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PREVALENCE OF BEING OVERWEIGHT AND OF OBESITY AND ASSOCIATED FACTORS AMONG SECONDARY SCHOOL CHILDREN IN THE KURDISTAN REGION OF IRAQ

CZĘSTOŚĆ WYSTĘPOWANIA NADWAGI I OTYŁOŚCI ORAZ CZYNNIKI Z TYM ZWIĄZANE WŚRÓD UCZNIÓW SZKÓŁ ŚREDNICH W REGIONIE KURDYSTANU W IRAKU

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Summary

Background. Early identification of obesity is crucial for effective control, treatment, and prevention of complications. This study aimed to investigate the prevalence and associated factors connected with children being overweight and with obesity among secondary school students.

Material and methods. In this cross-sectional study, 550 children were included from 32 schools in Duhok City, Iraqi Kurdistan, between November 2021 and April 2022.

Results. The mean age of the children was 15.54 years (13-18 years). Half of them engaged in regular physical activity. Most were normal sleepers (58.55%), followed by long sleepers (37.27%), and short sleepers (4.18%). The majority consistently consumed breakfast (66.91%), lunch (83.27%), and dinner (89.64%), with 53.27% having extra portions. A significant proportion regularly consumed junk food: 52.0% up to 3 times per week, and 39.46% more than 3 times. Regarding sugar-sweetened beverages, 89.64% drank them, primarily 1-3 times per day (85.09%). The prevalence of overweight children and obesity among school children was 13.27% and 14.91%, respectively. Females were more likely to be overweight (16.77%), while males were more likely to be obese (13.68%; p=0.023).

Conclusions. The prevalence of obesity and being overweight is relatively high in children in Duhok city. The study revealed that being male and having overweight or obese fathers were significant predictors of the prevalence of obesity among school children.

Keywords: Body Mass Index, overweight, obesity, prevalence, factors

Streszczenie

Wprowadzenie. Wczesne rozpoznanie otyłości ma kluczowe znaczenie dla skutecznej kontroli, leczenia i zapobiegania powikłaniom. Celem niniejszej pracy było zbadanie częstości występowania i czynników związanych z nadwagą i otyłością wśród uczniów szkół średnich.

Materiał i metody. W okresie od listopada 2021 roku do kwietnia 2022 roku w niniejszym przekrojowym badaniu wzięło udział 550 dzieci z 32 szkół w mieście Duhok w irackim Kurdystanie.

Wyniki. Średnia wieku dzieci wyniosła 15,54 lata (13-18 lat). Połowa z nich regularnie angażowała się w aktywność fizyczną. Większość z nich sypiała normalnie (58,55%), część sypiała długo (37,27%), a część krótko (4,18%). Większość konsekwentnie spożywała śniadanie (66,91%), lunch (83,27%) oraz kolację (89.64%), przy czym 53,27% brało dokładki. Znaczna część dzieci regularnie spożywała jedzenie śmieciowe: 52,0% do 3 razy w tygodniu, a 39,46% więcej niż 3 razy. Jeżeli chodzi o napoje słodzone cukrem, 89,64% piło je głównie 1-3 razy dziennie (85,09%). Częstość występowania nadwagi i otyłości wśród dzieci w wieku szkolnym wyniosła odpowiednio 13,27% i 14,91%. Nadwaga częściej występowała u dziewczynek (16,77%), natomiast wśród chłopców większe było prawdopodobieństwo wystąpienia otyłości (13,68%; p=0,023).

Wnioski. Częstość występowania otyłości i nadwagi u dzieci w mieście Duhok jest stosunkowo wysoka. Badanie wykazało, że płeć męska i posiadanie ojca z nadwagą lub otyłością były istotnymi wskaźnikami ryzyka występowania otyłości wśród dzieci w wieku szkolnym.

Słowa kluczowe: wskaźnik masy ciała, nadwaga, otyłość, częstość występowania, czynniki

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Introduction

The prevalence of obesity among children is increasing globally. Currently, obesity has evolved into a significant worldwide health issue, with approximately 200 million school-aged children falling into the overweight/obese category. Among them, 40-50 million are classified as obese [1]. The escalation of excess body weight is a progressively mounting issue and a growing subject of public health concern within developing nations [2]. This phenomenon can potentially contribute to various health complications during childhood, adolescence, and adulthood. Even during childhood, obesity is a risk factor for future cardiovascular disease, including hypertension and dyslipidemia. These risk factors have been proven to accelerate the progression of atherosclerotic lesions in the coronary arteries of young people [3].

The global rise of childhood obesity poses a serious challenge to public health, as its occurrence continuously grows across the world. The likelihood of overweight and obese children transitioning into obese adolescents and adults is considerable, bearing significant short-term and long-term implications for both health and economics [4,5]. Medical conditions linked to obesity, encompassing metabolic syndrome, insulin resistance, type 2 diabetes mellitus, and cardiovascular ailments, previously thought to exclusively affect adults, have now manifested in the pediatric population [6].

Globally, the prevalence of obesity increased from 0.7% in 1975 to 5.6% in 2016 in girls, and from 0.9% in 1975 to 7.8% in 2016 in boys for the age-standardized base. Obesity rates exceeding 20% were observed in various nations across Polynesia, Micronesia, the Middle East, North Africa, the Caribbean, and the United States. As of 2016, an estimated 75 million girls and 117 million boys globally were classified as moderately or severely underweight. Simultaneously, approximately 50 million girls and 74 million boys worldwide were identified as obese during the same period [7]. In developing nations, the Middle East emerges with the most substantial excess of dietary energy, and there exists compelling evidence of a swift surge in risk factors for non-communicable diseases, prominently including obesity [8]. Rates of obesity and being overweight increased significantly across different regions globally. Many studies show higher rates than in Europe. For instance, in Qatar, the prevalence of boys aged 12-17 years being overweight stood at 28.6%, while for girls in the same age group, it was 18.9% [9]. These disorders lead to high mortality and morbidity. Nutritional status has been improved a lot and because of this obesity has increased markedly in most Asian countries [10].

According to the World Health Organization (WHO), obesity is when someone's body mass index (BMI) falls at or above the 95th percentile for their age and sex. Meanwhile, being overweight is identified as falling between the 85th and 95th percentiles on the BMI scale for age and sex. WHO's definition of BMI pertains to the weight in kilograms divided by the square of height in meters, a metric recommended for assessing children and adolescents [11].

Hence, it is crucial to focus on preventing childhood obesity and effectively addressing overweight issues among children. The results of this study are expected to offer evidence-based suggestions for forthcoming strategies aimed at preventing non-communicable conditions like hypertension, being overweight, and obesity. Despite available data on the prevalence of being overweight and of obesity among adults, accurate figures about the prevalence of childhood obesity and being overweight among school children in developing countries are currently absent.

Aim of the work

This study aimed to explore the prevalence of obesity in school children and its related factors in an important region inside the Kurdistan Region.

Material and methods

Study design and sampling

This research constituted a cross-sectional investigation involving 550 secondary school students aged 13 to 18, comprising 316 females and 234 males. The participants were selected from 32 different public secondary schools in Duhok City, Iraqi Kurdistan. The inclusion of schools was determined through a simple random sampling method, utilizing a list of all secondary schools in Duhok City obtained from the Duhok Administration of Education. The aim was to incorporate 20% of these schools into the study. To achieve this, the names of the schools were input into the SPSS statistical software version 25, resulting in the random selection of 32 schools (21.05%) for inclusion in the study. However, the number of students selected from each school was based on the proportion of students, assuming an average of 10 classes per school. Five classes were then randomly chosen through simple random sampling, and, subsequently, 15 students from each selected class were chosen using the same sampling method. The selected students were then invited to participate in the study. The data collection was performed between November 3rd 2021 and April 10th, 2022.

Data collection methods

The research plan was approved by the research committee at Duhok University's College of Nursing. Additionally, ethical clearance was obtained from the Directorate General of Health and the Directorate General of Education in Duhok. Subsequently, the researcher visited the selected schools to introduce the purpose of the study and received the consent of each school administration. Following the receipt of schools' consents, a comprehensive questionnaire was crafted to gather data on personal, socioeconomic, demographic, and lifestyle aspects. Furthermore, potential risk factors were assessed through the questionnaire, and specific details such as age, gender, and parental educational background were acquired using forms that were provided alongside the consent forms.

The children's body weight was measured using a Digital Personal Flat Scale. To ensure accurate measurements, the children were instructed to remove their shoes and any heavy clothing, such as sweaters. Body weight readings were recorded to the nearest 0.1 kg. Similarly, body height measurements were taken with precision, rounded to the nearest 0.5 centimeters. The height measurement followed a specific protocol: no shoes, heels placed together, and the head touching the measuring ruler with the ruler aligned horizontally. During the measurements, the children were directed to look straight ahead and maintain a still posture on the scale, with both feet together, legs extended, arms by their sides, and shoulders level. The stadiometer's headpiece was gently lowered until it made contact with the top of the child's head. The resulting height was measured in centimeters and the weight in kilograms.

Measurements

The BMI was computed as the ratio of a child's body weight (in kilograms) to the square of their body height (in meters). To assess the BMI in relation to age and gender, growth charts released in 2000 by the Centers for Disease Control and Prevention were utilized. These charts facilitated the plotting of the BMI values against age for both males and females. The BMI categories were defined as underweight (less than the 5th percentile), normal weight (5th to 85th percentile), overweight (85th to 95th percentile), and obese (greater than the 95th percentile) [12].

Data collection occurred via a prearranged and pretested questionnaire that encompassed variables like age, gender, place of residence, sleep patterns, BMI, and dietary practices. Regarding dietary habits, factors such as

the frequency of daily meals, and the consumption of junk food, sweets, and sweetened beverages were taken into consideration. In terms of physical activity, the assessment involved quantifying the daily hours dedicated to outdoor pursuits such as walking, jogging, team sports, and other similar activities.

Validity and reliability

In terms of validity, it must be mentioned that the factors included in this study were extracted from previous studies in the literature. The pre-designed questionnaire was sent to five experts in different fields for evaluation. Their comments were considered in the final version of the questionnaire before collecting the data. In terms of reliability, the first 10 cases were collected by the first and third researchers. The obtained data were entered into statistical software for analysis. The final output showed no significant difference between these two measures. Therefore, we considered the measures reliable in this study.

Statistical analyses

The general information of school children was presented in mean and Sta. Deviation or number and percentage terms. The prevalence of obesity and being overweight among school children was determined in number and percentage terms. The association of being overweight and of obesity with general characteristics, diet behaviors, lifestyles, and parents' characteristics were examined in a Pearson chi-squared test. The predictors of obesity were determined in the nominal logistic regression model. A significant level of difference was identified in a p-value<0.05. The JMP Pro 14.3.0 was used for the statistical calculations.

Results

Demographic characteristics of the children

The mean age of the children was 15.54 years, with ages ranging between 13 and 18 years old. The study included both male (42.54%) and female (57.46%) participants, residing in both urban (90.0%) and rural areas (10.0%). The findings indicated that half of the children engaged in regular physical activity, with 23.64% exercising for less than 30 minutes per day, 21.27% for more than 45 minutes per day, 30.18% for 1-3 times per week, and 19.64% for 4-7 times per week. The majority of the children were classified as normal sleepers (58.55%), followed by long sleepers (37.27%), with the remaining classified as short sleepers (4.18%) (Table 1).

Table 1. General information on the school children

Characteristics (N=550)	Number	Percentage
Student age (range: 13-18 years)	Mean: 15.54	SD: 1.69
Gender		
Male	234	42.54
Female	316	57.46
Residence		
Urban	495	90.00
Rural	55	10.00
Exercise		
No	276	50.18
Yes	274	49.82

Characteristics (N=550)	Number	Percentage
Residence		
Urban	495	90.00
Rural	55	10.00
Min/day exercise		
No exercise	276	50.18
<30 min/day	130	23.64
31-45 min/day	27	4.91
>45 min/day	117	21.27
Frequency/week category		
No exercise	276	50.18
1-3 times/week	166	30.18
4-7 times/week	108	19.64
Sleeping		
Short sleeper	23.0	4.18
Normal sleeper	322	58.55
Long sleeper	205	37.27

Dietary behaviors of the children

The study revealed that a majority of the children consistently consumed breakfast (66.91%), lunch (83.27%), and dinner (89.64%), with 53.27% opting for an additional portion of food. Furthermore, the findings indicated that a significant portion of the children regularly consumed junk food, with 52.0% indulging up to 3 times per week and 39.46% consuming it more than 3 times per week. Conversely, the majority of the children predominantly consumed homemade food (91.64%). The prevalence of the consumption of sugar-sweetened drinks (SSB) was high, with 89.64% of children drinking them 1-3 times per day (85.09%) or 4-7 times per day (4.55%). Additionally, the study highlighted that 17.82% of children used fat in their food freely, while 82.18% employed mild to moderate levels of fat usage (Table 2).

Table 2. Dietary behavior information of the school children

Dietary behavior information (N=550)	Number	Percentage
Breakfast		
No	182	33.09
Yes	368	66.91
Lunch		
No	92	16.73
Yes	458	83.27
Dinner		
No	57	10.36
Yes	493	89.64

Dietary behavior information (N=550)	Number	Percentage
Extra portions		
No	257	46.73
Yes	293	53.27
Eating junk food (fast food)		
No	47	8.55
Up to 3 times/week	286	52.00
More than 3 times/week	217	39.46
Type of food		
Fast food	46	8.36
Homemade food	504	91.64
Sugar-sweetened beverage		
No	57	10.36
Yes	493	89.64
SSB/day		
No SSB	57	10.36
1-3 times/day	468	85.09
4-7 times/day	25	4.55
SSB/week category		
No SSB	57	10.36
1-3 times/week	146	26.55
4-7 times/week	347	63.09
Fat in food		
Mild-moderate	452	82.18
Freely used by family	98	17.82

Physical activity and obesity among children's parents

The study revealed that a significant proportion of the children's parents had either no education or a low level of education. Additionally, approximately one-fourth of the parents were classified as being overweight or obese. Only a small percentage of the parents engaged in regular physical activity. Regarding health conditions, the prevalence of diabetes mellitus among fathers and mothers was found to be 12.73% and 12.36%, respectively (Table 3).

Table 3. Characteristics of parents of the school children

Characteristics (N=550)	Number	Percentage
Fathers' characteristics		
Education status		
Unable to read and write	65	11.82
Can read and write	142	25.82
Primary school	134	24.36
Intermediately school	75	13.64
Secondary	27	4.91
Institute or college and above	107	19.46

Characteristics (N=550)	Number	Percentage
Obesity/overweight		
No	405	73.64
Yes	145	26.36
Regular physical activity		
No	455	82.73
Yes	95	17.27
Diabetes mellitus		
No	480	87.27
Yes	70	12.73
Mothers' characteristics		
Education status		
Unable to read and write	194	35.27
Can read and write	142	25.82
Primary school	94	17.09
Intermediately school	45	8.18
Secondary (preparatory)	20	3.64
Institute or college and above	55	10.00
Obesity/overweight		
No	418	76.00
Yes	132	24.00
Regular physical activity		
No	484	88.00
Yes	66	12.00
Diabetes mellitus		
No	482	87.64
Yes	68	12.36

Obesity in children and its associated general and dietary characteristics

The study indicated that among school children, the prevalence of being overweight and of obesity was 13.27% and 14.91%, respectively. The majority of children were within the normal weight range (64.55%), while 7.27% were classified as underweight. Interestingly, the study found that females were more likely to be overweight (16.77%) and males were more likely to be obese (13.68%; p=0.023). Furthermore, the prevalence of obesity was not significantly associated with residency (p=0.3257), exercise (p=0.3508), sleep patterns (p=0.4569), or media consumption (p=0.6555; Table 4).

Table 4. Association of obesity with general information on the school children

Characteristics (N=550)	Underweight (N=40, 7.27%)	Normal healthy weight (N=355, 64.55%)	Overweight (N=82, 14.91%)	Obese (N=73, 13.27%)	*p*-value (two-sided)
Gender					
Female	12 (3.80)	210 (66.46)	53 (16.77)	41 (12.97)	0.0023
Male	28 (11.97)	145 (61.97)	29 (12.39)	32 (13.68)	
Residence					
Urban	33 (6.67)	321 (64.85)	73 (14.75)	68 (13.74)	0.3257
Rural	7 (12.73)	34 (61.82)	9 (16.36)	5 (9.09)	
Exercise					
No	15 (5.43)	178 (64.49)	44 (15.94)	39 (14.13)	0.3508
Yes	25 (9.12)	177 (64.60)	38 (13.87)	34 (12.41)	
Min/day exercise					
No exercise	15 (5.43)	178 (64.49)	44 (15.94)	39 (14.13)	
<30 min/day	10 (7.69)	84 (64.62)	16 (12.31)	20 (15.38)	0.6871
31-45 min/day	2 (7.41)	18 (66.67)	4 (14.81)	3 (11.11)	
>45 min/day	13 (11.11)	75 (64.10)	18 (15.38)	11 (9.40)	
Frequency/week					
No exercise	15 (5.43)	178 (64.49)	44 (15.94)	39 (14.13)	0.4430
1-3 times/week	14 (8.43)	103 (62.05)	27 (16.27)	22 (13.25)	
4-7 times/week	11 (10.19)	74 (68.52)	11 (10.19)	12 (11.11)	
Sleep pattern					
Short sleeper	1 (4.35)	12 (52.17)	4 (17.39)	6 (26.09)	0.4569
Normal sleeper	25 (7.76)	212 (65.84)	49 (15.22)	36 (11.18)	
Long sleeper	14 (6.83)	131 (63.90)	29 (14.15)	31 (15.12)	
Media watching					
<3 h/day	25 (7.18)	231 (66.38)	49 (14.08)	43 (12.36)	0.6555
3 and more h/day	13 (6.60)	122 (61.93)	32 (16.24)	30 (15.23)	

Notes: Pearson chi-squared test was performed for statistical analyses.

Furthermore, our analysis did not reveal a significant difference in the prevalence of obesity and being overweight among children with varying dietary behavior characteristics (Table 5).

Table 5. Association of obesity with the dietary behavior information on the school children

Dietary information (N=550)	Underweight (N=40)	Normal healthy weight (N=355)	Overweight (N=82)	Obese (N=73)	*p*-value
Breakfast					
No	9 (4.95)	117 (64.29)	30 (16.48)	26 (14.29)	0.4416
Yes	31 (8.42)	238 (64.67)	52 (14.13)	47 (12.77)	
Lunch					
No	5 (5.43)	59 (64.13)	14 (15.22)	14 (15.22)	0.8404
Yes	35 (7.64)	296 (64.63)	68 (14.85)	59 (12.88)	

Dietary information (N=550)	Underweight (N=40)	Normal healthy weight (N=355)	Overweight (N=82)	Obese (N=73)	*p*-value
Dinner					
No	2 (3.51)	33 (57.89)	11 (19.30)	11 (19.30)	0.2371
Yes	38 (7.71)	322 (65.31)	71 (14.40)	62 (12.58)	
Extra portions					
No	15 (5.84)	161 (62.65)	37 (14.40)	44 (17.12)	0.0686
Yes	25 (8.53)	194 (66.21)	45 (15.36)	29 (9.90)	
Junk food (fast food)					
No	4 (8.51)	26 (55.32)	7 (14.89)	10 (21.28)	0.2417
Up to 3 times/week	21 (7.34)	179 (62.59)	51 (17.83)	35 (12.24)	
More than 3 times/week	15 (6.91)	150 (69.12)	24 (11.06)	28 (12.90)	
Type of food					
Fast food	0 (0.00)	30 (65.22)	7 (15.22)	9 (19.57)	0.1608
Homemade food	40 (7.94)	325 (64.48)	75 (14.88)	64 (12.70)	
Sugar-sweetened beverage					
No	2 (3.51)	34 (59.65)	8 (14.04)	13 (22.81)	0.1185
Yes	38 (7.71)	321 (65.11)	74 (15.01)	60 (12.17)	
SSB/day					
No SSB	2 (3.51)	34 (59.65)	8 (14.04)	13 (22.81)	0.2233
1-3 times/day	35 (7.48)	303 (64.74)	71 (15.17)	59 (12.61)	
4-7 times/day	3 (12.00)	18 (72.00)	3 (12.00)	1 (4.00)	
Frequency/week					
No SSB	2 (3.51)	34 (59.65)	8 (14.04)	13 (22.81)	0.2792
1-3 times/week	13 (8.90)	89 (60.96)	24 (16.44)	20 (13.70)	
4-7 times/week	25 (7.20)	232 (66.86)	50 (14.41)	40 (11.53)	
Fat in food					
Mild-moderate	31 (6.86)	293 (64.82)	64 (14.16)	64 (14.16)	0.3783
Freely used by family	9 (9.18)	62 (63.27)	18 (18.37)	9 (9.18)	

Notes: Pearson chi-squared test was performed for statistical analyses.

However, the study did uncover a notable association between children with overweight or obese fathers and the likelihood of being overweight/obese in children. Interestingly, the prevalence of being overweight and of obesity among children was not found to be associated with other general characteristics of the parents (Table 6).

Table 6. Association of obesity of school children with parents' characteristics

Characteristic of parents (N=550)	Underweight (N=40)	Normal healthy weight (N=355)	Overweight (N=82)	Obese (N=73)	*p*-value
Father					
Education					
Unable to read and write	2 (3.08)	50 (76.92)	8 (12.31)	5 (7.69)	
Can read and write	15 (10.56)	89 (62.68)	20 (14.08)	18 (12.68)	
Primary school	8 (5.97)	88 (65.67)	23 (17.16)	15 (11.19)	0.5731
Intermediately school	4 (5.33)	48 (64.00)	9 (12.00)	14 (18.67)	
Secondary	3 (11.11)	14 (51.85)	5 (18.52)	5 (18.52)	
Institute/college and above	8 (7.48)	66 (61.68)	17 (15.89)	16 (14.95)	
Obesity/overweight					
No	35 (8.64)	267 (65.93)	57 (14.07)	46 (11.36)	0.0247
Yes	5 (3.45)	88 (60.69)	25 (17.24)	27 (18.62)	
Regular physical activity					
No	32 (7.03)	296 (65.05)	67 (14.73)	60 (13.19)	0.9426
Yes	8 (8.42)	59 (62.11)	15 (15.79)	13 (13.68)	
Diabetes mellitus					
No	37 (7.71)	312 (65.00)	70 (14.58)	61 (12.71)	0.5167
Yes	3 (4.29)	43 (61.43)	12 (17.14)	12 (17.14)	
Mother					
Education					
Unable to read and write	16 (8.25)	126 (64.95)	27 (13.92)	25 (12.89)	
Can read and write	7 (4.93)	101 (71.13)	16 (11.27)	18 (12.68)	
Primary school	5 (5.32)	59 (62.77)	20 (21.28)	10 (10.64)	0.3528
Intermediately school	5 (11.11)	29 (64.44)	5 (11.11)	6 (13.33)	
Secondary	3 (15.00)	10 (50.00)	5 (25.00)	2 (10.00)	
Institute/college and above	4 (7.27)	30 (54.55)	9 (16.36)	12 (21.82)	
Obesity/overweight					
No	35 (8.37)	271 (64.83)	57 (13.64)	55 (13.16)	0.1845
Yes	5 (3.79)	84 (63.64)	25 (18.94)	18 (13.64)	
Regular physical activity					
No	38 (7.85)	313 (64.67)	70 (14.46)	63 (13.02)	0.4568
Yes	2 (3.03)	42 (63.64)	12 (18.18)	10 (15.15)	
Diabetes mellitus					
No	38 (7.88)	314 (65.15)	66 (13.69)	64 (13.28)	0.1075
Yes	2 (2.94)	41 (60.29)	16 (23.53)	9 (13.24)	

Notes: Pearson chi-squared test was performed for statistical analyses.

Predictors of obesity of school children

The study revealed that being male and having overweight or obese fathers were significant predictors of the prevalence of obesity among the school children. However, other factors examined were not shown to predict

obesity among this demographic, as depicted in Table 7.

Table 7. Predictors of obesity of the school children

Factors (N=550)	Outcome: obesity	*p*-value
Gender		0.01139
Father's obesity/overweight		0.01928
Student's age		0.11359
SSB/day		0.12786
Frequency of eating junk food (fast food)		0.15212
Mother's education status		0.17831
Sleeping		0.18188
Extra portions		0.20458
Dinner		0.28971
Father's education status		0.39176
Mother's obesity/overweight		0.41352
Regular physical activity (mother)		0.44628
Consumption of fat in food		0.54588
Breakfast		0.58870
Min/day exercise		0.64600
Residence		0.85332
Regular physical activity (father)		0.93661
Lunch		0.95976

Notes: The nominal logistic regression was performed for statistical analyses.

Discussion

This study showed that most children had normal BMI values (boys, 61.97%; girls, 66.46%), 14.91% were overweight (boys, 12.39%; girls, 16.77%), and 13.27% were obese (boys, 13.68%; girls, 12.97%). The prevalence of being overweight in our sample of children was 14.91%.

The findings reported in this study are similar to those observed in certain neighboring Middle Eastern nations, such as Jordan [13]. However, this investigation also revealed that the occurrence of being overweight and of obesity among Duhok adolescents was comparatively lower than in several other countries. For instance, in Saudi Arabia the prevalence of being overweight and of obesity in adolescents aged 15-19 years was reported as 16% and 24%, respectively [14]. Meanwhile, among adolescents with a mean age of 14.9 years in the eastern United States, the projected prevalence of being overweight was 19.8%, and for obesity, it was 26.6% [15]. Additionally, the rates of being overweight and of obesity discovered in this current research were similar to those documented among Chinese adolescents aged 13-17 years [15].

The present study showed a lower prevalence compared to research findings in Ghana, which reported a rate of 16.4% [16], and in China, where the rate was 20.0% [17]. The variability in these rates may stem from diverse factors, including socio-demographic and economic distinctions [18]. The prevalence of being overweight and

of obesity among secondary school students in the Kurdistan Region exceeds those in certain other countries. For instance, in Morocco, the prevalence of being overweight and of obesity in adolescents aged 12-18 years was estimated at 7.69% and 3.41%, respectively [18].

An additional potential explanation for the escalation of obesity among younger individuals could be their increased exposure to fast food compared to older age groups. Our investigation showed a noticeable elevation in the prevalence of being overweight and of obesity linked to gender. Our findings indicated that the prevalence of being overweight was greater among girls than boys, and this discrepancy was statistically significant (16.77% vs. 12.39%).

The findings from this study are different to the results from other research that indicated elevated rates of weight gain and obesity among girls [19]. The observed sex-related differences in our study can potentially be attributed to the fact that boys have more exposure to unhealthy fast food compared to girls. The boys in our region have increased opportunities to spend time with their friends away from home. Our study identified a prevalence of weight gain and obesity among Kurdish teenagers, with boys being at a higher risk of obesity compared to girls. The gender-based variations observed in our study can be ascribed to the distinct characteristics of Kurdish culture. Contrarily, adolescent girls, who often place a heightened emphasis on their body image, tend to adopt healthier dietary practices and demonstrate greater vigilance over their eating habits.

The impact of gender on obesity can be linked to hormonal shifts during puberty, leading to the emergence of secondary sexual traits that facilitate the accumulation and redistribution of fat [20]. The WHO recommends that children and adolescents aged 5-17 engage in a minimum of 60 minutes of moderate to vigorous-intensity physical activity daily. It is advised to include vigorous-intensity exercises that promote muscle and bone strength, at least three times a week [21].

The prevalence of being overweight and obese was not significantly different between urban and rural areas than in our study. The prevalence of obesity based on the residency could be different within various geographic locations [22,23]. The culture of the people in urban and rural areas of developing and developed countries could be a reason for this discrepancy.

Although the study indicated a lack of statistical significance between BMI and the educational background of parents. It is worth noting that higher BMI in children often appears linked to parents with lower levels of education. Educated individuals tend to exhibit a greater awareness of this issue and a higher dedication to safeguarding their children against the risks of excess weight and obesity [23].

Contrary to other research [24], this study found no correlation between watching TV for more than 3 hours per day and having a high BMI. Unlike some studies where BMI was notably linked to increased hours of TV viewing per day, this inconsistency might be attributed to the cultural norm in our society, where the practice of eating while watching TV is less prevalent.

Sleep duration, which regulates body weight and metabolism through the modulation of pivotal hormones such as leptin [25] emerges as a noteworthy factor. However, it could also potentially be a secondary consequence of being overweight or obese [26]. In contrast, factors such as the consumption of "junk" food [26] did not yield significant results in our study.

The association between obesity and being overweight and the fathers' occupation and education level was not statistically significant in our study. Although the study showed that children primarily consumed meals at home, they still encountered the availability of harmful items like chips, sugary beverages, and sweets at school. The behavior of consuming junk food and sweet beverages is common in other regions as well [27]. This situation poses a hazard to children's growth and well-being, contributing to both the risk of obesity and non-communicable diseases (NCDs) due to the inadequate expenditure of energy that children consume [28]. The excess energy is subsequently stored as body fat, leading to an elevation in body weight and placing a child at risk of developing obesity, cardiovascular ailments, and diabetes [29].

Recommendations

The outcomes of the current study call for the necessity to establish a strategic approach for preventing and addressing this growing endemic. Contemporary dietary behaviors significantly contribute to the emergence of childhood obesity, necessitating careful observation and control. We propose the implementation of platforms aimed at educating adolescents about the significance of balanced nutrition, along with increasing awareness about the risks associated with excessive weight gain. Such measures are pivotal in the prevention of nutrition-related ailments. Furthermore, it is advisable to incorporate courses in the high school curriculum in Duhok that promote the adoption of healthy eating habits and regular engagement in sports and physical activities. Moreover, the introduction of supplementary educational initiatives to address matters linked to being overweight and to obesity is crucial for nurturing a generation characterized by both physical health and mental well-being.

Strengths and limitations

The strong points of this study are including a sufficient sample size of school children through a random sampling technique. However the study was not exempt from limitations. The variables included in the study were self-reported data, introducing the potential for both over- and under-reporting. In addition, we may have not included all the related factors to being overweight and obesity, such as social and psychological factors. We used the BMI as an indicator of obesity. BMI is not as accurate an index as waist-hip ratio and skin-fold thickness, which directly measure fat mass. It's important to emphasize the need for further research to explore other relevant factors that were not covered in the current study.

Conclusions

To summarize, the study revealed a notable prevalence of being overweight and of obesity among adolescents residing in Duhok City. The escalation in obesity rates is likely attributed to swift urbanization, the shift from traditional to Western lifestyles, and the adoption of unhealthy dietary patterns. The study identified that being the female gender and having a father who is classified as overweight or obese were associated factors to obesity and being overweight.

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Artificial intelligence (AI) was not used in the creation of the manuscript.

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