiality. The data collection sheets will be locked in a cabinet at the principal investigator's office. Electronic versions of the data will also be secured and locked by a password. This data will be stored on the principal's investigator computer.

Only the PI will have access to the complete data set. Proper measures will be taken to keep the individually identifiable information confidential, only shared with the researchers listed in this IRB application, and only used for the purposes of this research project. All identifiers (name, DOB, address, etc.) will be de-identified once the data merging at the institution is complete. Your contact information will be securely stored at AUB for internal use during the study. The research data will not include your identifying information. Identifiers will be collected for study purposes; however, all data will be de-identified and identifiers will not be disclosed. Please acknowledge that participation in this study is completely voluntary.

Your decision not to participate will not influence your relationship with AUB in any possible way.

_____

Signature of Investigator or designee

_____

Date & Time

Participant's Consent:

I have read and understood all aspects of the research study and I had enough time to have all my questions answered. I voluntarily agree be a part of this research study and I know that I can contact Dr. Nahla Hwalla at 01-350000 Ext 4443 or any of her designee involved in the study in case of any questions at any time during and after the conduction of the study. If I felt that my questions have not been answered, I can contact the Institutional Review Board for human rights at 01-350000 Ext 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 my care or benefits. I know that I will receive a copy of this signed informed consent.

_____ _____

Name of Participant **Signature**

_____

Date & Time

_____ _____

Witness's name **Witness's Signature**

(If participant is illiterate)

_____

Date & Time

American University of Beirut
Institutional Review Board
16 December 2022
APPROVED

APPENDIX 2

(ARABIC CONSENT FORM)

موافقة للإشراك في البحث العلمي

عنوان البحث: " العوامل المحفزة لتناول الأطعمة المرتبطة بمخاطر الأمراض غير السارية للبالغين باستخدام المقياس العالمي لجودة النظام الغذائي"

الباحثة الرئيسية:
الدكتورة نهلة حوله- كلية العلوم الزراعية والغذائية - الجامعة الأمريكية في بيروت

الباحثون المتعاونون :
الدكتورة ا لارا نصر الدين - كلية العلوم الزراعية والغذائية - الجامعة الأميركية في بيروت
الدكتور سامر خروبي - كلية العلوم الزراعية والغذائية - الجامعة الأمريكية في بيروت

كارن زغبي - تلميذة قسم التغذية وعلوم الغذاء / الجامعة الأمريكية في بيروت
نجوى مراد - تلميذة قسم التغذية وعلوم الغذاء / الجامعة الأمريكية في بيروت

عنوان البحث :
الجامعة االميركية في بيروت - شارع بلس – بيروت - لبنان

التلفون:
... ٣٥٠ (٠١) مقسم ٤٤٤٣

مكان إجراء البحث:

الجامعة الأمريكية في بيروت, كلية الزراعة وعلم الغذاء, قسم التغذية وعلوم الغذاء

أنت مدعو للمشاركة في دراسة بعنوان: " العوامل المحفزة لتناول الأطعمة المرتبطة بمخاطر الأمراض غير السارية للبالغين باستخدام المقياس العالمي لجودة النظام الغذائي " التي تجريها الجامعة الأمريكية في بيروت، ويتضمن 585 مشترك: 385 طالب ذكر جامعي من الجامعة الأمريكية في بيروت ; و200 موظف غير أكاديمي (١٠٠ ذكور و ١٠٠ اناث) لا ينتمون إلى المناصب الإدارية العليا, من الجامعة الأميركية في بيروت.

نرجو منك قراءة المعلومات الواردة أدناه بعناية قبل أخذ القرار بمشاركتك في هذا البحث. يصف هذا البيان الأهداف والاجراءات والفوائد والمخاطر والإحتياطات المتعلقة بالدراسة. كما يتم وصف االجراءات البديلة المتعلقة بك، إن وجدت، وعن حقك في الإنسحاب من الدراسة في أي وقت. لا تتردد(ي) في طرح الأسئلة إذا كنت بحاجة إلى توضيح حول ما ورد في هذه الإستمارة أو إذا كنت بحاجة إلى أي معلومات إضافية.

1. هدف البحث وأهمية المشاركة:

في لبنان، تعتبر الانظمة الغذائية غير الصحية من بين العوامل الخطر القابلة للتعديل للعديد من الأمراض غير المعدية بما في ذلك مرض السكري وأمراض القلب والأوعية الدموية وأنواع معينة من السرطان. يعد فهم دوافع سلوكيات الأكل وتقييم جودة الانظمة الغذائية للسكان أمرًا مهمًا من أجل اختيار التدخلات الأكثر فاعلية التي تهدف إلى تعزيز سلوكيات الأكل الصحي وبالتالي التخفيف من الأمراض غير المعدية.

المقياس العالمي لجودة النظام الغذائي (GDQS: The Global Diet Quality Score) هو أداة يقيس مدى صحة النظام الغذائي للسكان ويتألف من ٢٥ مجموعة غذائية. يوفر هذا المقياس مقياسًا بسيطًا وموحدًا مناسبًا للقياس السكاني لجودة النظام الغذائي على مستوى العالم.

دراسات حول استكشاف دوافع سلوكيات الأكل وتقييم جودة النظام الغذائي لدى الشباب نادرة في لبنان. زيادةً على ذلك، أجبر الوضع الاقتصادي الحالي الذي يواجهه بلدنا الناس على تغيير خياراتهم الغذائية من خلال التحول من الاستهلاكات المتنوعة والمغذية إلى الوجبات الغذائية منخفضة الجودة. لجعل عينتنا متجانسة من حيث الوضع الاجتماعي والاقتصادي ، قررنا عدم تضمين الموظفين الذين ينتمون إلى المناصب الإدارية العليا ، لأن هذه الفئة من الموظفين لا تنتمي إلى فئة الدخل المنخفض إلى المتوسط التي نستهدفها في دراستنا . بذكر المناصب الإدارية العليا ، نستبعد الرئيس والعمداء ونواب الرئيس ورؤساء الوحدات الإدارية. لذلك، تهدف هذه الدراسة إلى استكشاف دوافع تناول الأطعمة المرتبطة بمخاطر الأمراض غير السارية وتقييم جودة النظام الغذائي لدى 585 مشترك: 385 طالب ذكر جامعي من الجامعة الأمريكية في بيروت ; و200 موظف غير أكاديمي (١٠٠ ذكور و ١٠٠ اناث) لا ينتمون إلى المناصب الإدارية العليا, من الجامعة الأميركية في بيروت.

2. استراتيجية التعيين:

إن مشاركتك في هذه الدراسة طوعية وسيتم السعي للحصول على الموافقة من الطلاب المؤهلين اللذين لهم الحق في قبول أو رفض المشاركة. سيتم الحصول على موافقتهم خلال مرحلة الفحص. سيتم تنفيذ طريقة التعيين، التي وافق عليها مجلس الأخلاقيات، على مرحلتين:

المرحلة الأولى - مرحلة الفحص: سيتم وضع منشورة معلومات عن الدراسة حول حرم الجامعة الأمريكية في بيروت وسوف يتم دعوة الأشخاص، المهتمين بالمشاركة، للحضور إلى قسم التغذية وعلم الطعام في الجامعة الأميركية في بيروت، في تاريخ ووقت محددين. سيتم تعريف الموضوع بالدراسة وأهدافها ومنهجيتها بشكل خاص. سيتم إطلاع المشارك على الدراسة وأهدافها ومنهجيتها وذلك على إنفراد. سيتم التأكد من أهلية المشاركة وفقا للعمر والجنسية وإذا كانوا يعيشون في لبنان. ستستغرق مرحلة الفحص حوالي ٥ دقائق من وقتك. ستستمر مرحلة الفحص حتى يتم تعيين 585 مشترك على الأقل.

بعد توقيع الموافقة والتأكد من أهليتك للمشاركة، سيبدأ جمع البيانات على الفور بعد مرحلة الفحص، ولكن إذا كنت تفضل الاجتماع لاحقًا لجمع البيانات، فسيتم الاتصال بك لتحديد التاريخ والوقت المناسبين للقاء.

المرحلة الثانية - مرحلة التعيين: تتطلب مرحلة التعيين إجمالي 585 مشترك, يتم إختيارهم إستنادا إلى بروتوكولات خاصة لأخذ العينات والتعيين.

3. وصف المشروع ومدته:

إذا قررت المشاركة في هذه الدراسة ، فستتم دعوتك لزيارة قسم التغذية وعلوم الغذاء في الجامعة الأميركية في بيروت ، في التاريخ والوقت المناسبين لك.

أثناء زيارتك إلى القسم، أو أي مكان مناسب آخر في حرم الجامعة الأميركية في بيروت سيُطلب منك البقاء لإجراء مقابلة وجهًا لوجه تستغرق حوالي 60 دقيقة لجمع البيانات.

في حالة عدم إمكانية جمع البيانات وجهًا لوجه في وقت بدء الدراسة، سيتم إجراء المقابلات عبر تطبيقzoom.

سيتم الحصول على البيانات من خلال تطبيق استبيان يديره المحاور. يتضمن هذا الاستبيان أسئلة حول العوامل الديموغرافية والاجتماعية والاقتصادية ونمط الحياة ووزنك وطولك واسترجاع النظام الغذائي على مدار ٢٤ ساعة والعوامل المحفزة لتناول مجموعات غذائية معينة . سيتم جمع الأطعمة والمشروبات الغذائية التي تناولتها خلال الساعات ال ٢٤ الماضية لتقييم جودة النظام الغذائي. سيتم إعطائك 2D Food Portion Visual ، بالإضافة إلى التعليمات اللازمة لتسهيل جمع معلومات عن الأطعمة والمشروبات الغذائية التي تناولتها خلال الساعات ال ٢٤ الماضية. ستقوم أخصائيات تغذية مدربات بأخذ هذه المعلومات.

4. المخاطر والمضايقات:

على الرغم من أن أي دراسة قد تترافق مع مخاطر لا يمكن التنبؤ بها، هذه الدراسة تحمل الحد الأدنى من المخاطر ولا توجد مخاطر كبيرة ناتجة عن مشاركتك. لا تحمل أي من عمليات جمع البيانات أية مخاطر على المدى الطويل أو القصير. قد تشمل المخاوف الوحيدة الممكنة عدم الراحة أو التوتر عند طرح أسئلة معينة مثل عمرك. قد تشعر بعدم الارتياح عند المشاركة في قياسات الوزن والطول. لتقليل المخاطر ، سيتم طرح الأسئلة بشكل فردي بدلاً من سياق المقابلة الجماعية حيث قد لا ترغب في الكشف عن أي معلومات وإذا كان أي من الأسئلة يجعلك تشعر بعدم الارتياح، فلا يلزمك الإجابة. لك الحرية في تخطي أي أسئلة والامتناع عن الإجابة. علاوة على ذلك، سيتم الحفاظ على سرية جميع البيانات والنتائج التي تم جمعها وسيتم اتخاذ تدابير لضمان عدم انتهاك الخصوصية.

بالنظر إلى حالة COVID-19 ، سيتم ضمان جميع تدابير السلامة اللازمة)الأقنعة والقفازات والمعدات الوقائية ...(في جميع الأوقات في قسم التغذية وعلوم الأغذية وفي الجامعات الأخرى (وفقًا لوثيقة توجيه IRB).

5. الفوائد:

مشاركتك في هذه الدراسة ستساهم في تطوير مجالات العلوم. كما وأننا سنعلمكم بنتائج الدراسة لدى انتهائها.

هناك فوائد من المشاركة في هذه الدراسة حيث ستتعرف على نقاط جودة نظامك الغذائي والعناصر الغذائية التي يبدو أنها تساهم في درجة جودة النظام الغذائي وتزيد من خطر الإصابة بالأمراض غير المعدية.

بما أن الدراسة تهدف إلى فهم دوافع سلوك الأكل وجودة النظام الغذائي، فإن هذه الدراسة ستوجه تنفيذ التدخلات لتعزيز الأكل الصحي.

ليس هنالك أي مصروف متوجب عليك مقابل مشاركتك في الدراسة.

إذا كنت لا ترغب في المشاركة في الدراسة لسبب خاص، باحثون الدراسة سينهون مشاركتها.

6. طرق بديلة للوصول إلى الهدف المرجو:

ليس هناك طرق أو وسائل بديلة للوصول للهدف المرجو.

7. السرية:

ستتم جميع الإجراءات في غرفة خاصة لضمان خصوصيتك.
يتعهد الباحثون بضمان عدم خرق خصوصية المشاركة، بأن تبقى كافة البيانات محفوظة بسرية وبعدم إعطاء النتائج إلا للمشترك المعني. إذا وافقت على المشاركة، سوف تبقى كافة البيانات محفوظة بسرية تامة وسيتم إتخاذ تدابير لضمان عدم خرق خصوصية المشاركين. كما سيتم تعيين للمشاركين رموز عشوائية لمزيد من ضمان سرية السجلات. وسيتم إعداد قائمة تربط كل رمز بإسم المشترك. ومع ذلك، فإن جميع البيانات المستخدمة في البحث فستكون مستندة إلى الرموز العشوائية فقط.

فقط فريق البحث يمكنه الإطلاع على البيانات وهذه المعلومات سوف تستعمل فقط لأهداف بحثية. سيتم مراقبة السجلات، دون إنتهاك السرية. سوف تحفظ جميع المعلومات في خزانة مقفلة في مكتب الباحثة الرئيسية. كما سي تم حفظ البيانات الإلكترونية مع التأمين عليها بكلمة سر. سيتم تخزين هذه البيانات على حاسوب الباحثة الرئيسية.

سيتمكن الباحث الرئيسي فقط من الوصول إلى مجموعة البيانات الكاملة. سيتم اتخاذ التدابير المناسبة للاحتفاظ ببيانات سرية المعلومات الشخصية، ومشاركتها فقط مع الباحثين المعنيين، واستخدامها فقط لأغراض هذا المشروع البحثي. ستتم إزالة جميع المعرفات)الاسم وتاريخ الميلاد والعنوان وما إلى ذلك(تلقائيًا بمجرد اكتمال دمج البيانات في مؤسستنا. سيتم تخزين معلومات الخاصة بك بشكل آمن في الجامعة الأمريكية في بيروت للاستخدام الداخلي أثناء الدراسة. لن تتضمن بيانات البحث معلومات التعريف الخاصة بك. سيتم جمع المعرفات لكن، سيتم إلغاء تحديد هوية جميع البيانات ولن يتم الكشف عن المعرفات.

الرجاء أخذ العلم بأن مشاركتك في هذه الدراسة طوعية. قرارك بعدم المشاركة لن يؤثر بأي شكل من الأشكال على علاقتك بالجامعة الأمريكية في بيروت

8. حقوق المشارك:

إن مشاركتك في هذه الدراسة طوعية وسيتم السعي للحصول على الموافقة من البالغين المؤهلين اللذين لهم الحق في قبول أو رفض المشاركة من تلقاء أنفسهم. الرجاء أخذ العلم بأن عدم المشاركة أو الإنسحاب من المشاركة لن يؤثر سلبا في المستقبل على منافعك الشخصية. ستتم مشاركة كل محتوى الموافقة معك قبل ملء الاستبيان

A. **إذا كنت تفضل الاجتماع لاحقًا لجمع البيانات ، فهل يمكننا الاتصال بك لتحديد تاريخ ووقت مناسبين لك لزيارة القسم؟**

نعم لا

إذا كانت إجابتك بنعم ، فيرجى تزويدنا برقم هاتف الاتصال الخاص بك:

_____

قد نخزن ونستخدم بعض أو جميع البيانات التي تم جمعها في دراسات أخرى في المستقبل. وقد يستدعي ذلك مشاركة المعلومات مع باحثين أخرين. قبل أن نفعل ذلك، سوف نتخلص من أي روابط بين هويتك والمعلومات المجموعة منك. أيضا، نود الإتصال بك لدعوتك للمشاركة بدراسات مستقبلية

B. **أوافق على أن يتم تخزين البيانات الخاصة بي وعلى إستخدام المعلومات التي تم جمعها لمشاركتها مع باحثين آخرين و/أو لإستخدامها في البحوث المستقبلية. أوافق على مشاركة البيانات مع باحثين داخل الجامعة الأمريكية في بيروت وخارجها**
نعم لا

C. **هل يمكننا الاتصال بك لدعوتك للدراسات المستقبلية؟**

نعم لا

موافقة الباحث:

لقد راجعت بالتفصيل مع المشترك ---------- (اسم المشارك) وثيقة المشاركة في الدراسة وطبيعة البحث ومجرياته ومكاسبه وتأثيراته السلبية. تم توضيح كافة الأسئلة وسوف أبلغ المشتركة بأي تغيير قد يطرأ على هذا البحث العلمي.

_____

اسم الباحث أو الشخص المولى الحصول على موافقة المشترك

_____
توقيع الباحث أو الشخص المولى الحصول على موافقة المشترك

_____التاريخ والساعة

موافقة المشترك:

لقد قرأت وفهمت كل جوانب هذا البحث وكان لدي الوقت الكافي لطرح جميع أسئلتي. أوافق بملىء إرادتي على المشاركة في هذا البحث وأنا على علم تام بأنني أستطيع الاتصال بالباحثة الدكتورة نهلا حولا أو أي من معاونيها للإجابة على أسئلتي وذلك على الرقم التالي ... ٣٥٠ (٠١) مقسم ٤٤٤٣
في حال عدم حصولي على إجابة، بإمكاني الاتصال بلجنة الاخلاقيات على الرقم ... ٣٥٠ (٠١) مقسم 5445 واذا شعرت ان الأجوبة تحتاج الى مزيد من الإيضاح فسوف أتصل بأحد اعضاء لجنة الأخلاقيات (01- 350000 5445 المقسم). اعلم انه بإمكاني سحب هذه الموافقة ووقف المشاركة في هذا المشروع في أي وقت، حتى بعد توقيع هذا النموذج، ولن يؤثر على رعايتي الصحية أو على المكاسب التي أحصل عليها. وأنا أعلم أنني سوف أتلقى نسخة عن هذه الموافقة .

_____ _____

اسم المشترك التوقيع

_____

التاريخ والساعة

_____ _____

إسم الشاهد التوقيع

(إذا كان المشترك أو الوصي أميا) _____ __التاريخ والساعة

American University of Beirut
Institutional Review Board
16 December 2022
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APPENDIX 3

(ENGLISH QUESTIONNAIRE)

Questionnaire

"The drivers of consumption of foods associated with noncommunicable disease risk among Lebanese adults using the Global Diet Quality Score''

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Institutional Review Board
16 December 2022
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''

1. PERSONAL & HOUSEHOLD INFORMATION

1. Gender

☐ 1.Male

☐ 2. Female

2. Age (years): _____

3. Living arrangement:

☐ 1. Living at parental home

☐ 2. Living in student residence

☐ 3. Living at their own home

4. Place of Residence:

☐ 1. Urban area

☐ 2. Rural area

If the participant is a university student, please answer questions 5 and 6 - and skip questions 9,8,7:

5. Major of study

☐ 1. Health related major (Biomedical, Nutrition, Food science, Medicine, Public health, and nursing)

☐ 2. Non- health related major

6. Academic year of study: _____

If the participant is a non-academic staff , please answer questions 9,8,7 - and skip questions 5 and 6:

7. Job title: _____

8. Marital status:

☐ 1.single

☐ 2.Married

☐ 3.Divorced

☐ 4.Widowed

9. Educational Level:

☐ 1. Illiterate, primary education

☐ 2. Elementary

☐ 3. Secondary

☐ 4.Technical

☐ 5.University and higher education

10. Total Family members number who usually sleep in this house: _____

11. How many rooms are there in your house other than the kitchen, the bathroom, the parking, the open-air balcony? _____

2. ANTHROPOMETRIC MEASUREMENTS

12. Reported height: _____(cm)

13. Reported weight: _____(kg)

3.ALCOHOL CONSUMPTION

14.. Alcohol drinker

☐ 1. Drinker

☐ 2. Non-drinker or past drinker

4. SMOKING

15. Smoking status?

☐ 1. Current smoker

☐ 2. Non-smoker or Past-smoker

5. PHYSICAL ACTIVITY

16. How often do you Exercise?

☐ 1.Never or very rarely

☐ 2.Less than once a week

☐ 3.Once a week

☐ 4.Two or three times a week

☐ 5.More than three times a week

17. How many hours/ minutes per day do you Exercise?

☐ 1.Don't exercise

☐ 2. Less than 30 minutes

☐ 3. 30 minutes

☐ 4. 1-2 hour

☐ 5. More than 2 hours

6. DIETARY ASSESSMENT: 24-HOUR DIETARY RECALL:

Please recall what you ate and drank the previous day from the time you woke up until the next morning. Mention the kind of the food, quantity, the place and the time that you ate at:

Place	Time	Food Eaten	Quantity (Amount)	Method of preparation

Is this an unusual example? ☐ 1.Yes ☐ 2. No

If "Yes", then how it is unusual? ----------

7.DRIVERS OF CONSUMPTION OF HARMFUL AND PROTECTIVE FOODS:

18. What sorts of things makes it harder to consume Fruits? *(Multiple answers possible)*

I don't like the taste/ texture	High cost	I don't know the health benefits	Not available at home	Not available at local markets	Past eating habits (Not used to eat fruits frequently)	High spoilage rate	Others: _
1. ☐	2. ☐	3. ☐	4. ☐	5. ☐	6. ☐	7. ☐	

***19.* What sorts of things make it harder to consume Vegetables?** *(Multiple answers possible)*

I don't like the taste/ texture	High cost	I don't know the health benefits	Not available at home	Not available at local markets	Past eating habits (Not used to eat vegetables frequently)	High spoilage rate	Others: _
1. ☐	2. ☐	3. ☐	4. ☐	5. ☐	6. ☐	7. ☐	

20. What sorts of things makes it harder to consume Low-Fat Dairy products? *(Multiple answers possible)*

I don't like the taste/ texture	High cost	I don't know the health benefits	Not available at home	Not available at local markets	Past eating habits (Not used to eat low-fat dairy products frequently)	Lactose intolerant	Others:
1. ☐	2. ☐	3. ☐	4. ☐	5. ☐	6. ☐	7. ☐	

***21.* What sorts of things makes it harder to consume Deep Orange Tubers (carrots)?** *(Multiple answers possible)*

I don't like the taste / texture	High cost	I don't know the health benefits	Not available at home	Not available at local markets	Past eating habits (Not used to eat deep orange tubers frequently)	High spoilage rate	Others: -
1. ☐	2. ☐	3. ☐	4. ☐	5. ☐	6. ☐	7. ☐	

***22.* What sorts of things make it easier to consume Refined Grains (White bread, pasta, rice…)?** *(Multiple answers possible)*

I like the taste/ texture	Low cost	I don't know the adverse health effect	Available at home	Available at local markets	Past eating habits (Used to eat refined grains frequently)	TV, internet, social media ads	Others:
1. ☐	2. ☐	3. ☐	4. ☐	5. ☐	6. ☐	7. ☐	

***23.* What sorts of things makes it easier to consume Sweets and Ice cream?** *(Multiple answers possible)*

I like the taste/ texture	Low cost	I don't know the adverse health effect	Available at home	Available at local markets	Past eating habits (Used to eat sweets frequently)	Convenient (easy to prepare/ eat, long shelf life...)	TV, internet, social media ads	Others:
1. ☐	2. ☐	3. ☐	4. ☐	5. ☐	6. ☐	7. ☐	8. ☐	

***24.* What sorts of things makes it easier to drink Sugar Sweetened Beverages?** *(Multiple answers possible)*

I like the taste/ texture	Low cost	I don't know the adverse health effect	Available at home	Available at local markets	Past eating habits (Used to drink sugar sweetened beverages frequently)	Convenient (easy to prepare/ eat, long shelf life...)	TV, internet, social media ads	Others:
1. ☐	2. ☐	3. ☐	4. ☐	5. ☐	6. ☐	7. ☐	8. ☐	

***25.* What sorts of thing makes it easier to consume Red Meat?** *(Multiple answers possible)*

I like the taste/ texture	I don't know the adverse health effect	Available at home	Available at local markets	Past eating habits (Used to eat red meat frequently)	Others:
1. ☐	2. ☐	3. ☐	4. ☐	5. ☐	

***26.* Do you eat Whole Grains frequently?**

☐ 1.Yes (Please skip question 24)
☐ 2. No (Please go to question 24)

27. **If no, why don't you eat Whole Grains?** *(Multiple answers possible)*

I don't like the taste/ texture	High cost	I don't know the health benefits	Not available at home	Not available at local markets	Past eating habits (Not used to eat Whole grains frequently)	I am unable to identify whole grain products	Others:
1. ☐	2. ☐	3. ☐	4. ☐	5. ☐	6. ☐	7. ☐	

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APPENDIX 4

(ARABIC QUESTIONNAIRE)

استبيان

" " العوامل المحفزة لتناول الأطعمة المرتبطة بمخاطر الأمراض غير السارية للبالغين باستخدام المقياس العالمي لجودة النظام الغذائي "

1. المعلومات الشخصية والأسرية

1.الجنس:

- ☐ **1.** ذكر
- ☐ **2.** أنثى

2. العمر (بالسنوات): _____

3. ترتيب المعيشة :

- ☐ 1. العيش في منزل الوالدين
- ☐ 2. العيش في سكن الطالب
- ☐ 3. العيش في منزل خاص

4. مكان الإقامة:

- ☐ 1. منطقة حضرية
- ☐ 2. منطقة ريفية

إذا كان المشترك طالب جامعي يرجى الإجابة على الاسئلة 5 و6 - وعدم الاجابة على الأسئلة 9,8,7:

5 تخصص الدراسة:

- ☐ 1. (تخصص متعلق بالصحة)الطب الحيوي، التغذية، علوم الغذاء، الطب، الصحة العامة، التمريض
- ☐ 2. تخصص غير متعلق بالصحة

6 .العام الدراسي : _____

إذا كان المشترك موظف غير أكاديمي يرجى الإجابة على الاسئلة 9,8,7- وعدم الاجابة على الأسئلة 5 و6:

7. المسمى الوظيفي: _____

8 . الحالة الاجتماعية:

- ☐ 1. أعزب
- ☐ 2. متزوج
- ☐ 3. مطلق
- ☐ 4. ارمل

9. المستوى التعليمي:

- ☐ 1. تعليم أولي, أمي
- ☐ 2. ابتدائي
- ☐ 3. ثانوي
- ☐ 4. تقني
- ☐ 5. الجامعة والتعليم العالي

10. **كم شخص يعيش معك في المنزل:** _____

11. **من كم غرفة يتكون بيتك (باستثناء الحمام، المطبخ، الشرفة والكاراج)؟** (العدد) _____

2. القياسات الجسم

12. **الطول المعلن** (سم): _____

13. **الوزن المعلن** (كلغ): _____

3. استهلاك الكحول

14. **شرب الكحول:**

- ☐ 1. شارب
- ☐ 2. غيرشارب أو كان يشرب الكحول في الماضي

4. التدخين

15. هل تدخن أو معتاد على التدخين؟

- ☐ 1. مدخن حالي
- ☐ 2. غير مدخن ن أو مدخن سابق

5. النشاط البدني

16. .كم تتمرن؟

- ☐ ١) أبدا أو نادرا ً جدًا
- ☐ ٢) أقل من مرة في الاسبوع
- ☐ ٣) مرة في الاسبوع
- ☐ ٤) مرتين أو ثالث مرات في الاسبوع
- ☐ ٥) أكثر من ثالث مرات في الاسبوع

17. كم ساعة / دقيقة في اليوم تمارس الرياضة؟

- ☐ ١) لا تمارس الرياضة
- ☐ ٢) أقل من
- ☐ ٣) ٣٠ دقيقة
- ☐ ٤) ٢-١ ساعة
- ☐ ٥) أكثر من ساعتين

6. التقييم الغذائي: استرجاع النظام الغذائي على مدار 24 ساعة:

يرجى تذكر ما أكلته وشربته في اليوم السابق من وقت استيقاظك حتى صباح اليوم التالي. اذكر نوع الطعام والكمية والمكان والوقت الذي تناولته فيه.

المكان	الزمان	الطعام المأكول	الكمية (المقدار)	طريقة التحضير

هل هذا مثال غير إعتيادي؟

☐ 1. نعم ☐ 2. لا

إذا كانت الإجابة "نعم" ، فكيف يكون الأمر غير إعتيادي ؟ _____

7. دوافع استهلاك الأغذية الضارة والحمائية:

18. ما هي الأشياء التي تجعل من الصعب تناول الفاكهة؟ (حدد كل الإجابات الممكنة)

لا أحب المذاق / الملمس	التكلفة العالية	لا أعرف الفوائد الصحية	غير متوفر في المنزل	غير متوفر في الأسواق المحلية	عادات الأكل السابقة (لست معتاد على تناول الفاكهة بشكل متكرر)	معدل تلف مرتفع	أسباب أخرى

1. □	2. □	3. □	4. □	5. □	6. □	7. □	

19. ما هي الأشياء التي تجعل من الصعب تناول الخضار؟ (حدد كل الإجابات الممكنة)

لا أحب المذاق / الملمس	التكلفة العالية	لا أعرف الفوائد الصحية	غير متوفر في المنزل	غير متوفر في الأسواق المحلية	عادات الأكل السابقة (لست معتاد على تناول الخضار بشكل منكرر)	معدل تلف مرتفع	أسباب أخرى
1. □	2. □	3. □	4. □	5. □	6. □	7. □	

20.ما هي الأشياء التي تجعل من الصعب تناول منتجات الألبان قليلة الدسم؟ (حدد كل الإجابات الممكنة)

لا أحب المذاق / الملمس	التكلفة العالية	لا أعرف الفوائد الصحية	غير متوفر في المنزل	غير متوفر في الأسواق المحلية	عادات الأكل السابقة (لست معتاد على تناول منتجات الألبان قليلة الدسم بشكل منكرر)	معدل تلف مرتفع	أسباب أخرى
1. □	2. □	3. □	4. □	5. □	6. □	7. □	

21. **ما هي الأشياء التي تجعل من الصعب تناول الدرنات البرتقالية العميقة (الجزر)؟** (حدد كل الإجابات الممكنة)

لا أحب المذاق / الملمس	التكلفة العالية	لا أعرف الفوائد الصحية	غير متوفر في المنزل	غير متوفر في الأسواق المحلية	عادات الأكل السابقة (لست معتاد على تناول الدرنات البرتقالية العميقة	معدل تلف مرتفع	أسباب أخرى

						بشكل منكرر)	
1. ☐	2. ☐	3. ☐	4. ☐	5. ☐	6. ☐	7. ☐	

22. **ما هي الأشياء التي تجعل من السهل تناول الحبوب المكررة (الخبز الأبيض والمعكرونة والأرز ...)؟** (حدد كل الإجابات الممكنة)

أحب المذاق / الملمس	التكلفة منخفضة	لا أعرف الآثار الصحية الضارة	متوفر في المنزل	متوفر في الأسواق المحلية	عادات الأكل السابقة (معتاد على تناول الحبوب المكررة بشكل منكرر)	التلفزيون ، والإنترنت ، وإعلانات صفحات التواصل الاجتماعي	أسباب أخرى
1. ☐	2. ☐	3. ☐	4. ☐	5. ☐	6. ☐	7. ☐	

23 . **ما هي الأشياء التي تجعل من السهل تناول الحلويات والمثلجات؟** (حدد كل الإجابات الممكنة)

أحب المذاق / الملمس	التكلفة منخفضة	لا أعرف الآثار الصحية الضارة	متوفر في المنزل	متوفر في الأسواق المحلية	عادات الأكل السابقة (معتاد على تناول تناول الحلويات والمثلجات بشكل منكرر)	التلفزيون ، والإنترنت ، وإعلانات صفحات التواصل الاجتماعي	أسباب أخرى
1. ☐	2. ☐	3. ☐	4. ☐	5. ☐	6. ☐	7. ☐	

24. **ما هي الأشياء التي تجعل من السهل شرب المشروبات المحلاة بالسكر؟** (حدد كل الإجابات الممكنة)

أحب المذاق / الملمس	التكلفة منخفضة	لا أعرف الآثار الصحية الضارة	متوفر في المنزل	متوفر في الأسواق المحلية	عادات الأكل السابقة (معتاد على شرب المشروبات المحلاة بالسكر بشكل متكرر)	التلفزيون ، والإنترنت ، واعلانات صفحات التواصل الاجتماعي	أسباب أخرى
1. ☐	2. ☐	3. ☐	4. ☐	5. ☐	6. ☐	7. ☐	

25. **ما هي الأشياء التي تجعل من السهل تناول اللحوم الحمراء؟** (حدد كل الإجابات الممكنة)

أحب المذاق / الملمس	التكلفة منخفضة	لا أعرف الآثار الصحية الضارة	متوفر في المنزل	متوفر في الأسواق المحلية	عادات الأكل السابقة (معتاد على تناول اللحوم الحمراء بشكل متكرر)	التلفزيون ، والإنترنت ، واعلانات صفحات التواصل الاجتماعي	أسباب أخرى
1. ☐	2. ☐	3. ☐	4. ☐	5. ☐	6. ☐	7. ☐	

26. هل تأكل الحبوب الكاملة بشكل متكرر؟

☐ ١) نعم (يرجى تخطي السؤال ٢٤)
☐ 2) لا (يرجى الانتقال إلى السؤال ٢٤)

27. إذا كانت الإجابة لا، فلماذا لا تأكل الحبوب الكاملة؟ (حدد كل الإجابات الممكنة)

لا أحب المذاق / الملمس	التكلفة العالية	لا أعرف الفوائد الصحية	غير متوفر في المنزل	غير متوفر في الأسواق المحلية	عادات الأكل السابقة (لست معتاد على تناول تناول الحبوب الكاملة بشكل متكرر)	معدل تلف مرتفع	أسباب أخرى

	7. ☐	6. ☐	5. ☐	4. ☐	3. ☐	2. ☐	1. ☐

American University of Beirut
Institutional Review Board
16 December 2022
APPROVED

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