Dietary Patterns and its Associations with Body Mass Index among Saudi University Students. A Cross-Sectional Study

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KEYWORDS

Dietary pattern
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Food frequency
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ABSTRACT:

Introduction: Obesity is a complex multifactorial disease characterized by the accumulation of excess body fat, leading to adverse health outcomes. Over the past four decades, Saudi Arabia has experienced significant economic growth, leading to shifts in lifestyle and dietary habits, especially among young adults.

Objectives: This study aimed to investigate the dietary patterns and their relationship with body mass index among university students.

Methods: A cross-sectional study was conducted among university students using a pretested self-designed questionnaire encompassing 103 common Saudi food items. Ethical approval was obtained from the standing committee for scientific research of Jazan University. Data were coded, validated, and analyzed using IBM SPSS Statistics version 27.0. Exploratory factor analysis with varimax rotation was performed, and scree plot was used to delineate the predominant dietary patterns. The association between identified dietary patterns and BMI was assessed using regression analysis and generalized additive models. A two-tailed P-value of < 0.05 was set as the threshold for statistical significance.

Results: Four distinct dietary patterns emerged among university students: 1) a Western diet, accounting for 20.114% of the variance, characterized by high factor loadings of fast foods, fried items, snacks, soda drinks, and sweets; 2) a traditional diet, representing 18.058% of the variance, predominantly consisting of milk and milk products, breakfast cereals, rice, pasta, potatoes, and traditional Saudi dishes; 3) a prudent diet, comprising 12.186% of the variance, marked by significant consumption of fruits, legumes, vegetables, and nuts; and 4) a high-protein/high-fat diet, accounting for 9.061% of the variance, associated with the intake of meat, chicken, fish and seafood, eggs, and processed meats. The western diet showed a significant association with an increased risk of obesity, whereas prudent diet was linked to a reduced risk.

Conclusions: The findings emphasize the potential benefits of restriction western pattern and promoting prudent dietary pattern to help curtail the obesity epidemic in the studied population.

1. Introduction

Obesity is a multifactorial condition characterized by excessive body fat accumulation that adversely affects health. The escalation of this condition has resulted in an epidemic with no significant signs of decline. An elevated body mass index (BMI) is linked to several non-communicable diseases (NCDs), including diabetes, cardiovascular disorders, and musculoskeletal diseases, leading to a marked reduction in quality and expectancy [1]. The predominant cause of obesity is long-term energy imbalance between calorie consumption and expenditure [2].

The incidence of overweight and obesity has emerged as a global health crisis with rates nearly tripling since 1975. According to the World Health Organization (WHO) [3], in 2016, more than 1.9 billion adults worldwide were classified as overweight. Furthermore, in 2020, approximately 39 million children under the age of five years were reported to be overweight or obese. Previously considered a challenge predominantly for affluent nations, obesity is now surging in low- and middle-income countries [3,4], which now have the highest number of obese people [4]. These figures underscore the magnitude of the issue on a global scale and its profound implications for public health.

In the Kingdom of Saudi Arabia (KSA), the rise in overweight and obesity rates parallels economic growth and accompanying lifestyle shifts [5]. This includes a shift from traditional diets to those rich in sugar sweeteners and processed meat. At present, the obesity prevalence in the KSA is alarmingly high, with estimates of 51% in women and 41% in men [4]. Globally, KSA is among the countries with the highest prevalence of obesity, bearing a significant burden of NCDs, as reflected by the substantial number of disability-adjusted life years (DALYs) attributed to high BMI. Aldubikhi (2023) in his systematic review on obesity management in the Saudi population concludes that diet and exercise interventions can have a significant impact reducing obesity [6].

Furthermore, the economic impact of obesity is substantial, representing as much as 2.24% of the nation's gross domestic product [4]. Consequently, addressing this health concern has become a paramount public health priority in KSA [7].

BMI is a simple index commonly used to assess obesity and overweight at the population level for both adult males and females across all age groups. It is calculated by dividing an individual's weight in kilograms by the square of their height in meters (kg/m2) [3]. The WHO employs BMI as a standard measure for these assessments [4]. Elevated BMI has significantly contributed to the worldwide disease burden, with notable proportions attributed to various conditions, including type II diabetes, ischemic heart disease, hypertensive disorders, ischemic stroke, and several types of cancer [2,8–11]. Such increases in BMI have directly affected life quality and expectancy [2], accounting for over 30 million DALYs and approximately 2.5 million deaths, predominantly resulting from ischemic heart disease and type II diabetes [8].

Diet and physical activity are the primary risk factors for NCDs [9,12,13]. Furthermore, the benefits of both diet and physical activity extend beyond obesity [4]. The WHO advocates a diet that contains fruits, vegetables, legumes, and nuts, as well as restricted amounts of saturated fats, trans fats, and salt [14]. A lower risk of CVD morbidity and mortality was observed with consumption of diet with higher quantities of fruits, vegetables, nuts, legumes, and a moderate quantity of whole-fat dairy and fish in all world regions including Gulf countries [15].

Dietary patterns have gained increasing prominence in nutritional research because of their invaluable insights into health outcomes [16]. Traditionally, nutritional research has predominantly concentrated on individual nutrients or specific food items, thereby neglecting the broader perspective that individuals typically consume food in combinations or patterns [17]. Such dietary patterns capture the quantities, proportions, variety, or combinations of various foods, beverages, and nutrients in diets, offering a comprehensive view of an individual's daily dietary habits [18,19].

Beyond merely focusing on individual nutrients or foods, the evaluation of entire dietary patterns offers a more insightful perspective on the relationship between diet and health [18]. Examining these dietary patterns provides a deeper understanding of the intricate interactions and collective impacts of diverse foods and nutrients on health [19,20], disease outcomes, and various biomarkers [21]. Such a holistic approach is essential for thorough nutritional research aimed at enhancing public health outcomes and has been increasingly recognized in contemporary nutritional studies [16,22]. Only a limited number of studies have focused on dietary patterns in this region. Given that these patterns are influenced by cultural nuances, it is crucial to examine them in various settings. The objective of this study was to elucidate the dietary habits of Saudi university students and identify any potential correlations with BMI.

2. Methods

2.1. Study Design and Population

This cross-sectional study was conducted to assess the association between BMI and dietary patterns among students at Jazan University. This study was conducted from January to June 2023 within the Clinical Nutrition Department of the College of Nursing and Health Sciences. Due to anticipated changes in eating habits during the holy month of Ramadan, data collection was temporarily suspended and subsequently resumed after fasting. A detailed questionnaire was designed in collaboration with the Clinical Nutrition Department. Prior to the main study, a pilot test was conducted to ensure instrument reliability. This study included all students, with the exception of pregnant females.

2.2. Dietary Assessment

A comprehensive data collection training program was implemented, and students from the Clinical Nutrition Department, who underwent prior training, were administered the Food Frequency Questionnaire (FFQ) [23]. This was used to gather dietary data over a span of 6 months. For each food item listed, respondents could select from six frequency categories: never, once/week, 2–4 times/week, 5–7 times/week, 8–10 times/week, and more than 10 times/week. The questionnaire included 103 commonly consumed local food items. These items were further categorized into 18 groups based on their inherent characteristics, as outlined in previous studies [24,25].

2.3. Covariates

Self-reported background characteristics included weight (kg), height (cm), sex (male and female), age (≤ 20 years, 21–23 years, and ≥ 24 years), residence, marital status, monthly income (expressed in Saudi Riyals, with an approximate conversion of USD 0.27), and medical and family histories.

Body mass index (BMI) was determined by dividing body weight (kg) by height squared (m2). The classifications were as follows: underweight (< 18.5), normal weight (18.5–24.9), overweight (25.0–29.9), and obese (≥ 30) [3].

2.4. Sample Size and Sampling Procedure

The targeted sample size was determined to be 586, using the formula provided. This figure was subsequently rounded to 600 for ease of administration. The formula used was as follows:

$n = (N \times X) / (X + N - 1)$,
where $X = Z2\alpha/2 \times p \times (1 - p) / MOE2$; N is the population size, which is 24,968 (the total number of students admitted to Jazan University in 2021); p is the response distribution, assumed to be 50%; $Z\alpha/2$ is the critical value at a 5% level of significance, equal to 1.96; and MOE is the margin of error, set at 4%.

2.5. Statistical Analysis

Dietary patterns were derived from FFQ data. Reliability coefficient Cronbach's alpha index for internal consistency was computed 0.84 of the data. Factor analysis was employed to identify food patterns, considering 103 FFQ food items categorized into 18 food groups based on their nutritional characteristics (Supplementary Table S1). The Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test of sphericity were calculated to assess the suitability of the factor analysis for the dataset. Principal component analysis was then used to reduce the food groups to factors by applying an orthogonal varimax rotation to facilitate the interpretability [25] of the derived factors. Considering an eigenvalue greater than 1.1 on the scree plot, the explained variance proportion of each factor.

Four dietary patterns (DP) were identified, the first western pattern includes fried foods, drinks and juices, soda drinks, cake/biscuits/sweets, salty snacks/chips and pastries/pizza. The second traditional pattern includes milk/milk products, breakfast cereal, rice/pasta/potatoes, traditional foods. The third prudent pattern, which includes vegetables, legumes, nuts and fruits and lastly the fourth high protein / high fat pattern includes meat & chicken, processed meat, fish and sea foods and egg [26]. A factor loading threshold of 0.30 was set to determine significant food groups within a pattern. Data processing, validation, and analysis were performed using IBM SPSS software, version 27.0 for Windows (IBM, Chicago, IL). Graphical plots were generated using R software (version 4.1.2) incorporating the psych and ggplot2 packages. Regression analysis was applied to investigate the association between BMI and dietary patterns, adjusting for potential confounders including age, residence, marital status and income level. Additionally, generalized additive models (GAMs) were used to produce smooth curves illustrating the relationship between dietary patterns and BMI. Statistical significance was defined as a two-tailed P-value < 0.05.

2.6. Ethical consideration

Ethical issues were addressed in accordance with the guidelines of the Declaration of Helsinki and the Saudi Bioethics standards. Informed consent was obtained and assured that the collected data would be keep confidentially. Ethical clearance for this study was granted by the Standing Committee for Scientific Research of Jazan University (REC-44/06/471).

3. Results

3.1. General Background Characteristics of the Study Population

This study was conducted with 600 university students between January and June 2023. Females comprised 42.5% of the participants, with a mean age of 22.69 ± 3.53 years. The vast majority of the participants were single, three-quarters resided in ur-ban areas, and most earned less than 4,000 Saudi Riyals (approximately USD 1,000). The mean BMI of the participants was 22.61 ± 5.27 [Table-1].

Characteristics	Frequency (%)
Age in years (Mean ± SD) (22.69 ± 3.53)	
Gender	
Male	345 (57.5%)
Female	255 (42.5%)
Residence	
Urban	452 (75.3%)
Rural	148 (24.7%)
Marital status	
Single	525 (87.5%)
Married	70 (11.7%)
Divorced	5 (0.8%)
Monthly income (SAR)	
<4.000	459 (76.5%)
4.000-10.000	103 (17.2%)
>10.000	38 (6.3%)

BMI (Mean ± SD) (22.61 ± 5.27)

Table 1: Background characteristics of study participants n=600.

3.2. Body Mass Index by Gender

Figure-1 presents a boxplot illustrating the distribution of BMI by sex, with the Wilcoxon signed-rank test used to assess this association. There was a highly significant difference ($P < 0.01$), with male students displaying a higher BMI.

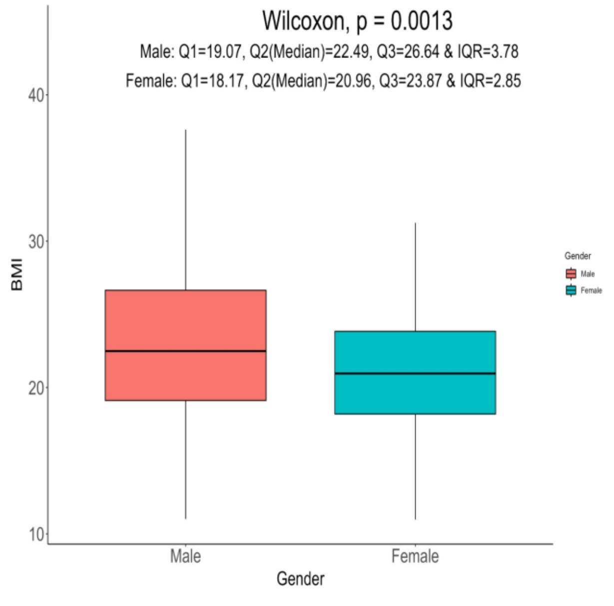

Figure 1: Body mass index distribution by gender.

3.3. Dietary Patterns by Principal Components Analysis

Among Saudi students, four major dietary patterns were identified through factor analysis and named based on their food composition and characteristics: Western, tra-ditional, prudent, and high-protein/high-fat. Collectively, the model explains 59.419% of the total variance. The Western food pattern, which accounted for 20.114% of the variance, was characterized by high factor loadings for fast food, fried food, snacks, soda drinks, and sweets. The traditional food pattern accounted for 18.058%, and in-cluded milk and milk products, breakfast cereal, rice, pasta, potatoes, and traditional foods. The prudent food pattern, accounting for 12.186%, consisted of fruits, legumes, vegetables, and nuts. Lastly, the high-protein/high-fat food pattern explained 9.061% of the variance and comprised meat, chicken, fish and seafood, eggs, and processed meat [Table-2].

Food groups	Components or dietary pattern			
	Western	Traditional	Prudent	High-protein/high-fat
Fried foods	.738			
Drinks and Juices	.574			
Soda drinks	.742			
Cake, Biscuits, Sweets	.741			
Salty snacks and chips	.738			
Pastries and Pizza	.633			
Milk and Milk products		.592		
Breakfast cereal		.744		
Rice/Pasta/Potatoes		.675		
Traditional foods		.603		
Vegetable (fresh & cooked)			.500	
Legumes			.483	
Nuts			.719	
Fruits			.743	
Meats and Chicken				.325
Processed meat				.784
Fish and seafood				.670
Egg				.311
% Explained Variance	20.114	18.058	12.186	9.061
% Cumulative Variance	20.114	38.172	50.358	59.419

Extraction Method: Principal Component Analysis, Rotation Method: Varimax with Kaiser Normalization.

Table 2: Foods group factor loadings for the four dietary patterns.

3.4. Association between BMI and background characteristics

The overall prevalence rates of overweight and obesity were 15.8% and 11.2%, respectively. Overweight and obesity were significantly more prevalent among males than females (18.3% and 12.5% vs. 13.9% and 7.5%, respectively; $P < 0.01$). The prevalence of underweight and normal weight was 24% and 49%, respectively. Regarding marital status, overweight was significantly more prevalent among married males than females (28.6% vs. 12.9%), whereas obesity was the same among them (20%, $P < 0.05$) [Table-3].

Characteristics	Underweight 144 (24%)	Normal weight 294 (49%)	Overweight 95 (15.8%)	Obesity 67 (11.2%)	¥P-value
Gender					
Male	75 (21.7%)	159 (46.1%)	63 (18.3%)	48 (13.9%)	0.009*
Female	69 (27.1%)	135 (52.9%)	32 (12.5%)	19 (7.5%)	
Residence					
Urban	113 (25.0%)	219 (48.5%)	74 (16.4%)	46 (10.2%%)	0.420
Rural	31 (20.9%)	75 (50.7%)	21 (14.2%)	21 (14.2%)	
Marital status					
Single	136 (25.9%)	258 (49.1%)	74 (14.1%)	57 (10.9%)	0.016*
Married	8 (11.4%)	33 (47.1%)	20 (28.6%)	9 (12.9%)	
Divorced	0 (0.0%)	3 (60.0%)	1 (20%)	1 (20%)	
Monthly income (SAR)					
<4.000	117 (25.5%)	224 (48.8%)	70 (15.3%)	48 (10.5%)	0.415
4.000-10.000	20 (19.4%)	50 (48.5%)	21 (20.4%)	12 (11.7%)	
>10.000	7 (18.4%)	20 (52.6%)	4 (10.5%)	7 (18.4%)	

¥Chi square test p-value, *Significant

Table 3: Association between BMI and background characteristics.

3.5. Association Between Dietary Patterns and BMI

Regression analysis (Table-4), after adjust the confounding factors age, residence, marital status and income levels demonstrated that the male and female had same type of association between BMI and the identified four dietary patterns. BMI positively associated with western (β: 0.94, 95% CI: 0.54-1.34, highly significant: P<0.01), traditional (β: 0.37, 95% CI: -0.05-0.80) and high protein / high fat (β: 0.42, 95% CI: -0.01-0.84) dietary pattern whereas with prudent dietary pattern negatively associated (β: -0.44, 95% CI: -0.90—0.02).

DP	Male	Female	All
	β (95% Confidence Interval)		
Western	1.02 (0.51-1.52) **	0.69 (0.05-1.33) *	0.94 (0.54-1.34) **
Traditional	0.89 (0.33-1.46) **	-0.35 (-0.97-0.26)	0.37 (-0.05-0.80)
Prudent	-0.80 (-1.42- -0.20) **	0.34 (-0.35-1.03)	-0.44 (-0.90-0.02)
High protein/ High fat	0.13 (-0.42-0.69)	0.41 (-0.33-1.16)	0.42 (-0.01-0.84)

Regression analysis, where dependant variable Body Mass Index (BMI) and independent variables: Western, Traditional, Prudent and High protein/ High fat dietary patterns. *P<0.05 (significant) and **P<0.01 (highly significant).

Table 4: Regression analysis of dietary patterns association with BMI

Figure 2 uses smoothing splines to visually illustrate the relationships between BMI and dietary patterns, employing the GAM with BMI as the response variable. The results indicated a statistically significant association between the Western dietary pattern and BMI (R2 = 0.035, P < 0.01).

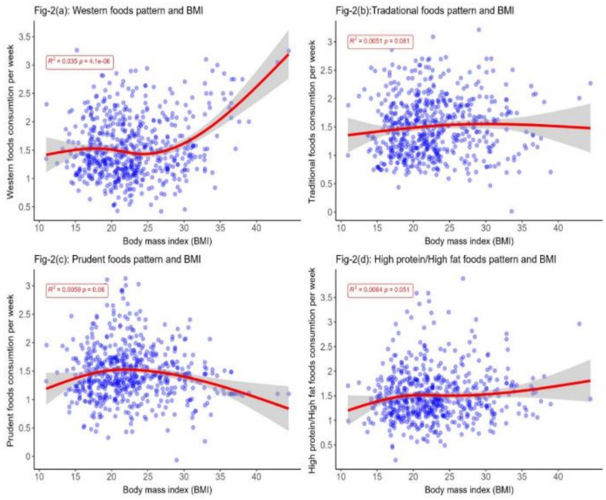

Figure 2: Association between dietary patterns and body mass index.

4. Discussion

The current study is among the first within the region to delineate dietary patterns and their associations with overweight/obesity. We identified four distinct patterns: Western, traditional, prudent, and high-protein/high-fat food patterns. Notably, the Western pattern was significantly positively associated with overweight/obesity, whereas the prudent pattern was associated with significantly lower odds of over-weight/obesity.

Our research uncovered notable insights into the prevalence of obesity in our study population. We observed that the prevalence of obesity was 13.9% among males and 7.5% among females. These figures are markedly lower than the national averages reported in a recent study [27], which indicated obesity rates of 23.1% for males and 24.2% for females. Our results are in stark contrast to the considerably higher rates re-ported in the 2005 Saudi STEPwise survey, which found obesity rates of 43.8% for males and 28% for females in the general population.

However, our findings are more aligned with those of the STEPwise survey when considering age-specific trends that match our study's average participant age of ap-proximately 22.69 years. For a similar age group, the STEPwise survey reported obesity rates of 19.6% for males and 17.8% for females. When examining the prevalence among Saudi students, as reported by Syed in 2020, the rates were slightly higher at 15.7% for males and 14.8% for females [28].

Within the broader context of the Eastern Mediterranean Region, the obesity rates observed in our study are consistent with those reported among university students in Pakistan, which were 15.7% [29]. However, they were significantly higher than those seen among Sudanese medical students, which were reported to be 6.5% [30]. It is also noteworthy that our study highlighted a considerable prevalence of underweight individuals, recorded at 24%, which exceeded the prevalence found among Sudanese stu-dents, reported at 13% [30]. Additionally, a literature review on gender differences in these rates yielded mixed results.

Regarding the dietary patterns identified in our study, the constituent food items largely aligned with those documented in the existing literature. Western dietary pat-terns are typically associated with animal-source foods, including red and processed meats, refined grains, and items high in fat, sugar, and salt [31,32]. In this study, this pattern was characterized by the intake of fried foods, soda and sugary drinks, cakes, biscuits, sweets, pastries, pizzas, and salty snacks such as chips. Notably, protein-rich items, such as red or processed meats and fish, were particularly pertinent to the "protein pattern," aligning with its descriptive name. The occurrence of overlapping elements across these dietary patterns is a recognized phenomenon that has also been documented in literature [33].

A prudent dietary pattern is commonly characterized by a high intake of fruits, vegetables, legumes, and nuts [16,31,33,34]. This is consistent with our findings and the WHO recommendations for a healthy diet [14]. Additional components often associated with this pattern include olive oil and poultry [16,33]. Notably, although fish and seafood are frequently included within the prudent pattern [31], in our study, these items were more significantly aligned with the protein pattern because of their higher factor loadings and relevance.

As previously mentioned, the protein pattern predominantly consists of red meat, processed meat, fish, and seafood, which aligns with the findings of Gutiérrez-Pliego et al. [33].

The traditional pattern observed in our study encompasses local dishes (e.g., Kabsa and Gareesh), breakfast cereals, and staples such as rice, pasta, potatoes, milk, and dairy products. This pattern reflects the dietary customs prevalent in particular geographical regions shaped by a complex interplay of environmental, economic, and cultural factors [22,35]. Such patterns are deeply rooted in the local context; hence, their generalization beyond the studied regions can be challenging. For a comprehensive list of the food items categorized within each dietary pattern, refer to Supplementary Table S1, and for a visual representation, see Supplementary Figure S1.

The relationship between dietary patterns and weight status is crucial for under-standing the health outcomes. Certain patterns were associated with varying tendencies toward weight fluctuations. Notably, Western and prudent dietary patterns exhibited divergent effects on BMI. The Western pattern correlates with an increased BMI, a finding reported by other researchers [32]. In contrast, the prudent pattern is significantly linked to reduced odds of being overweight or obese, supporting the findings of Eng et al.[36]. They observed that a Western dietary pattern elevated the risk of be-coming overweight or obese, whereas a prudent dietary pattern mitigated this risk. Similarly, Schulze et al.[34] identified a correlation between weight gain and the adop-tion of a Western dietary pattern, whereas a prudent dietary pattern was associated with weight maintenance. The global increase in obesity rates has been attributed to a dietary shift toward higher fat content, greater consumption of animal-based products, and calorie-dense sweeteners coupled with diminished physical activity [32]. In Korea, efforts to promote traditional dietary patterns and reduce fat-derived caloric intake have shown success in decreasing the obesity prevalence [37]. Western and prudent patterns have also been documented to exert similar yet opposing effects on coronary heart disease risk [31]. Osler et al. [38] found that adherence to a prudent diet is inversely related to all-cause and cardiovascular mortality.

The study population comprised of university students may not fully reflect the demographic diversity of the general population. Consequently, the findings of the study may have limited applicability outside of this demographic group. Further large sample study settings are intended to cover the whole nation.

Conclusions

The current study identified four distinct dietary patterns among Saudi university students: western, prudent, traditional, and high-protein/high-fat. Notably, a Western diet is significantly correlated with an increased likelihood of obesity, underscoring the critical need for dietary awareness and intervention. Conversely, evidence indicates that adherence to prudent dietary patterns could lower the risk of obesity. These find-ings support the promotion of a prudent diet as a strategy to reduce the prevalence of obesity within the studied demographic group.

Supplementary Materials: The following supporting information can be downloaded at: www.mdpi.com/xxx/s1, Figure S1: Average Consumption of Food Items per week; Table S1: Common Saudi Arabia Food Items.

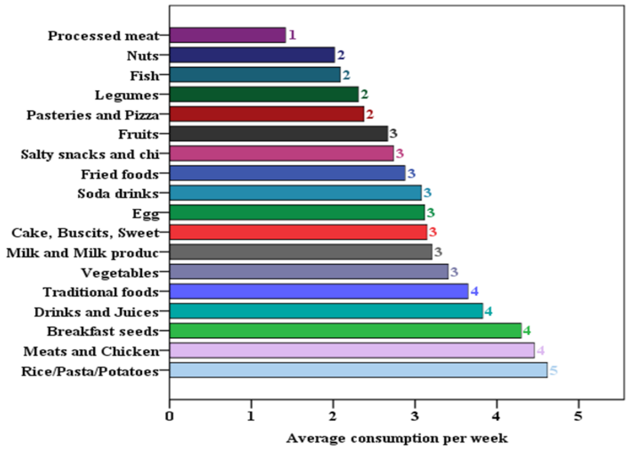

Figure S1. Average Consumption of Food Items per week.

Sl. No	Food Group	Food Items
1	Fried foods	Fast foods (all types), mayonnaise, salad dressing
2	Drinks and juices	Juices (all types), coffee, tea, Arabic coffee
3	Soda drinks	Soft drinks, energy drinks.
4	Cake, biscuits, sweets	Cake, biscuits (all types), pancakes, waffles, honey, jam, cream, caramel, Arabic desserts, maamool dates, cinnamon, doughnut, ice cream, chocolate
5	Salty snacks and chips	Crackers, chips (all types), popcorn
6	Pastries and pizza	Pizza, sambosa, fatayer, croissants
7	Milk and milk products	Milk, yogurt, cheese (all types), labenah, laban
8	Breakfast seeds	Bread (all types), shaborah, cornflakes, breakfast
9	Rice, pasta, potato	Rice (all types), pasta (all types), potatoes (all types)
10	Tradition foods	Kabsa, gareesh, haress, qursan, mashghotha, areka, manto, yagmush, maasoob, mohala, aseedatamerr-gareesh soup
11	Vegetables (fresh and cooked)	Tomatoes, onion, cucumber, carrot, cauliflower, lettuce, watercress, celery, cabbage, cooked mixed vegetables, cooked pumpkin, cooked okra, cooked peas, cooked green beans, cooked molokhiyah, cooked spinach, vegetable soup
12	Legumes	Lentils, chickpeas, beans, peas soup, soy products

13	Nuts	Nuts (all types)
14	Fruits	Melon, watermelon, apple, orange, mandarin, banana, grapes, pears, apricot, peach, strawberry, dates, dried fruit
15	Meats and chicken	Chicken (all types), beef (all types), lamb, goat, camel
16	Processed meat	Sausage, hot dogs, pepperoni, martedella
17	Fish and seafood	Fried fish, grilled fish, tuna (all types), seafood, shrimp
18	Eggs	Eggs (all types)

Foods consumed by study participants were categorized into 18 food groups. *Food intake data were collected using a 103-item semi-quantitative Food Frequency Questionnaire.

Table S1. Common Saudi Arabia Food Items.

Author Contributions: R.M.C, conceptualization, methodology, project administration, formal analysis; F.A.E, conceptualization, validation, supervision; H.E.K, investigation, validation; A.A.A., supervision, validation; F.M.A, K.M.D, R.O.H, N.M.H, N.H.A, and H.M.H, data curation, writing-original draft preparation; R.M.C, F.A.E, H.E.K, A.A.A, writing-original draft preparation, review & editing. All authors have read and agreed to the published version of the manuscript.

Institutional Review Board Statement: The study was conducted in accordance with the Declaration of Helsinki and the Saudi Bioethics standards. Ethical clearance for this study was granted by the Standing Committee for Scientific Research of Jazan University (REC-44/06/471).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The datasets generated and/or analyzed during the current study are not publicly available. However, they can be obtained from the corresponding author upon request.

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Conflicts of Interest: Authors declare that they have no conflicts of interest.

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