ISSN: 2457-0400

Impact Factor: 7.675

WORLD JOURNAL OF ADVANCE HEALTHCARE RESEARCH

www.wjahr.com

Volume: 10, Issue: 8

Page N. 303-319

Year: 2026

Original Article

Coden USA: WJAMA3

ASSESSING DIETARY HABITS AMONG PREPARATORY SCHOOL STUDENTS IN KARBALA CITY / 2025

Hibba Essa Umran[1]*, Prof. Dr. Ali Abdulridha Abutiheen[2], Dr. Manal Ali Hasan[3]

[1]M.B.CH.B.
[2]Consultant Family Physician M.B.Ch.B, F.I.B.M.S (FM)
[3]Consultant Family Physician M.B.Ch.B, F.I.B.M.S (FM).

Article Received: 04 July 2026 **Article Revised: 24 July 2026** **Article Published: 01 August 2026**

***Corresponding Author: Hibba Essa Umran**

M.B.CH.B.

DOI: https://doi.org/10.5281/zenodo.21713724

How to cite this Article: Hibba Essa Umran[1]*, Prof. Dr. Ali Abdulridha Abutiheen[2], Dr. Manal Ali Hasan[3] (2026). Assessing Dietary Habits Among Preparatory School Students In Karbala City / 2025. World Journal of Advance Healthcare Research, 10(8), 303–319.

ABSTRACT

Introduction: Adolescents face growing global health risks from unhealthy eating behaviors, and Iraq is no exception. Years of conflict, economic pressures, and social change have altered the diets of Iraqi teenagers, leading to both undernutrition and rising levels of overweight and obesity. However, limited studies have examined these trends in stable urban areas. This study assessed the dietary habits and nutritional status of secondary preparatory school students in Karbala City and explored their associations with lifestyle factors. **Method:** A school-based cross-sectional descriptive and analytical study was conducted from 8 April to 30 May 2025 in governmental secondary preparatory schools for males and females. A culturally adapted, self-administered questionnaire based on FAO guidelines was used to evaluate dietary habits, meal patterns, physical activity, and related behaviors. Height and weight were measured using WHO-standardized procedures, and BMI-for-age was classified using WHO growth charts. **Results:** Of 600 distributed questionnaires, 493 students (53.8% male, 46.2% female; aged 16–19 years) participated. BMI results showed 20.3% underweight, 65.1% normal weight, 7.7% overweight and 6.9% obese. High consumption of white bread, snacks, and caffeinated drinks was common, while nutrient-dense foods such as fish and whole grains were rarely consumed. Breakfast skipping, inadequate water intake—especially among females—and high screen time were also prominent. Physical inactivity showed a strong relationship with obesity ($p<0.001$). **Conclusion:** The study highlights concerning dietary and lifestyle patterns among adolescents in Karbala. Comprehensive, culturally appropriate school-based nutrition programs and supportive policies are urgently needed to improve adolescent health in Iraq.

KEYWORDS: unhealthy eating behaviors, Dietary Habits, Preparatory School, Iraq, Karbala City.

INTRODUCTION

In the Middle East and North Africa (MENA) region, economic change and western food trends have altered how teens eat.[1] Over a quarter of adolescents are overweight or obese, and many suffer from both over nutrition and undernutrition.[1] Fast food is especially popular. In Saudi Arabia, 85% of teens prefer it to home meals.[13], and similar patterns are seen across the Gulf.[14] Traditional diets are being replaced with fast food, even among second-generation immigrants, who tend to adopt these eating habits more than their parents.[4]

Economic hardship also affects food choices. In Lebanon, teens in poor households eat cheaper, processed foods and less fresh produce.[4] Gulf lifestyle changes—like screen time, late sleep, and limited physical activity—further contribute to unhealthy eating.[16]

Iraq faces complex nutritional challenges. Decades of war, economic trouble, and social change have left a deep impact on adolescent diets. Studies show that both underweight and overweight conditions are common

among Iraqi teens, with many suffering from meal skipping and high fast food intake.[17]

Urban teens eat more processed food than those in rural areas. In cities like Baghdad, up to 80% of teens consume processed food frequently, nearly twice the rate of rural areas.[15] This urban diet shift has raised obesity rates while undernutrition remains an issue in poor or conflict-affected areas.[4]

Conflict has damaged food systems and stunted growth among children exposed to violence.[13] Economic inequality also influences diet. In Sulaimani, private school students eat more meat and fast food, while public school students consume more dairy.[18]

Since 2003, Westernized diets have become more common. Around 94% of female teens report eating fast food regularly, and 80% snack between meals.[17] Traditional meal structures have broken down, with many skipping meals, especially underweight adolescents'.[17]

Food insecurity remains a major concern. Years of conflict reduced food production and access. Many families now rely on what's available rather than what's nutritious.[13] Still, traditional Iraqi families retain influence, as studies show that supportive parenting habits help guide teen eating behaviors.[19]

However, Iraqi schools lack strong nutrition education. Most programs focus on food science, not public health or behavior.[20]

Globally, poor eating habits among teens are widespread. About 79% don't eat enough fruits and vegetables, and 50% eat fast food regularly.[21] Many teens show patterns of multiple risky behaviors—like skipping breakfast and drinking sugary drinks. Studies show that some adolescent groups have unhealthy diet rates close to 100%.[22] In South Asia, teens face both stunting and obesity. Risk factors include peer pressure, social media, and low family income. Studies from Korea link food-related social media exposure to higher fast food and sugary drink intake.[23] Girls tend to show more unhealthy habits than boys, and teens in wealthier nations consume more calorie-dense foods. These patterns underscore the global scale of the problem and the need for context-specific solutions.[24]

In Iraq, little research has explored why adolescents eat the way they do. Most studies focus on malnutrition linked to war and poverty, ignoring the growing trend of fast food and processed meals in stable urban areas. As traditional diets give way to modern eating shaped by media, busy lifestyles, and global trends, this shift remains poorly understood.

This study aims to assess dietary habits among preparatory school students in Karbala City, Iraq, estimate the proportion of Obesity, Over-weight, Under-weight and Normal weight in the sample, examine associations between dietary patterns, lifestyle factors, and nutritional status and to address the problems of and the strategies needed to improve dietary habits among the adolescent in Karbala city and Iraq in general.

PATIENTS AND METHODS

A cross-sectional descriptive and analytical study was carried out between 8th of April to 30th of May, 2025. The study was conducted in governmental secondary schools located within the central district of Karbala City, Iraq. School selection was carried out by the Directorate of Education of Karbala City with two male and two female schools, following an official task facilitation letter issued by the Arab Board for Health Specialties in support of this research project.

From the selected schools, classes were chosen through a simple random sampling method selected by consecutively picking available classes until the target sample size was achieved. All students enrolled in the selected classes were invited to participate in the study, except those who met the predefined exclusion criteria.

The names of the participating schools are listed below.
The Elite (Al-Nukba) Secondary School for Boys, Karbala
Abu Al-Maali Secondary School for Boys
Karbala Girls' Secondary School
Al-Najah Secondary School for Girls

The Sample size of this study was (600) students. This size was calculated using the Cochran's formula (**n = (Z^2 * p * (1-p)) / e^2**) for proportions with a 95% confidence level, a 5% margin of error, and an assumed response distribution of 50% to ensure maximum variability (p = 0.50). The base sample size was then adjusted using a finite population correction (FPC), based on the total number of students enrolled in preparatory schools in Karbala Governorate, which was obtained from the most recent official statistics taken from the School health department, Public health Division of Karbala Health Directorate in Kerbala city, this total population size was equal to (n = 26,540).

Accordingly, the sample size in this study (n = 379) was determined based on the previously mentioned statistical formula, taking into account the confidence level and margin of error, in order to ensure that the selected sample is representative of the target population.

To account for the potential of a low response rate and to enhance the accuracy and reliability of the study findings, the sample size was increased from 379 to 600 students of both sexes.

With this sample size (n = 600), a total of 493 responses from the distributed questionnaires were received which represent the study sample, with a response rate of

82.2%. A total of 107 questionnaires were excluded for the following reasons: non-returned or lost forms (n=105) and age outside the study criteria (n=2). This 82.2% response rate exceeds the generally acceptable range of 60–70% for cross-sectional studies conducted in school settings.[2]

The study included preparatory school students aged 16–19 years in Karbala City who agreed to participate and finished their questionnaires responses. Students were excluded if they declined participation, declared that they had medical conditions requiring special dietary restrictions (e.g., diabetes, celiac disease, or metabolic disorders), for the girls; if they are pregnant, return incomplete data and were outside the target age range.

Ethical approval for the study was obtained from the Arab Board for Health Specialties in Iraq and the Karbala Education Directorate. Additional permission was granted by school managers and teaching staff. Students provided verbal consent after a brief explanation of the study's purpose, procedures, and the process of completing the questionnaire and measuring height and weight. Confidentiality was ensured by keeping all responses anonymous and not recording student names. Participation was fully voluntary, and students were informed that they could withdraw at any time without consequences, which may explain the high number of lost questionnaires.

Data collection took place from the 8th of April to the 30th of May, 2025. During this period, the researcher conducted multiple visits to randomly selected governmental secondary preparatory schools located in central Karbala which was selected using the two-stage cluster sampling method as stated earlier.

At each visit, students were briefly introduced to the study in clear Arabic. The explanation outlined the study's purpose and provided instructions for completing the questionnaire and answering any questions raised by the participants. Immediately afterward, questionnaires were distributed at the start of the class.

Students who agreed to participate had their height and weight measured individually by the researcher before completing the questionnaire using calibrated digital scale and stadiometers with a fixed vertical board and movable headpiece. These measurements were performed privately and respectfully, in accordance with local cultural norms, behind a curtain or in another room according the school.

To protect confidentiality and reduce response bias, students filled out the questionnaire independently and without any supervision. They were instructed to fold their completed forms before submission to ensure their answers remained private. School staff assisted in coordinating the forms collecting process but did not review them. The collection was made by asking the students to put their forms inside a box privately (similar to the ballot box). All questionnaires were returned directly to the researcher for verification and later analysis.

The questionnaire used in this study was a structured, self-administered form written in Standard Arabic and adapted to reflect the cultural and dietary context of the Iraqi adolescents. It was developed using core tools and templates from the Food and Agriculture Organization's (FAO) 2018 resource guide.[3]

Key elements—such as food frequency sections, behavioral assessments, and consumption categories—were based on validated models from that guide. The questionnaire was tailored to align with the local food environment, school culture, and eating behaviors of preparatory students in Karbala.

In this study, students' daily water intake was assessed through a self-reported frequency-based system. Participants were asked to select from five predefined categories: "rarely except when thirsty," "1–2 glasses per day," "3–4 glasses per day," "5–6 glasses per day," or "7 or more glasses per day." This approach was intentionally chosen over asking for exact volumes in milliliters, as many students (and even adults) may struggle to recall or estimate their daily fluid consumption accurately.

Using this simplified classification ensures greater feasibility and reliability in a school setting, where time and comprehension can be limited. The aim was not to obtain precise quantitative intake, but rather to provide a general indication of hydration habits among adolescents. This method reflects recommended best practices in dietary assessment—especially in low-resource or youth-based populations—and is consistent with guidance from the Food and Agriculture Organization (FAO) and findings from validated population-based research.[4]

The final questionnaire was reviewed and accepted by experienced Specialist in this field and it was consisted of several sections, including.
Sociodemographic data.
Dietary patterns and food frequency.
Frequency of water intake.
Smoking status and Beverages consumptions.
Eating behavior and lifestyle (physical activity, screen time).
Perceived barriers and factors supporting healthy eating.
Anthropometric data.

Height and weight were measured by the researcher using standardized WHO protocols for field studies involving adolescent.[25] The same calibrated equipment and procedures were used in all schools to ensure consistency.

Weight was measured with a digital scale named ***Etekcity Digital Body Weight Bathroom Scale*** with precision = 0.1 kg. Students removed shoes and heavy outerwear, and the scale was placed on a hard, level surface.

Height was measured using a portable stadiometer (precision: 0.1 cm). Students stood barefoot, with heels together and heads aligned to the Frankfurt Horizontal Plane (a line drawn between the inferior orbital rim and the supratragal notch; the tragion).[26] to ensure neutral head position, while the headpiece was gently lowered to the top of the head.

All measurements were taken in isolated corner or behind a curtain where feasible and recorded immediately on each student's data questionnaire.

All the above measurements were performed in accordance with WHO protocols.[27]

Anthropometric data for each participant, including weight (in kilograms) and height (in meters), were entered into SPSS for analysis. The Body Mass Index (BMI) was first calculated for each student using the formula.
BMI = weight (kg) / [height (m)] ²

To ensure accurate analysis, all measurements were checked for completeness and consistency prior to calculation.

To account for differences in age and sex which is because body composition is different with age and sex, BMI values were then compared to international references using the WHO growth charts for school-aged children and adolescents (5–19 years).[9] These charts rely on the LMS method (Lambda-Mu-Sigma).[10], which summarizes the distribution of BMI by age and sex using three parameters.
L (Lambda): adjusts for the skewness in the distribution,
M (Mu): represents the median BMI value for each age and sex,
S (Sigma): represents the coefficient of variation.[11]

The LMS method enables calculation of z-scores and percentiles for each individual's BMI, allowing for accurate categorization of nutritional status. To perform this calculation, the official WHO SPSS macro files were used in this study named (WHO 2007 macro).[52] The macro was used in the SPSS to apply the LMS parameters to each student's BMI, age in months, and sex, producing standardized z-scores and percentiles for BMI-for-age.

All students were then classified based on **WHO** recommended BMI-for-age percentile in (5-19 years old persons) cut-offs.[14]
Underweight: <5th percentile
Normal weight: 5th–84th percentile
Overweight: 85th–96th percentile
Obese: ≥97th percentile

Data entry (students responses and their variables-key-values) were completed and organized using Microsoft Excel 2010 and the statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) version 28. Descriptive statistics were employed to characterize the study population, including frequencies, percentages, means, and standard deviations. Cross-tabulation analyses were conducted to examine relationships between categorical variables. Chi-square tests were utilized to assess statistical associations between sociodemographic factors and eating behaviors, with p-values < 0.05 considered statistically significant. The significance level was set at $\alpha = 0.05$ for all statistical tests, consistent with standard practice in nutritional epidemiology research.[14]

A pilot study was conducted in late March 2025 to validate the questionnaire, assess logistics, and ensure the feasibility and reliability of the main study. Thirty students from two non-sample preparatory schools completed the self- administered questionnaire, with verbal consent obtained after a brief explanation. The average completion time was 27 minutes, and most students found the questionnaire clear, except for minor confusion regarding food-intake sections. Cultural barriers were noted, particularly the refusal of several girls to undergo waist-circumference measurement.

Based on feedback, ambiguous food-related terms were clarified using local examples, Arabic synonyms were added, and sections were slightly reordered for better flow. No items were removed, but waist circumference was excluded from the final study due to cultural sensitivities, leaving BMI-for-age and sex as the sole nutritional indicator.

Overall, the pilot confirmed that the questionnaire was feasible, culturally appropriate, and acceptable for use in schools, although challenges included difficulty gaining teacher approval during a busy academic period and resistance to specific anthropometric measurements.

RESULTS

The study included a sample of 493 students from preparatory school students in Karbala City. The sample had a mean age of 17 ± 0.9 years (range 16–19). Males comprised 53.8% (n=265) and females 46.2% (n=228).

Table (1): Socio-demographic Characteristics of the Study Population.

Characteristic	Variable	n	%
Age(Years)	Age Range from 16 -19 years	493	%100
Sex	Male	265	53.8%
	Female	228	46.2%
School Type	Government	493	100%
Grade Level	Fourth Preparatory (4th)	200	40.6%
	Fifth Preparatory (5th)	293	59.4%
Family Income Level	Low	15	3.0%
	Medium	258	52.3%
	Good	220	44.6%
Father Education	No formal education	29	5.9%
	Primary school	30	6.1%
	Secondary School	190	38.5%
	University or higher	244	49.5%
Mother Education	No formal education	34	6.9%
	Primary school	100	20.3%
	Secondary school	180	36.5%
	University or higher	179	36.3%
Family Status	Both Parents alive	453	91.9%
	Father deceased	10	2.0%
	Mother deceased	0	0%
	Separated	30	6.1%

The students' mean height was 165.6 ± 8.3 cm, mean weight 60.0 ± 13.4 kg, and mean BMI 21.8 ± 3.9 kg/m². By sex, BMI averaged 22.46 ± 3.1 kg/m² in males and 20.93 ± 2.8 kg/m² in females. Figure (1) presents the distribution of nutritional status (BMI-For-Age) according to the WHO percentiles.

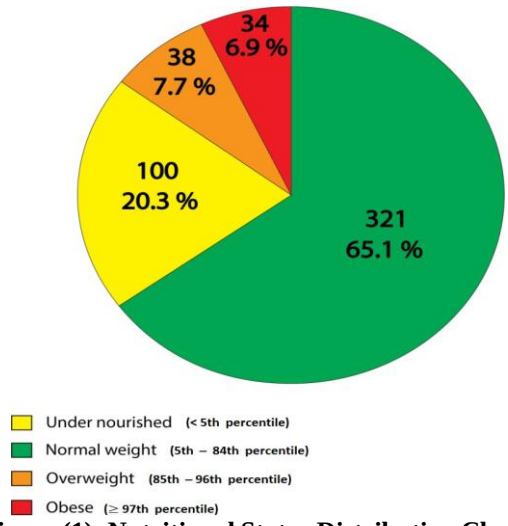

Figure (1): Nutritional Status Distribution Chart.

The mean BMI was higher in males (22.5 kg/m²) than females (20.9 kg/m²). Underweight and obesity were more prevalent among females and males respectively. Normal BMI predominated in both sexes, especially among females (68.9%).

Table (3) illustrates diverse dietary patterns among students; categorized as either high or low frequency based on how often specific foods were consumed. The most commonly consumed items were white bread, snacks, and caffeinated drinks, each reported by over 70% of students. In contrast, nutrient-rich foods such as fish, whole grains, and whole wheat bread were consumed infrequently by the majority.

Table (2): BMI-for-Age and Sex Category Distribution (WHO Percentile-Based Classification).

Parameter	Males (n=265)	Females (n=228)	Total (n=493)
BMI (kg/m²) mean ± SD	22.5±4.3	20.9±3.1	21.8±3.9
Underweight (< 5th percentile) n (%)	45 (17.0%)	55 (24.1%)	100 (20.3%)
Normal (5th – 84th percentile) n (%)	100 (20.3%)	157 (68.9%)	321 (65.1%)
Overweight (85th – 96th percentile) n (%)	28 (10.6%)	10 (4.4%)	38 (7.7%)
Obese (≥ 97th percentile) n (%)	28 (10.6%)	6 (2.6%)	34 (6.9%)

Table (3): Frequency of Food Type Consumption among Participants (n=493).

Food Type	More than once daily	Once daily	4–6 times/week	High Frequency The sum of (More than once daily) + (Once daily) + (4–6 times/week)	1-3 times /week	<1/week	Never	Low Frequency The sum of (1-3 times/week) + (<1/week) + (Never)
Fruits	7.1%	22.3%	24.1%	53.5%	21.3%	22.3%	2.8%	46.4%
Vegetables	12.2%	33.3%	15.2%	60.7%	17.0%	11.2%	11.2%	39.4%
White Bread	25.2%	46.7%	4.1%	76.0%	6.1%	7.1%	11.0%	24.2%
Whole Wheat Bread	2.8%	11.0%	3.0%	16.8%	7.1%	18.3%	57.8%	83.2%
Whole Grains	1.0%	8.7%	8.1%	17.8%	17.2%	30.4%	34.5%	82.1%
Sweets	2.8%	7.1%	5.1%	15.0%	23.3%	46.5%	15.2%	85.0%
Baked Goods	7.9%	9.1%	19.3%	36.3%	27.4%	25.2%	11.2%	63.8%
Fast Food	4.1%	11.0%	17.2%	32.3%	35.3%	28.4%	4.1%	67.8%
Dairy	11.0%	29.4%	25.4%	65.8%	15.2%	16.2%	2.8%	34.2%
Eggs	9.9%	37.3%	17.2%	64.4%	13.2%	13.2%	9.1%	35.5%
Red Meat	6.1%	24.9%	22.3%	53.3%	23.3%	16.2%	7.1%	46.6%
Fish	0.0%	0.0%	0.0%	0.0%	5.3%	47.1%	47.7 %	100%
Poultry	3.9%	23.1%	29.4%	56.4%	26.4%	15.0%	2.2%	43.6%
Snacks	23.3%	27.4%	21.1%	71.8%	14.0%	12.2%	2.0%	28.2%
Fried Food	8.1%	21.1%	23.3%	52.5%	26.4%	19.1%	2.0%	47.5%
Caffeinated Drinks	19.3%	35.1%	17.2%	71.6%	13.2%	12.2%	3.0%	28.4%
Ice Cream	8.1%	17.0%	26.4%	51.5%	25.2%	16.2%	7.1%	48.5%
Western Sweets	5.1%	12.2%	12.0%	29.3%	28.4%	27.2%	15.2 %	70.8%
Soft Drinks	13.2%	24.1%	17.2%	54.5%	21.3%	18.1%	6.1%	45.5%

Water intake showed significant gender differences. Males were more likely to consume 7+ cups daily, while females more commonly drank only when thirsty. These differences were statistically significant ($p < 0.001$), indicating poorer hydration habits among females.

Table (4): Water intake by sex.

Water Intake Response	Male (n, %)	Female (n, %)	P-Value
+7 cups per day	53 (20.0%)	15 (6.6%)	< 0.001
5-6 cups per day	19 (7.2%)	6 (2.6%)	< 0.05
3-4 cups per day	89 (33.6%)	95 (41.7%)	0.079
1-2 cups per day	53 (20.0%)	32 (14.0%)	0.103
Only when thirsty	51 (19.2%)	80 (35.1%)	< 0.001
TOTAL	265 (100.0%)	228 (100.0%)	< 0.001

Table (5) shows that the majority of students reported consuming three meals per day (48.5%, n = 239). However, breakfast habits were concerning, as 31.2% (n = 154) rarely or never ate breakfast. Meal skipping was also common, with 39.6% (n = 195) skipping meals one to two times per week.

Table (5): Meals and Eating Characteristics.

Variable	Choice	n	%
Meal Characteristics			
Meals Per Day	One meal	20	4.1%
	Two meals	189	38.3%
	Three meals	239	48.5%
	More than three meals	45	9.1%
Breakfast Frequency	Rarely or never	154	31.2%
	1-2 times per week	90	18.3%
	3-4 times per week	119	24.1%
	Daily	130	26.4%
Skip Meals	Never	65	13.2%
	1-2 times per week	195	39.6%
	3-4 times per week	129	26.2%
	+5 times per week	104	21.1%

Main Meal Time	Morning	95	19.3%
	Noon	319	64.7%
	Before midnight	44	8.9%
	After midnight	35	7.1%
Eating Behavior			
Eating Out Frequency	Daily	30	6.1%
	4-6 times per week	60	12.2%
	1-3 times per week	160	32.5%
	Less than once per week	208	42.2%
	Never	35	7.1%
Eating While Using Devices	Always	134	27.2%
	Often	115	23.3%
	Sometimes	150	30.4%
	Rarely	89	18.1%
	Never	5	1.0%
Eat Until Full	Always	90	18.3%
	Often	174	35.3%
	Sometimes	140	28.4%
	Rarely	65	13.2%
	Never	24	4.9%

Smoking was generally uncommon, with 87.0% of students reporting they had never smoked. The most used tobacco product was cigarettes (7.7%), followed by electronic cigarettes and hookah (both 2.6%).

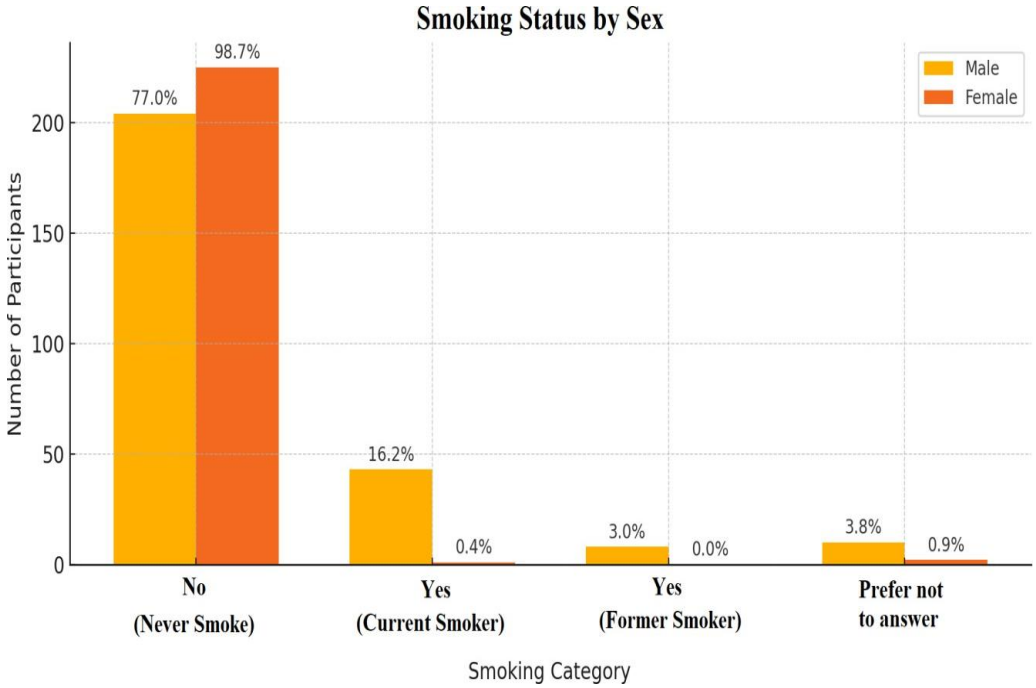

Figure (2): Smoking Characteristics in both Sexes.

Tea was the most frequently consumed beverage (78.1%), and overall, 77% of students reported regular caffeine intake. Males consumed more coffee and tea, while females preferred cappuccino and cocoa.

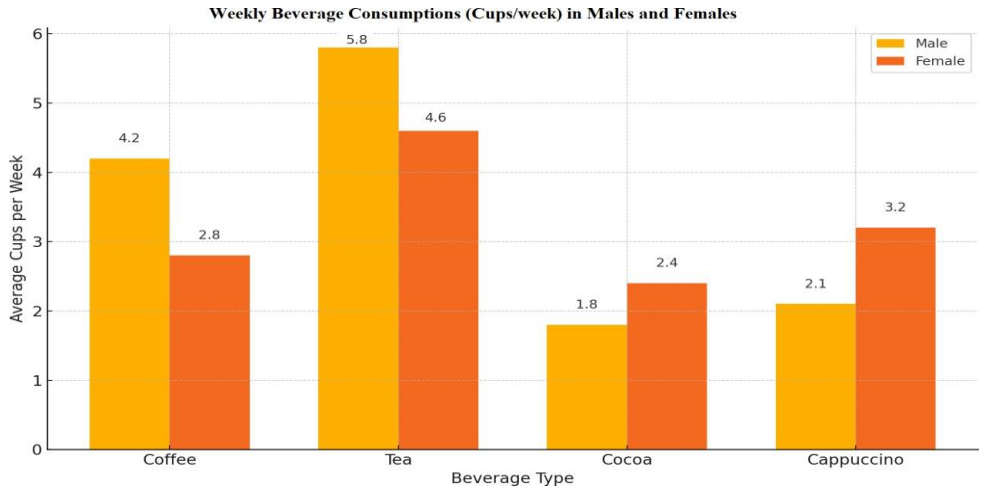

Figure 3: Beverages consumption characteristics in Both Sexes.

The most frequent obstacles to healthy eating were lack of time and taste preferences, each reported by 27.4% of students.

Statistically significant associations were found between grade level and key obstacles—especially "no time," "cost," and "taste" ($p < 0.01$).

Time constraints showed the strongest grade-related variation ($\chi^2 = 18.420$, $p < 0.001$), increasing in higher grades.

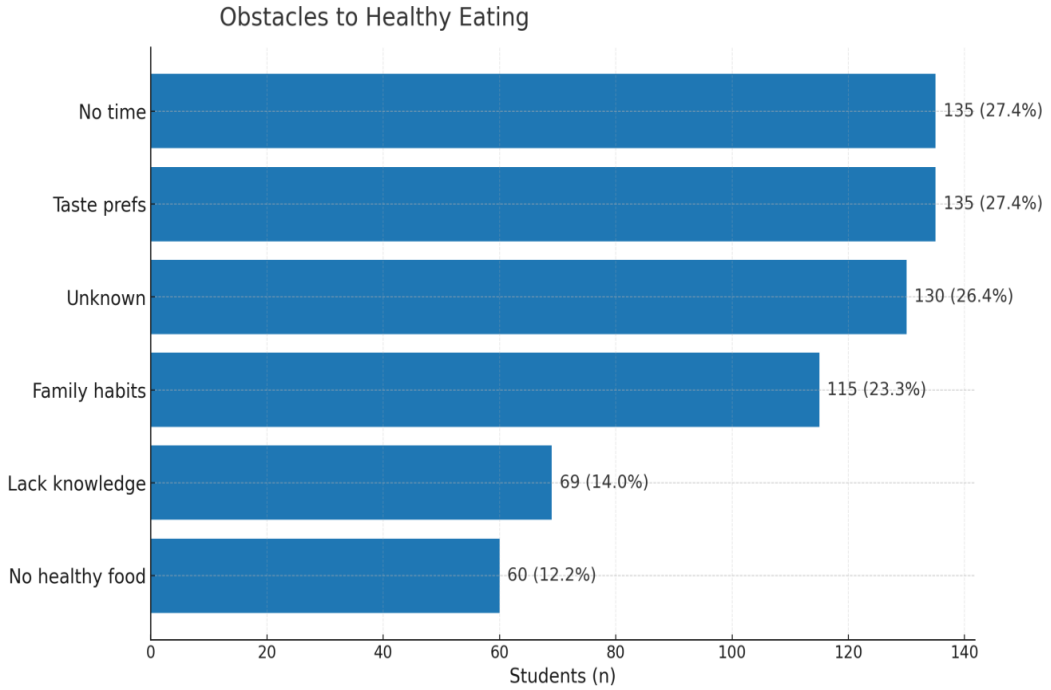

Figure (4): Obstacles to Healthy Eating (Multiple answers for each student).

Family support was the most commonly reported facilitator of healthy eating, cited by 44.2% of students.

Significant associations were found between grade level and the need for school education programs and availability of healthy food options ($p < 0.05$).

These two factors showed increasing importance in higher grades, while other helping factors showed no significant variation.

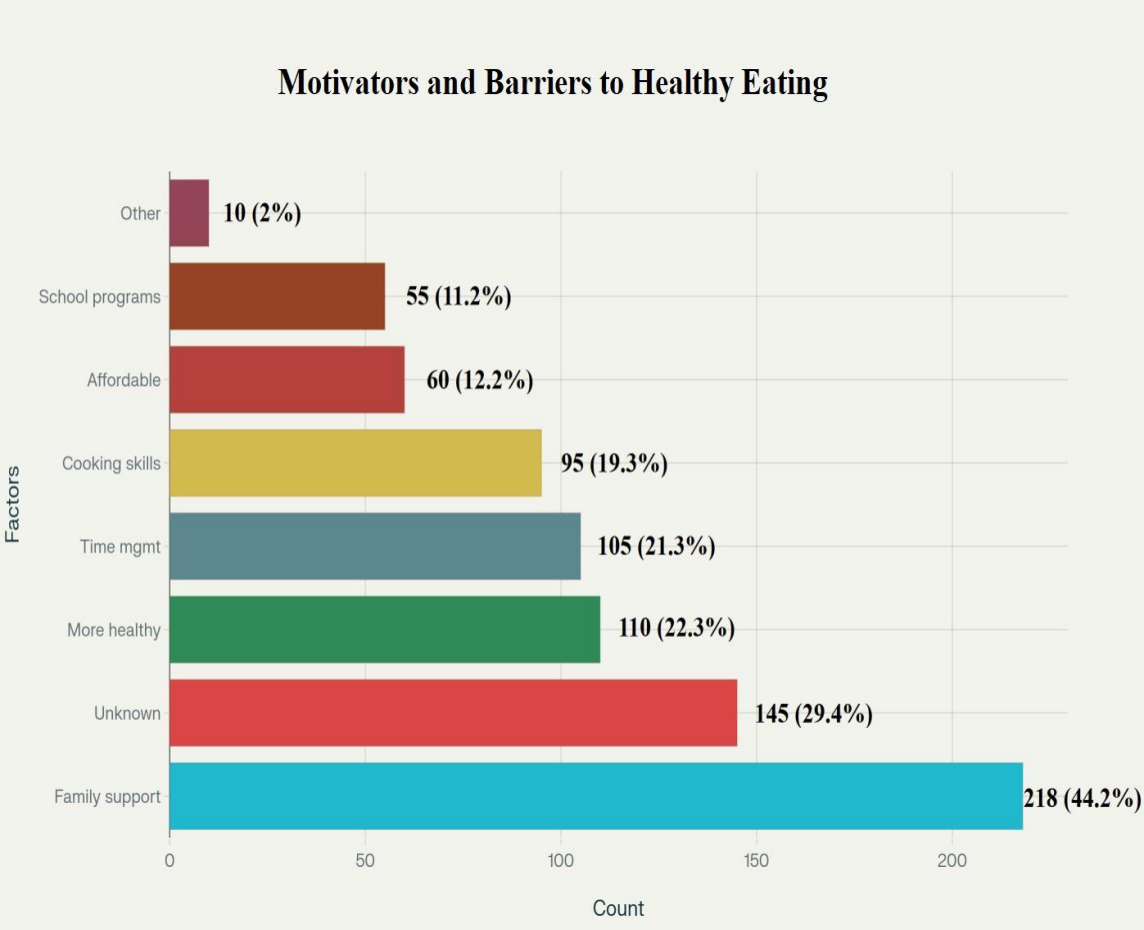

Figure (5): Motivators to Healthy Eating (Multiple answers for each student).

Sex was significantly associated with BMI, with males predominating in overweight and obese groups ($p < 0.001$). Other variables—including age, grade level, parental education, and family status—showed no statistically significant differences across BMI categories.

Table (6): Associations of Socio-demographic Characteristics with Nutritional Status

Characteristic		Nutritional Status (BMI) (n, %) for each group				P-Value
		Underweight	Normal	Overweight	Obese	
Age	Mean ± SD	17.0 ± 0.9	17.0 ± 0.9	17.1 ± 1.0	17.1 ± 1.0	0.928
Sex	Male	45 (45.0%)	164 (51.1%)	28 (73.7%)	28 (82.4%)	< 0.001
	Female	55 (55.0%)	157 (48.9%)	10 (26.3%)	6 (17.6%)	
Grade Level	4th Grade	38 (38.0%)	132 (41.1%)	15 (39.5%)	15 (44.1%)	0.690
	5th Grade	62 (62.0%)	189 (58.9%)	23 (60.61%)	19 (55.9%)	
Father Education	No formal education	7 (7.0%)	17 (5.3%)	3 (7.9%)	2 (5.9%)	0.928
	Primary School	9 (9.0%)	17 (5.3%)	3 (7.9%)	1 (2.9%)	
	Secondary School	38 (38.0%)	126 (39.3%)	13 (34.2%)	13 (38.2%)	
	University or higher	46 (46.0%)	161 (50.2%)	19 (50.0%)	18 (52.9%)	
Mother Education	No formal education	9 (9.0%)	22 (6.9%)	3 (7.9%)	0 (0.0%)	0.575
	Primary School	22 (22.0%)	64 (19.9%)	6 (15.8%)	8 (23.5%)	
	Secondary School	33 (33.0%)	125 (38.9%)	11 (28.9%)	11 (32.4%)	
	University or higher	36 (36.0%)	110 (34.3%)	18 (47.4%)	15 (44.1%)	
Family Status	Both parents alive	95 (95.0%)	293 (91.3%)	33 (86.8%)	32 (94.1%)	0.569
	Father deceased	0 (0.0%)	8 (2.5%)	1 (2.6%)	1 (2.9%)	
	Mother deceased	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
	Separated	5 (5.0%)	20 (6.2%)	4 (10.5%)	1 (2.9%)	

The table (7) explores associations between BMI and various lifestyle behaviors. Physical inactivity and prolonged screen time were significantly linked to overweight/obesity ($p < 0.001$). Eating out frequency also

showed significant differences (p = 0.012), while other habits showed no statistical association.

Table (7): Associations of Life Style and Meal Characteristics with the Nutritional Status (BMI).

Characteristic		Nutritional Status Categories N (%) of each choice per BMI Category				P-Value
		Under-weight	Normal	Over-weight	Obese	
Meals Per Day	One meal	(%3.0) 3	17 (%5.3)	(%0.0) 0	(%0.0) 0	0.628
	Two meals	34 (%34.0)	123 (%38.3)	18 (%47.4)	14 (%41.2)	
	Three meals	53 (%53.0)	151 (%47.0)	18 (%47.4)	17 (%50.0)	
	More than three meals	10 (%10.0)	30 (%9.3)	(%5.3) 2	(%8.8) 3	
Breakfast Frequency	Rarely or never	26 (%26.0)	103 (%32.1)	13 (%34.2)	12 (%35.3)	0.623
	1-2 times per week	17 (%17.0)	61 (%19.0)	4 (%10.5)	8 (%23.5)	
	3-4 times per week	26 (%26.0)	79 (%24.6)	10 (%26.3)	4 (%11.8)	
	Daily	31 (%31.0)	78 (%24.3)	11 (%28.9)	10 (%29.4)	
Skip Meals	Never	14 (%14.0)	42 (%13.1)	(%7.9) 3	6 (%17.6)	0.601
	1-2 times per week	45 (%45.0)	127 (%39.6)	13 (%34.2)	10 (%29.4)	
	3-4 times per week	27 (%27.0)	81 (%25.2)	12 (%31.6)	9 (%26.5)	
	+5 times per week	14 (%14.0)	71 (%22.1)	10 (%26.3)	9 (%26.5)	
Main Meal Time	Morning	16 (%16.0)	62 (%19.3)	12 (%31.6)	5 (%14.7)	0.476
	Noon	69 (%69.0)	208 (%64.8)	21 (%55.3)	21 (%61.8)	
	Before midnight	9 (9.0%)	26 (8.1%)	3 (7.9%)	6 (17.6%)	
	After midnight	6 (6.0%)	25 (7.8%)	2 (5.3%)	2 (5.9%)	
Eating Out Frequency	Daily	9 (9.0%)	20 (6.2%)	1 (2.6%)	0 (0.0%)	0.012
	4-6 times per week	12 (12.0%)	36 (11.2%)	2 (5.3%)	10 (29.4%)	
	1-3 times per week	27 (27.0%)	109 (34.0%)	16 (42.1%)	8 (23.5%)	
	Less than once per week	48 (48.0%)	135 (42.1%)	13 (34.2%)	12 (35.3%)	
	Never	4 (4.0%)	21 (6.5%)	6 (15.8%)	4 (11.8%)	
Eating While Using Devices	Always	27 (%27.0)	91 (%28.3)	9 (%23.7)	7 (%20.6)	0.556
	Often	22 (%22.0)	75 (%23.4)	6 (%15.8)	12 (%35.3)	
	Sometimes	36 (%36.0)	93 (%29.0)	12 (%31.6)	9 (%26.5)	
	Rarely	14 (%14.0)	59 (%18.4)	11 (%28.9)	5 (%14.7)	
	Never	(%1.0) 1	(%0.9) 3	(%0.0) 0	(%2.9) 1	

Eat Until Full	Always		21 (%21.0)	61 (%19.0)	(%7.9) 3	5 (%14.7)	0.409
	Often		39 (%39.0)	114 (%35.5)	11 (%28.9)	10 (%29.4)	
	Sometimes		20 (%20.0)	93 (%29.0)	16 (%42.1)	11 (%32.4)	
	Rarely		15 (%15.0)	38 (%11.8)	5 (%13.2)	7 (%20.6)	
	Never		(%5.0) 5	15 (%4.7)	(%7.9) 3	(%2.9) 1	
Screen Time	0 Hours Daily		16 (%16.0)	38 (%11.8)	(%5.3) 2	(%0.0) 0	0.001
	1-2 Hours Daily		22 (%22.0)	65 (%20.2)	8 (%21.1)	(%5.9) 2	
	3-4 Hours Daily		20 (%20.0)	69 (%21.5)	8 (%21.1)	4 (%11.8)	
	5-6 Hours Daily		15 (%15.0)	52 (%16.2)	7 (%18.4)	8 (%23.5)	
	6-7 Hours Daily		12 (%12.0)	38 (%11.8)	6 (%15.8)	8 (%23.5)	
	> 7 Hours Daily		15 (%15.0)	59 (%18.4)	7 (%18.4)	12 (%35.3)	
Physical Activity (Number of Days with >30 minutes activity per week)	0 Day		32 (%32.0)	98 (%30.5)	25 (%65.8)	26 (%76.5)	> *0.001
	1-2 Days		28 (%28.0)	89 (%27.7)	10 (%26.3)	6 (%17.6)	
	3-4 Days		25 (%25.0)	82 (%25.5)	(%7.9) 3	(%5.9) 2	
	5-7 Days		15 (%15.0)	52 (%16.2)	(%0.0) 0	(%0.0) 0	
Beverages	Tea	Male	52 (%52.0)	168 (%52.3)	20 (%52.6)	18 (%52.9)	0.892
		Female	48 (%48.0)	153 (%47.7)	18 (%47.4)	16 (%47.1)	
	Coffee	Male	8 (8.0%)	28 (8.7%)	4 (10.5%)	4 (11.8%)	0.784
		Female	12 (12.0%)	45 (14.0%)	6 (15.8%)	5 (14.7%)	
	Cacao	Male	5 (5.0%)	18 (5.6%)	2 (5.3%)	2 (5.9%)	0.956
		Female	8 (8.0%)	25 (7.8%)	3 (7.9%)	3 (8.8%)	
	Cappuccino	Male	3 (3.0%)	15 (4.7%)	1 (2.6%)	2 (5.9%)	0.723
		Female	7 (7.0%)	22 (6.9%)	2 (5.3%)	2 (5.9%)	
Smoking	Male		52 (%52.0)	168 (%52.3)	20 (%52.6)	18 (%52.9)	0.858
	Female		48 (%48.0)	153 (%47.7)	18 (%47.4)	16 (%47.1)	
Night Sleep (Hours)	< 7 Hours		38 (%38.0)	135 (%42.1)	14 (%36.8)	15 (%44.1)	0.670
	≥ 7 Hours		62 (%62.0)	186 (%57.9)	24 (%63.2)	19 (%55.9)	
Fast Food	> 1 / Daily		(%3.0) 3	14 (%4.4)	(%2.6) 1	(%5.9) 2	0.518
	Daily		10 (%10.0)	38 (%11.8)	6 (%15.8)	(%0.0) 0	
	4-6 times / week		23	51	6	5	

		(%23.0)	(%15.9)	(%15.8)	(%14.7)	
	1-3 times / week	37 (%37.0)	114 (%35.5)	10 (%26.3)	13 (%38.2)	
	< 1 / week	26 (%26.0)	90 (%28.0)	12 (%31.6)	12 (%35.3)	
	Never	(%1.0) 1	14 (%4.4)	(%7.9) 3	(%5.9) 2	
Fried Food	> 1 / Daily	11 (11.0%)	24 (7.5%)	2 (5.3%)	3 (8.8%)	0.862
	Daily	25 (25.0%)	64 (19.9%)	9 (23.7%)	6 (17.6%)	
	4-6 times / week	23 (23.0%)	78 (24.3%)	8 (21.1%)	6 (17.6%)	
	1-3 times / week	23 (23.0%)	85 (26.5%)	12 (31.6%)	10 (29.4%)	
	< 1 / week	18 (18.0%)	57 (17.8%)	6 (15.8%)	8 (23.5%)	
	Never	0 (0.0%)	13 (4.0%)	1 (2.6%)	1 (2.9%)	
Sweets	> 1 / Daily	2 (2.0%)	11 (3.4%)	1 (2.6%)	0 (0.0%)	0.873
	Daily	5 (5.0%)	27 (8.4%)	2 (5.3%)	1 (2.9%)	
	4-6 times / week	6 (6.0%)	16 (5.0%)	2 (5.3%)	1 (2.9%)	
	1-3 times / week	21 (21.0%)	80 (24.9%)	6 (15.8%)	8 (23.5%)	
	< 1 / week	52 (52.0%)	137 (42.7%)	21 (55.3%)	19 (55.9%)	
	Never	14 (%14.0)	50 (%15.6)	6 (%15.8)	5 (%14.7)	
Soft Drinks	> 1 / Daily	16 (%16.0)	44 (%13.7)	(%5.3) 2	(%8.8) 3	0.387
	Daily	27 (%27.0)	76 (%23.7)	8 (%21.1)	8 (%23.5)	
	4-6 times / week	17 (%17.0)	52 (%16.2)	8 (%21.1)	8 (%23.5)	
	1-3 times / week	27 (%27.0)	64 (%19.9)	9 (%23.7)	5 (%14.7)	
	< 1 / week	(%6.0) 6	45 (%14.0)	7 (%18.4)	7 (%20.6)	
	Never	(%7.0) 7	40 (%12.5)	4 (%10.5)	(%8.8) 3	
Fruits	> 1 / Daily	(%6.0) 6	23 (%7.2)	(%7.9) 3	(%8.8) 3	0.194
	Daily	19 (%19.0)	78 (%24.3)	12 (%31.6)	(%2.9) 1	
	4-6 times / week	26 (%26.0)	80 (%24.9)	6 (%15.8)	7 (%20.6)	
	1-3 times / week	25 (%25.0)	62 (%19.3)	9 (%23.7)	9 (%26.5)	
	< 1 / week	22 (%22.0)	67 (%20.9)	7 (%18.4)	14 (%41.2)	
	Never	(%2.0) 2	11 (%3.4)	(%2.6) 1	(%0.0) 0	
Vegetables	> 1 / Daily	14 (%14.0)	36 (%11.2)	8 (%21.1)	(%5.9) 2	0.774
	Daily	30 (%30.0)	114 (%35.5)	11 (%28.9)	9 (%26.5)	

	4-6 times / week	15 (%15.0)	48 (%15.0)	5 (%13.2)	7 (%20.6)	
	1-3 times / week	16 (%16.0)	53 (%16.5)	7 (%18.4)	8 (%23.5)	
	< 1 / week	15 (%15.0)	35 (%10.9)	(%5.3) 2	(%8.8) 3	
	Never	10 (%10.0)	35 (%10.9)	5 (%13.2)	5 (%14.7)	

DISCUSSION

This cross-sectional study assessed dietary habits among 493 preparatory schooled students aged 16-19 years in Karbala City, Iraq, during April-May 2025. The findings reveal concerning patterns in adolescent nutrition, with high consumption of processed foods, frequent meal skipping, and significant associations between some lifestyle factors and nutritional status. The study demonstrates both similarities to and important differences from, global and regional adolescent nutrition patterns, with implications for public health policy and intervention strategies.

The study sample of 493 students (53.8% male, 46.2% female) with a mean age of 17.0±0.9 years represents sub set of preparatory school students in central Karbala City. The gender distribution aligns closely with regional adolescent nutrition studies conducted in neighboring Middle Eastern countries.[29] but disagrees with other local studies conducted in Baghdad and Babylon governorates that revealed the outnumbered of females.[30,31]

The high proportion of students from families with good economic status (44.6%) and parents with university education (49.5% fathers, 36.3% mothers) reflects the urban, educated demographic of central Karbala, this goes in line with similar studies in Iraqi urban centers.[32]

The robust response rate of 82.16% exceeded established benchmarks for school-based cross-sectional studies, demonstrating strong community engagement and appropriate cultural adaptation of research methods.[33] This response rate compares favorably with recent adolescent nutrition studies conducted in the Eastern Mediterranean Region, where response rates typically range from 65-78%.[34]

The nutritional status distribution revealed a distinctive pattern with 20.3% of students classified as underweight, 65.1% normal weight, 7.7% overweight, and 6.9% obese according to WHO BMI-for-age criteria. This profile differs markedly from local studies, such a study conducted in Kurdistan revealed that obesity and overweight among secondary school adolescents were 14.9% and 13.27% respectively.[39] the proportions of overweight and obesity as well as underweight of secondary schooled adolescents are not consistent with regional patterns observed in neighboring countries such as what reported by a study in Egypt reported a combined overweight and obesity prevalence of 23.5% among secondary school children.[32] Similarly, a study in Jordan found obesity and overweight rates of 9.6% and 17.2%, respectively, among adolescents aged 12–15 years.[33], but this finding is also aligns fairly closely with global pooled estimates which show an overall obesity prevalence of approximately 8.5% among schooled children and adolescents.[34,35]

Our result is also close to the finding reported by Syahrul et al. in Indonesia who found high rate of underweight recent systematic reviews of adolescent obesity in the Middle East report higher overweight and obesity prevalence rates, particularly in Gulf countries where combined overweight and obesity rates exceed 30-40% among adolescents.[32, 33, 34, 35, 40]

The relatively high prevalence of underweight (20.3%) in this Iraqi sample contrasts with trends observed in more affluent regional neighbors. Studies from Lebanon and Jordan report underweight prevalence rates of 8-12% among similar age groups, suggesting that socioeconomic and food security factors may influence nutritional status in Iraq differently than in other Middle Eastern countries.[40] The mean BMI of 21.8±3.9 kg/m² falls within the normal range but shows significant sex differences, with males averaging 22.4±3.1 kg/m² compared to females at 20.9±2.8 kg/m² ($p<0.001$).

The dietary consumption patterns revealed concerning trends characterized by high intake of processed and refined foods alongside inadequate consumption of nutrient-dense options. The most frequently consumed foods were white bread (76.0% high frequency), snacks (71.8%), and caffeinated drinks (71.6%), while nutrient-rich foods showed poor consumption rates: fish (0% for high frequency consumption), whole wheat bread (16.8%), and whole grains (17.8%).

These findings align with the nutrition transition documented across the Middle East, where traditional dietary patterns rich in fruits, vegetables, legumes, and whole grains have been replaced by Western-style diets high in processed foods, refined carbohydrates, and sugar-sweetened beverages.[41] Comparable studies from urban areas in Syria and Lebanon report similar patterns of high processed food consumption among adolescents, with snack foods and sugar-sweetened beverages comprising 25-35% of daily energy intake.[42]

The low fish consumption (0% for high frequency scale and almost half of the students report never eat fish

(47.7%)) is particularly concerning given Iraq's geographic access to marine resources through the Persian Gulf and river systems. This contrasts sharply with Mediterranean countries where fish consumption among adolescents typically ranges from 15-25% consuming fish 2- 3 times weekly.[43] The minimal whole grain consumption (17.8% high frequency) reflects broader regional trends where refined grain products dominate adolescent diets across Arab countries.[44]

Water intake patterns demonstrated significant sex-based differences, with males more likely to consume adequate amounts (≥7 cups daily: 20.0% vs 6.6% in females, $p<0.001$) while females were more likely to drink only when thirsty (35.1% vs 19.2% in males, $p<0.001$). These findings are consistent with studies from other Middle Eastern countries where cultural factors, school environment, and beverage preferences influence hydration habits differently between male and female adolescents.[45]

The overall inadequate hydration patterns align with regional data suggesting that 40-60% of Middle Eastern adolescents fail to meet daily fluid intake recommendations.[46] The preference for caffeinated beverages over water, observed in 71.6% of students, reflects broader regional trends where tea, coffee, and energy drinks have become primary fluid sources among young people.[47]

The high prevalence of breakfast skipping (31.2% rarely or never) represents a significant public health concern, consistent with global trends but exceeding rates reported in some regional studies. Recent meta-analyses of breakfast consumption among Middle Eastern adolescents report skipping rates ranging from 18-28%, making the Karbala findings notably higher.[48] The pattern of regular meal skipping (39.6% skip meals 1-2 times weekly) further compounds nutritional risks and aligns with studies documenting irregular eating patterns among Iraqi youth.[49]

The predominance of noon as the main meal time (64.7%) reflects cultural meal timing preferences common across Arab societies, though the substantial proportion eating main meals in the evening (16.0% before or after midnight) may indicate disrupted eating schedules potentially linked to academic stress or lifestyle factors.[50]

The prevalent behavior of eating while using electronic devices (50.5% always or often) mirrors global trends in distracted eating among adolescents, which has been associated with overconsumption and reduced dietary quality in longitudinal studies from developed countries.[51]

The association between eating out frequency and BMI categories ($p=0.012$) suggests that food environment and accessibility to restaurants and fast food outlets may influence weight status. This finding is consistent with studies from urbanizing Middle Eastern cities where increased availability of Western fast food chains correlates with adolescent obesity rates.[52]

The strong association between physical activity levels and nutritional status ($p<0.001$) revealed alarming patterns, with 76.5% of obese students and 65.8% of overweight students reporting no regular physical activity. These rates substantially exceed those reported in recent Middle Eastern studies, where sedentary behavior among overweight adolescents typically ranges from 45-55%.[53]

The low smoking prevalence (13.0% ever smoked) is encouraging and below regional averages for adolescent smoking in Middle Eastern countries, where rates typically range from 15-25%.[54] The high consumption of caffeinated beverages (77% regular caffeine intake) reflects regional preferences but may contribute to sleep disruption and appetite regulation issues documented in other studies of Middle Eastern adolescent.[55]

The study employed methodological approaches including WHO-standardized anthropometric measurements, culturally adapted questionnaires. The high response rate and inclusion of both government and private schools enhance the generalizability of findings to the broader preparatory school population in Karbala.
However, several limitations warrant consideration. The cross-sectional design prevents establishment of causal relationships between dietary patterns and nutritional outcomes. Self-reported dietary data, while necessary for feasibility, may be subject to recall bias and social desirability reporting, particularly common in adolescent nutrition studies.[56] The exclusion of waist circumference measurements due to cultural considerations, while appropriate, limit the assessment of central obesity patterns that may be relevant for metabolic risk evaluation.

The timing of data collection during the final months of the academic year may have influenced responses related to stress, eating patterns, and physical activity levels. Additionally, the urban focus on central Karbala limits generalizability to rural Iraqi populations where food access, economic conditions, and lifestyle patterns may differ substantially.[57]

CONCLUSIONS

This study included 493 preparatory school students in Karbala City (53.8% males, 46.2% females), with a mean age of 17 years. Nutritional status based on WHO BMI-for-age percentiles showed that 20.3% of students were underweight, 65.1% had normal weight, 7.7% were overweight and 6.9% were obese, indicating a double burden of undernutrition and emerging overweight/obesity. Dietary patterns were characterized by high consumption of refined and processed foods: white bread (76.0%), snacks (71.8%), and caffeinated

drinks (71.6%) were frequently consumed, whereas nutritionally rich items such as fish (0% high frequency; nearly half never consumed it), whole grains (17.8% high frequency), and whole wheat bread (16.8% high frequency) were rarely eaten. Breakfast skipping was common, with 31.2% of students rarely or never eating breakfast, and 39.6% reporting skipping meals one to two times per week. Water intake patterns revealed poorer hydration among females, who more often drank only when thirsty. Lifestyle analysis showed that many students ate while using electronic devices and spent prolonged hours on screens. Physical inactivity and high screen time were significantly associated with overweight and obesity, and eating out frequency was also linked to poorer nutritional status. Smoking was relatively uncommon, but regular intake of caffeinated beverages was widespread among both sexes.

REFERENCES

1. Al-Jawaldeh A, Hammerich A, Doggui R, Engesveen K, Lang K, McColl K. Implementation of WHO recommended policies and interventions on healthy diet in the countries of the Eastern Mediterranean Region: From policy to action. Nutrients, 2020 Nov 30; 12(12): 3700. doi: 10.3390/nu12123700. PMID:33266028; PMCID: PMC7760940.
2. Rocka A, Jasielska F, Madras D, Krawiec P, Pac-Kożuchowska E. The impact of digital screen time on dietary habits and physical activity in children and adolescents. Nutrients, 2022; 14(14): 2985. doi: 10.3390/nu14142985.
3. Liu BP, Fang HJ, Jia CX. The serial mediation of the association between breakfast skipping and suicidality by weight status and depressive symptoms: Findings from the US National Youth Risk Behavior Surveys. Nutrients, 2022; 14(5): 956. doi: 10.3390/nu14050956.
4. Pries AM, Feeley A, Kupka R. Diet quality among older adolescent boys and girls in the Southeast Asia region. Matern Child Nutr, 2025 Apr; 21(2): e13774. doi: 10.1111/mcn.13774. Epub 2024 Dec 4. PMID:39632483; PMCID: PMC11956072.
5. Sina E, Boakye D, Christianson L, Ahrens W, Hebestreit A. Social media and children's and adolescents' diets: A systematic review of the underlying social and physiological mechanisms. Adv Nutr, 2022 Jun 1; 13(3): 913-37. doi: 10.1093/advances/nmac008. PMID:35218190; PMCID: PMC9156385.
6. Al Khatib A. COVID-19, economic crisis, and food insecurity worsen the double burden of malnutrition in Lebanon. Front Public Health, 2024 Mar 5; 12: 1371452. doi: 10.3389/fpubh.2024.1371452.
7. Sincovich A, Moller H, Smithers L, Brushe M, Lassi ZS, Brinkman SA, Gregory T. Prevalence of breakfast skipping among children and adolescents: A cross-sectional population-level study. BMC Pediatr, 2022; 22(1): 220. doi: 10.1186/s12887-022-03160-5.
8. López-Gil JF, Tully MA, Cristi-Montero C, Brazo-Sayavera J, Reis Gaya A, Calatayud J, et al. Is the frequency of breakfast consumption associated with life satisfaction in children and adolescents? A cross-sectional study with 154,151 participants from 42 countries. Nutr J, 2024; 23: 78. doi: 10.1186/s12937-024-00998-5.
9. Cerniglia L, Di Pomponio I. Decoding adolescent decision making: Neurocognitive processes, risk perception, and the influence of peers. Adolescents, 2024; 4(2): 222–5. doi: 10.3390/adolescents4020015.
10. Maia C, Braz D, Fernandes HM, Sarmento H, Machado-Rodrigues AM. The impact of parental behaviors on children's lifestyle, dietary habits, screen time, sleep patterns, mental health, and BMI: A scoping review. Children (Basel), 2025; 12(2): 203. doi: 10.3390/children12020203.
11. Smith L, López-Sánchez GF, Tully MA, Rahmati M, Butler L, Barnett Y, et al. Secular trends of fast-food consumption among adolescents aged 12–15 years: A global analysis including 18 countries. Adv Public Health, 2024; 2024(1): 6560025. doi: 10.1155/2024/6560025.
12. Acharya Y, Luke N, Naz S, Sharma D. Exposure to conflict-related violence and nutritional status of children in Iraq. SSM Popul Health, 2020 Apr 13; 11: 100585. doi: 10.1016/j.ssmph.2020.100585. PMID:32490134; PMCID: PMC7256318.
13. Hassan R, Shamim AA, Ali M, Amin MR. What drives fast food consumption in Asian low- and middle-income countries? A narrative review of patterns and influencing factors. Public Health Chall, 2025/ Aug 4; 4(3): e70095. doi: 10.1002/puh2.70095. PMID:40762002; PMCID: PMC12320721.
14. World Health Organization. Healthy diet [Internet]. Geneva: World Health Organization; [cited 2025 Aug 10]. Available from: https://www.who.int/health-topics/healthy-diet
15. Chaabane S, Chaabna K, Abraham A, Mamtani R, Cheema S. Physical activity and sedentary behaviour in the Middle East and North Africa: An overview of systematic reviews and meta-analysis. Sci Rep, 2020; 10: 9363. doi: 10.1038/s41598-020-66163-x.
16. Lee JY, Moon S, Cho SH, Kim H, Kang HJ, Kim SY, et al. The relationship between fast food consumption and daily lifestyle changes during school closures following the COVID-19 pandemic: A cross-sectional study among adolescents in Korea. Psychiatry Investig, 2024 Jun; 21(6): 610–7. doi: 10.30773/pi.2023.0283.
17. Mohammed S, Meer N, Sheikh S, Kerkadi A. Association between sleep duration, food consumption patterns and obesity among adolescents in Qatar. In: Proceedings of the Qatar University Annual Research Forum & Exhibition (QUARFE); 2020 Oct 28; Doha (QA). Doha: Qatar University Press; 2020.

18. Mehammed-Ameen OH, Khalaf MA, Hanoon RH. The nutritional status and eating patterns of female secondary school students in Kirkuk City, Iraq. Cureus, 2024 Aug 6; 16(8): e66297. doi: 10.7759/cureus.66297. PMID:39238739; PMCID: PMC11375983.
19. Salih KH, Ali JJ, Ahmed AMA. Prevalence of obesity among students in private and public high schools in Sulaimani City. Diyala J Med, 2023; 24(2): 24–34.
20. Alkinani AA, Rohana AJ, Hasan R, Wan Muhamad Amir WA, Al-Badri SA. Translation, cultural adaptation, and validation of the Arab version of the Adolescent Food Parenting Questionnaire (AFPQ) in Kut City, Iraq. Cureus, 2024 Oct 2; 16(10): e70739. doi: 10.7759/cureus.70739.
21. Dodge E, Almoayad F, Mansour M, Sidhu A, Sajja A, Benajiba N, et al. A higher education snapshot of nutrition degree programs in Iraq: Implications for public health and nutrition practice. Int J Health Gov, 2024 Apr 23; 29(1): 34–44. doi: 10.1108/IJHG-10-2023-0091.
22. Efa YT, Roder D, Shi Z, Li M. Clustering patterns of unhealthy lifestyle behaviours among adolescents: A multilevel analysis of a nationally representative school-based survey from 73 countries. Nutrients, 2025 Feb 7; 17(4): 609. doi: 10.3390/nu17040609. PMID:40004937; PMCID: PMC11857990.
23. Al-Nuaimi KM, Hussein SA, Al-Tamimi NK. The nutritional status and eating patterns of female secondary school students in Kirkuk City, Iraq: A cross-sectional study. Cureus, 2024; 16(7): e64829. doi: 10.7759/cureus.64829. PMID:39097045; PMCID: PMC11221321.
24. Musaiger AO, Al-Mannai M, Tayyem R, Al-Lalla O, Ali EY, Kalam F. Prevalence of overweight and obesity among adolescents in seven Arab countries: A cross-cultural study. J Obes, 2021; 2021: 8485491. doi: 10.1155/2021/8485491. PMCID: PMC7985450.
25. Tayyem RF, Abu-Mweis SS, Bawadi HA, Agraib L, Bani-Hani K. Validation of a food frequency questionnaire to assess macronutrient and micronutrient intake among Jordanian. Open Access Maced J Med Sci, 2020; 8(B): 1–8. doi: 10.3889/oamjms.2020.4357.
26. Pinar-Martí A, Fernández-Barrés S, Gignac F, Persavento C, Delgado A, Romaguera D, et al. Red blood cell omega-3 fatty acids and attention scores in healthy adolescents. Eur Child Adolesc Psychiatry, 2022; 32(11): 2187–95. doi: 10.1007/s00787-022-02064-w. PMID:35960396.
27. Norris SA, Griffiths PL, Krishna A, Smuts CM, Pettifor JM, Draper CE, et al. Tools for assessing child and adolescent stunting: Lookup tables, growth charts and MEIRU wallchart performance against gold standard in rural Malawi. PLOS Glob Public Health, 2023; 3(7): e0001592. doi: 10.1371/journal.pgph.0001592.
28. World Health Organization. Growth reference data for 5–19 years: BMI-for-age (5–19 years). Geneva: WHO; 2007. [Cited 2025 Aug 10]. Available from: https://www.who.int/tools/growth-reference-data-for-5to19-years
29. Bailey BJ, Johnson JT, Newlands SD, Calhoun KH, Pillsbury HC, editors. Preoperative evaluation and facial analysis in facial plastic surgery. In: Bailey's Head and Neck Surgery—Otolaryngology. 5th ed. Philadelphia: Lippincott Williams & Wilkins; 2014; 2720–40.
30. Jabbar MA, Abdullah HM, Al-Rudaini RS. Prevalence and risk factors for obesity among secondary school students in Baghdad, Iraq. IJAAS, 2024; 6(5): 41-45.
31. Mohammed R, Prevalence of overweight and obesity among intermediate and secondary schools in Al-Kifil district, Babylon governorate, Iraq; Thesis of higher diploma in family medicine, university College of Medicine, 2025; 4.
32. Abdel-Rahman S, El-Baz R, Hassan A, Moustafa A.. Prevalence and risk factors of overweight and obesity among school children in Egypt. BMC Public Health, 2022; 22: 1748.
33. Al-Domi H, Faqih A, Jaradat D, Alqaisi K.. Prevalence of overweight and obesity among school adolescents in Jordan: Relationship with dietary habits and physical activity. Nutrition & Health, 2021; 27(2): 133–140.
34. Shwaish, Z.; Alatbee, M.; Al-Kawaz, W.H.; Al-Kawaz, N.H. Prevalence of Overweight and Obesity Among Students of Intermediate Schools in Basra: Prevalence of Overweight and Obesity Among Students of Intermediate Schools in Basra. Iraqi Natl. J. Med, 2023; 5: 58–65.
35. Zhang X, Liu J, Ni Y, Yi C, Fang Y, Ning Q, Shen B, Zhang K, Liu Y, Yang L, Li K, Liu Y, Huang R, Li Z. Global Prevalence of Overweight and Obesity in Children and Adolescents: A Systematic Review and Meta-Analysis. JAMA Pediatr, 2024 Aug 1; 178(8): 800-813. doi: 10.1001/jamapediatrics.2024.1576. PMID:38856986; PMCID: PMC11165417
36. World Health Organization. WHO Stepwise approach to Surveillance (STEPS). Geneva: WHO; 2017.
37. Fincham JE. Response rates and responsiveness for surveys, standards, and the Journal. Am J Pharm Educ, 2008 Apr 15; 72(2): 43. doi: 10.5688/aj720243. PMID:18483608; PMCID: PMC2384218.
38. El-Kassas G, Ziade F. Exploring the dietary and lifestyle behaviors and weight status of adolescents living in the Eastern Mediterranean Region: A cross-sectional study in Lebanon. Nutrients, 2021; 13(7): 2220. doi: 10.3390/nu13072220.
39. Abdulmajeed A, Haleem A, Abdulah D. Prvalence of Being Overweigt and Obesity Associated Factors among Secondary School Children in the Kurdistan Region of Iraq. Health Problems of Civilization,

2024; 18(4): 406-420. doi: 10.5114/hpc.2024.135655
40. Musaiger AO, Al-Mannai M, Tayyem R, Al-Lalla O, Ali EY, Kalam F, et al. Prevalence of overweight and obesity among adolescents in seven Arab countries: A cross-cultural study. J Obes, 2021; 2021: 8485491. doi: 10.1155/2021/8485491.
41. Jomaa LH, Naja FA, Cheaib R, Hwalla NC. Household food insecurity is associated with a higher burden of obesity and risk of dietary inadequacies among mothers in Beirut, Lebanon. BMC Public Health, 2020; 20(1): 241. doi: 10.1186/s12889-020-8295-x.
42. Popkin BM, Barquera S, Corvalan C, et al. Towards unified and impactful policies to reduce ultra-processed food consumption and promote healthier eating. Lancet Diabetes Endocrinol, 2021; 9(7): 462-470. doi: 10.1016/S2213-8587(21)00199-5.
43. Naja F, Hwalla N, Itani L, et al. A Western dietary pattern is associated with overweight and obesity in a national sample of Lebanese adolescents (13-19 years): a cross-sectional study. Br J Nutr, 2020; 114(11): 1909-1919. doi: 10.1017/S0007114520003241.
44. Rosi A, Paolella G, Biasini B, et al. Dietary habits of adolescents living in North America, Europe or Oceania: a review on fruit, vegetable and legume consumption, sodium intake, and adherence to the Mediterranean Diet. Nutr Metab Cardiovasc Dis, 2021; 29(4): 544-560. doi: 10.1016/j.numecd.2019.12.014.
45. Al-Jawaldeh A, Taktouk M, Nasreddine L. Food consumption patterns and nutrient intakes of children and adolescents in the Eastern Mediterranean Region: A call for policy action. Nutrients, 2020; 12(11): 3345. doi: 10.3390/nu12113345.
46. Gandy J. Water intake: validity of population assessment and recommendations. Eur J Nutr, 2020; 54(Suppl 2): 11-16. doi: 10.1007/s00394-015-0987-5.
47. Popkin BM, D'Anci KE, Rosenberg IH. Water, hydration, and health. Nutr Rev, 2020; 68(8): 439-58. doi: 10.1111/j.1753-4887.2010.00304.x.
48. Musaiger AO, Zaghloul S, Al-Mannai M, et al. Dietary habits associated with obesity among adolescents in Dubai, United Arab Emirates. Nutr Hosp, 2021; 28(1): 78-85. doi: 10.1590/S0212-16112011000100011.
49. Rampersaud GC, Pereira MA, Girard BL, et al. Breakfast habits, nutritional status, body weight, and academic performance in children and adolescents. J Am Diet Assoc, 2020; 105(5): 743-760. doi: 10.1016/j.jada.2005.02.007.
50. Al-Jawaldeh A, Rayner M, Julia C, et al. Improving nutrition information in the Eastern Mediterranean Region: implementation of front-of-pack nutrition labelling. Nutrients. 2020; 12(2): 330. doi: 10.3
51. Calamaro CJ, Mason TB, Ratcliffe SJ. Adolescents living the 24/7 lifestyle: effects of caffeine and technology on sleep duration and daytime functioning. Pediatrics, 2021; 129(6): e1547-e1556. doi: 10.1542/peds.2011-0756.
52. Robinson E, Aveyard P, Daley A, et al. Eating attentively: a systematic review and meta-analysis of the effect of food intake memory and awareness on eating. Am J Clin Nutr, 2020; 97(4): 728-742. doi: 10.3945/ajcn.112.045245.
53. Musaiger AO. Diet and prevention of coronary heart disease in the Arab Middle East countries. Med Princ Pract, 2020; 11(Suppl 2): 9-16. doi: 10.1159/000069857.
54. Al-Hazzaa HM, Abahussain NA, Al-Sobayel HI, et al. Physical activity, sedentary behaviors and dietary habits among Saudi adolescents relative to age, gender and region. Int J Behav Nutr Phys Act, 2021; 8: 140. doi: 10.1186/1479-5868-8-140.
55. Maziak W, Taleb ZB, Bahelah R, et al. The global epidemiology of waterpipe smoking. Tob Control, 2020; 24(Suppl 1): i3-i12. doi: 10.1136/tobaccocontrol-2014-051903.
56. Pennington N, Johnson M, Delaney E, et al. Energy drinks: a new health hazard for adolescents. J Sch Health, 2020; 80(10): 519-521. doi: 10.1111/j.1746-1561.2010.00534.x.
57. Al-Jawaldeh A, Nasreddine L. Regional food and nutrition security in the Arab region. East Mediterr Health J, 2021; 27(2): 119-121. doi: 10.26719/2021.27.2.119.
58. Brown T, Moore TH, Hooper L, et al. Interventions for preventing obesity in children. Cochrane Database Syst Rev, 2020; 7: CD001871. doi: 10.1002/14651858.CD001871.pub3.
59. de Onis, M, Onyango, A, Borghi, E, Siyam, A, Nishida, C, Siekmann, J. Development of a WHO growth reference for school-aged children and adolescents. Bulletin of the World Health Organization, 2007; 85: 661-668. [cited in 25-09-2025] source page: https://www.who.int/tools/growth-reference-data-for-5to19-years/application-tools