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Prevalence and Associated Factors of Overweight and Obesity among Adolescents students: A Cross-Sectional Study in a Developing country.

Maha. A. Kadim[1], Zainab Abdulameer Abdulrasol [2], Ali Fadhil Obaid[3], Yasmin Ali. Abbas[4] & Noor Amar Latif[5]

[1]*Assist. Lect., Msn. pediatric Nursing. College of Nursing, University of Babylon, Iraq.*

[2]*Assist. Lect., Msn. Maternal and Newborn Health Nursing, College of nursing, University of Babylon, Iraq.*

[3]*Msn. pediatric Nursing. College of Nursing, University of Babylon, Iraq.*

[4,5]*Academic Nurses, Ministry of Health, Iraq.*

Corresponding Author: Zainab Abdulameer Abdulrasol, **Email:** saraaameer44@gmail.com

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ABSTRACT

Background: The epidemic of obesity in developed countries is commonly associated with poor dietary habits and a sedentary lifestyle. Obesity and overweight are defined as an excessive buildup of body fat and pose a risk to health. Adolescent obesity continues to be a subject of increasing global public health importance and is considered a vital risk factor for obesity and associated morbidity in adulthood. ***Methods:*** A descriptive cross-sectional study was carried out among (500) students in AL-Hilla city from the period 12th January to 2nd April 2022 at (10) secondary schools. The questionnaire is composed of two parts; Part one: involved the socio-demographic characteristics of students and their parents. This section also includes BMI was calculated by measuring height& weight; weight was measured with domestic scales and height with a meter rule and classified according to international classification. Part two is related to the risk factors of obesity. Data were collected through direct interviews with students for filling the tool required by spending approximately 20-30 minutes. **Results:** Obesity and overweight were predominant at age (16-17) (58.6 %), and most of them were male (56.4 %) whose come from governmental schools (86.8 %). 28.8% of the sample were overweight and (14.4%) were obese children. Boys are riskier to be overweight and obese than girls (OR= 1.55, 95%CI (1.33 -1.807). Adolescents who did vigorous physical activity were less risky to be obese one time compared to those with non-vigorous activity OR=1.072, 95% CI= (0.966-1.189). **Conclusion:** The study conclude that around forty-three percent of adolescent school students were either overweight or obese. So, indicated that obesity was predominant at age (16-17) among Iraqi adolescent students aged 14-19 years. In addition, adolescents' eating habits and physical activity were highly significant factors in overweight/ obesity. Therefore, interventions are recommended to focus on these risk variables of overweight and obesity.

Keywords: Obesity, Overweight, Physical activity, Eating habits, Adolescent School student.

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INTRODUCTION

Overweight and obesity are characterized as excessive or abnormal fat accumulations that compromise an individual's health. The World Health Organization has classified obesity as a "global epidemic" that lowers young people's life expectancy significantly and raises the risk of future morbidity (Arora et al., 2019). Obesity is also the fifth leading cause of death globally. (Shabu, 2019), (Nicolucci & Maffeis, 2022). Adolescence is a critical phase in which most of the body's growth and development occur. It is a period that marks the transition from childhood to adulthood and traditionally covers the ages of 12 to 19 years. Furthermore, are a good force for a country, accountable for their future success as well as the prosperity of their nations. Nearly 35% of the global burden of disease has its root emergence in adolescence (Prasad, Bazroy, & Singh, 2016), (Seema et al., 2021). Adolescent obesity is among the twenty-first century's most significant public health issues. (Alredainy & AL-Lami, 2016), (Prasad, Bazroy, & Singh, 2016).

According to WHO; obesity and overweight prevalence increased from four percent in 1975 to slightly over eighteen percent in 2016 among children and adolescents average age of 5-19 years (Brown et al., 2019), with 340 million children and adolescents being overweight or obese in 2016 (Arora et al., 2019). In addition, the United States has risen from 31.8 percent in 2011 to 33.2 percent in 2013 in the age range of 6-19 years (Alencar et al., 2016). Several Iraqi studies aimed at analyzing the prevalence of overweight and obesity among adolescents revealed a significant increase in our society (Alredainy & AL-Lami, 2016). In 2009, the prevalence of overweight and obesity in Kurdistan was 8.3% and 7.9%, respectively (AL-DABBAGH& MOHAMMED, 2009), but by 2020, the obesity prevalence in Mosul City was 26% (Sulaiman, 2020). So according to recent research, obesity in adolescence is a risk factor for obesity and related illness in adulthood, with 50 to 80 percent of obese adolescents becoming obese adults. As a result of the influence on the child's physical and psychological health (Abiri et al. 2019), (Arora et al., 2019). Aside from psychological and emotional issues, adolescent obesity can lead to life-threatening illnesses such as diabetes, high blood pressure, heart disease, cancer, and other disorders such as liver disease, early puberty or menarche, sleep problems, skin infection, and asthma (Arora et al., 2019).

Given the fact that regular physical exercise and adherence to a balanced diet are essential for losing extra weight or maintaining a healthy weight (Alencar et al., 2016). Worldwide statistics show that physical activity levels in younger people are considerably low, and both

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developed and developing nations consider physical inactivity prevalence to be a serious public health problem (Sulaiman, 2020) (Eker et al., 2018). The level of physical activity, food system, sedentary lifestyle, urbanization, a short time of BF, eating snacks frequently, an increase in fast food, increasing in time spent watching TV, ingesting caloric dense foods with a high glycemic index, and rich in saturated fats and trans-fatty acids (EMR) are factors associated with overweight and obesity prevalence (Musaiger (2011), (Al-hadabi et al., 2017), (Abiri et al., 2019). However, a certain study in Egypt (Genena & Salama, 2017); the most prevalent harmful eating behaviors of the participants were irregular and infrequent meals, poor vegetable consumption, and frequent snaking. Additionally, education level, demographic characteristics, and older age groups of children are significantly associated with obesity and overweight (Hallal et al., 2012).

Behavioral changes in an individual, such as encouraging daily physical activity, have been the main focus of interventions for overweight/obesity prevention (Kansra et al., 2021) (Brown et al., 2019). In addition, lifestyle modifications toward a healthy diet, such as improving meal quality while avoiding extra calories, can help. So, evidence shows that modifying these health practices might improve cognitive function and school performance in children and adolescents in general (Martin et al., 2018). Identifying the risk factors that contribute to overweight and obesity is the first step in their control and prevention. Therefore; the aim of this study was to determine the prevalence of obesity and its risk factors among adolescent students in Hilla city, Babylon.

METHODOLOGY

Study design: Descriptive study of the cross-sectional design was conducted to identify the prevalence of obesity and its associated risk factors among adolescent school students in AL-Hilla city from the period of 12th January to 2nd March 2022.

Setting of study: This study was conducted at (10) secondary schools in AL-Hilla city; which include (5) private schools and (5) governmental schools.

Sample of study: The sample was chosen as a non-probability convenience type and it included (500) students, a sample size of (500) was determined by considering the 9.4% expected prevalence among adolescents using single proportion formula (Anteneh et al., 2015). Based on the proportion of students in each school, calculated samples of students were chosen from those schools. The study included all adolescents aged 14 to 19 in private and

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public schools, but excluded those over the age of 20, physically disabled, pregnant, and suffering from chronic diseases.

Instrument of study: The questionnaire was constructed after an extensive literature review and exposed to a panel of experts to be clear and applicable for data collection composed of two parts, and rated on a binary scale (1 = Yes; 2= No).

Part one: involved General information, related to socio-demographic characteristics of students and their parents. This section also includes BMI was calculated by measuring height& weight. Each participant's weight has been measured with domestic scales and height with a meter rule. And classified according to international classification (Hockenberry and Wilson, 2015); underweight (less than 18.5 kg), Normal weight (18.5 to 24.9), Overweight (25 to 29.9), Obesity (30 or greater). Part Two related to risk factors of obesity among adolescent students.

Data collection: Data were collected by researchers who interviewed students for filling the tool required by spending approximately 20-30 minutes. Written informed consent was obtained for each participant less than 18 years from their parents after sending the information form.

Statistical Analysis: The data which are collected for the purpose of the study are analyzed electronically by using the Statistical Package of Social Science (SPSS) version 24 by application of frequencies, percentages as descriptive, and inferential as correlational statistics, logistic regression. The odds ratio (OR), and 95% confidence interval (CI) were calculated for each categorical variable and statistically determined as a significant factor at ($p<0.05$).

Ethical consideration: Ethical approval was obtained from the research ethics committee at the college of nursing, Babylon university in Iraq. Agreements were obtained from the Ministry of Education/ Babylon Education directorate, then the school's administrative offices were given permission. Written informed consent was obtained for each participant less than 18 years from their parents after sending the information form. Explained that each participant has the right to accept or refuse participation during data collection. So, informed them about the purpose of this study and that all participant's data will be kept confidential.

RESULTS

Part one: Parent-students Demographical data

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Table 1: Distribution of the student-Parents Socio-demographic data

Items		Frequency	Percent %
Age	14-15	44	8.8
	16-17	**326**	**65.2**
	18-19	130	26.0
	Total	500	100.0
Gender	Male	**282**	**56.4**
	Female	218	43.6
	Total	500	100.0
School type	Governmental	**284**	**56.8**
	private	216	43.2
	Total	500	100.0
Father occupation	Working	**404**	**80.8**
	Not working	96	19.2
	Total	500	100.0
Mother occupation	Working mother	148	29.6
	House wife	**352**	**70.4**
	Total	500	100.0
Moher education	Illiterate	12	2.4
	Read and write	39	7.8
	Primary	81	16.2
	Secondary	**234**	**46.8**
	Diploma	134	26.8
	Total	500	100.0
Residence	Urban	**469**	**93.8**
	Rural	31	6.2
	Total	500	100.0
Socio-economic status	Enough	**302**	**60.4**
	Enough to some extent	178	35.6
	Not enough	20	4.0
	Total	500	100.0
Family history	Yes	114	22.8
	No	**386**	**77.2**
	Total	500	100.0

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Table (1) show that obesity and overweight were predominant at age (16-17) (65.2%), and most of them were male (56.4%) whose come from government school (56.8%). In addition, a higher proportion of the participants lived in rural areas (93%). Father's occupation was working and the mother's occupation was a housewife (80.8%), (70.4%) respectively. However, (46.8%) of the children's mother's education level was secondary with enough (60.4%) socioeconomic status. As well, (22.8%) of participants were having a family history of obesity.

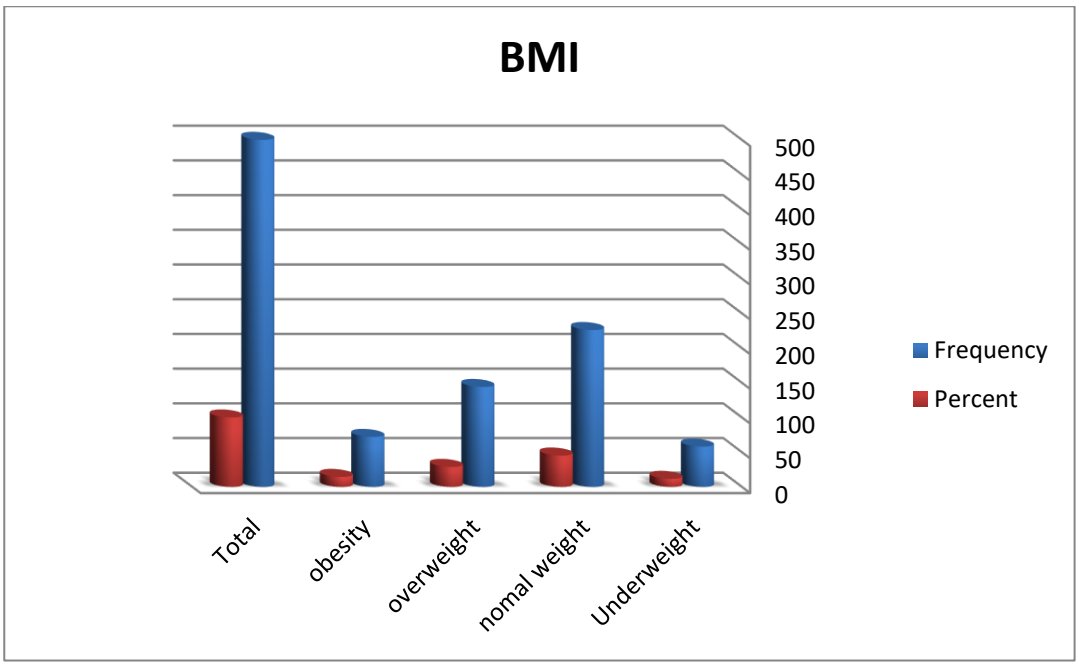

Figure 1: **Body Mass Index (BMI) Percentage among Adolescent Students, in AL-Hilla City, Babylon 2022.**

Figure (1) found that the percentage of body mass index: (28.8%) of the participants were OW, and (14.4%) were OB. While (45.2%), (11.6%) were normal weight, under-weight respectively.

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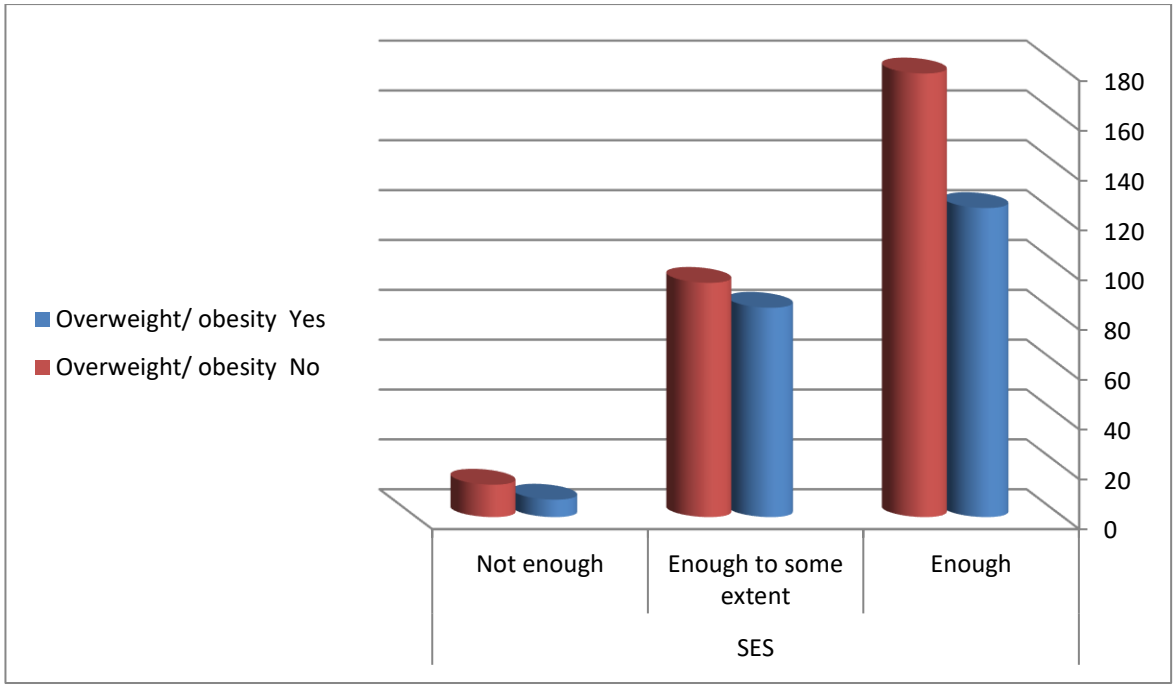

Figure 2: **Distribution of Socioeconomic status among overweight and obese students.**

The majority (41.1%) of overweight and obese adolescent school students fall into a high socioeconomic status, as shown in figure (2).

Part II. Risk factors of obesity among school students.

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Table 2.1: physical activity

Items		Frequency	Percent
Vigorous activity	Yes	261	52.2
	No	239	47.8
	Total	500	100.0
Number of days vigorous activity was done per week	1-3	**126**	**25.2**
	4-6	72	14.4
	≥ 7	63	12.6
	Non	239	47.8
	Total	500	100.0
Moderate physical activity	Yes	**369**	**73.8**
	No	131	26.2
	Total	500	100.0
Number of days moderate activities were done /week	1-3	**226**	**45.2**
	4-6	81	16.2
	≥7	62	12.4
	Non	131	26.2
	Total	500	100.0
Mean of transport	Taxi	**285**	**57.0**
	Bicycle	44	8.8
	Feet	119	23.8
	Sometimes vehicle	52	10.4
	Total	500	100.0
Vigorous sport	Yes	198	39.6
	No	**302**	**60.4**
	Total	500	100.0
Number of days vigorous sport was done per week	1-3	**108**	**21.6**
	4-6	53	10.6
	≥7 days	37	7.4
	Non	302	60.4
	Total	500	100.0
Number of hours spent in TV watching	Non	52	10.4
	1 - 2	**349**	**69.6**
	2.1 - 3	59	11.8
	3.1 - ≥ 4	41	8.2
	Total	500	100.0

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Table (2.1) shows that more than half (52.2%) were doing vigorous activity 1-3 times per week. In addition, the majority of parentage (73.8%) were moderate physical activity for one-three days per week. Most of them 57.0 % were transported to school by taxi. Also, a higher percentage (69.8%) spent 1-3 hours watching TV.

Table (2.2) concludes that more than half (54.6%) of the sample consumed fruit 1-3 days per week which included one time per day. So, vegetable intake per week mainly (51.4%) was 1-3 days within one-time per day.

Also, this table shows that the average of eating food out of home (fast food) was 1-2 times per week (60.0%). The majority of samples (76.4) were eaten snacks, most (58.6%) of them were eaten one- two-time snacks per day, and (59.0%) had two main meals other than snacks per day. Chocolate consumed was high percent (39.2%) as a portion of food eaten other than the main food (snack).

Table 2.2: Dietary habits

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Variables		Frequency	Percent
Number of days of fruit intake/week	Non	61	12.2
	1-3	**273**	**54.6**
	≥4	166	33.2
	Total	500	100.0
Number of times of fruit intake on the day fruit were taken	1	**192**	**38.4**
	2	185	37.0
	≥ 3	62	12.4
	Non	61	12.2
	Total	500	100.0
Number of days of vegetables intake/week	Non	116	23.2
	1-3	**257**	**51.4**
	> 3	127	25.4
	Total	500	100.0
Number of times of vegetables intake on the day fruit were taken	1	**179**	**35.8**
	2	136	27.2
	≥ 3	69	13.2
	Non	116	23.2
	Total	500	100.0
Average times of eating food out of home per week	1-2	**300**	**60.0**
	3-4	119	23.8
	≥ 5	59	11.8
	Non	22	4.4
	Total	500	100.0
Eaten snack?	Yes	**382**	**76.4**
	No	118	23.6
	Total	500	100.0
Number of times snack was eaten per day	1-2	**293**	**58.6**
	3-4	89	17.6
	Non	118	23.6
	Total	500	100.0
Number of times of normal food eaten other than snack/day	2	**295**	**59.0**
	3	164	32.8
	> 3	41	8.2
	Total	500	100.0
The food eaten other than main food	Cake	167	33.4
	Biscuit	88	17.6

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	Ice cream	31	6.2
	Chocolate	**196**	**39.2**
	Non	18	3.6
	Total	500	100.0

Table (3) conclude; In bivariate, multivariable logistic regression, and cross-tabulation analysis; age, gender, residence, school type, vigorous activity, number of vigorous activity/week, time of TV watching, number of vegetables and fruit intake per day were significantly associated with overweight and obesity.

Table (3): Association between some predicted varibles and overweight/ obesity among adolescent students (*n=500*)**.**

Items	Classification	Overweight /Obesity		*OR and 95% of CI value*			Sig
		Yes	No	OR	Min	Max	
Age (years)	14-15	18	26	1.655	0.288	9.531	0.064
	16-17	148	178	4.298	.848	6.231	
	18-19	49	81		1.00		
Gender	Male	152	130	1.55	1.33	1.807	0.000**
	Female	63	155		1.00		
School type	Governmental	163	121	4.249	2.875	6.279	0.000**
	Private	52	164		1.00		
Residence	Urban	196	273		1.00		0.034*
	Rural	19	12	2.099	1.719	2.416	
SES	Enough	124	178	2.140	0.661	6.930	0.264
	Enough to some extent	84	94	1.609	0.502	5.158	
	No enough	7	13		1.00		
Family history of obesity	Yes	46	169	1.032	.938	1.136	0.516
	No	68	217		1.00		
Vigorous activity	Yes	97	164		1.00		0.006**
	No	118	121	1.072	0.966	1.189	
Vigorous sports?	Yes	82	116		1.00		0.563
	No	133	169	1.047	0.897	1.221	
Number of vigorous activity per week (n=383)	1-3	45	81	2.509	.158	2.509	0.032*
	4-6	38	34	1.014	.067	1.014	
	≥7	15	48	0.587	0.036	0.587	

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Hours spent of TV watching (n=448)	1-2	131	218	0.674	0.279	1.628	0.041*
	2.1 to 3	31	28	0.483	0.146	1.599	
	3.1 to ≥ 4	15	25	2.042	0.137	2.177	
Number of times of fruit intake per day (n=493)	1	76	137	3.448	1.834	6.483	0.001**
	2	93	109	4.746	2.601	8.659	
	≥ 3	39	39	5.189	5.189	5.189	
Number of times of vegetables intake per day (n=479)	One	82	163	0.518	0.285	1.939	0.003**
	Two	74	84	1.309	0.727	2.357	
	≥ 3	38	36	3.211	1.060	4.611	

OR= *odd ratio*, CI= *Confidence interval*, *= Significant, MIN= minimum, MAX= maximum, Sig= Significant

In addition, students aged (16 -17) are a higher rate to be obesity than other age groups (OR= 4.298, 95%CI= (0.848- 6.231). Boys are more riskier to be obese than girls (OR= 1.55, 95%CI (1.33 -1.807). In addition, adolescents with high SES (socio-economic status) have a high rate of prevalence of obesity than those of lower income (OR=2.140, 95%CI= (0.661- 6.930). Statistically, obesity is strongly associated with school type, which is higher in governmental schools than in private at OR=4.249 (2.875-2. 6.279).

Also, adolescents with non-vigorous vigorous physical activity were more risky to be obese one time compared to those with vigorous activity (OR=1.072, 95% CI= (0.966-1.189). Furthermore, students who did not participate in vigorous sports were more than one time as likely to develop (overweight and obesity) as those who did it. (OR=1.047, 95% CI= (0.897-1.221).

Students who engaged in vigorous physical activity four-six-time per week are more likely to decline in obesity than those who engaged in vigorous physical activity one time per week (OR=2.509, 95%= 0.158-2.509). Furthermore, respondents who watched TV for three to more than four hours are more likely to be obese than those who watch TV for less than two hours (OR=2.042, 95%=0.137-2.177). However,Obesity has a likelihood to decrease five times in a student who consumed the fruit more than three times compared to those with one time (OR= 5.189, 95% CI= 5.189-5.189). So, participants who consumed vegetables two and three-time per day are more likely to decrease obesity compared to one-time vegetables (OR= 3.211,95% CI=(1.060-4.611).

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DISCUSSION

Globally, obesity in adolescents is considered a major health problem because of changes in lifestyle and the occurrence of puberty among this age group (Kumar et al., 2020).

In the current study, around forty-three percent of adolescent school students were either overweight or obese. As inactive lifestyles and a lack of physical activities to have a more comfortable life in the Iraqi population, therefore obesity prevalence has become a major public health concern (Sulaiman, 2020). However, several supported studies conducted in Iraq showed a significant increase in the prevalence of overweight and obesity among adolescents (Alredainy & AL-Lami, 2016), (Sulaiman, 2020), (Mohammed et al., 2019).

Sociocultural variables may play a role in the differences in obesity prevalence between boys and girls. Some data shows that females choose low-energy, nutrient-dense diets, whereas guys prefer meat and calorie-dense foods. According to these data, parents are more concerned about the weight of their girls than their sons. Interestingly, girls in high and upper-middle-income nations tend to have lower obesity prevalence than boys" (Shah et al., 2020), and our data are in line with these findings.

Mesawa et al., 2020, reported that obesity and socioeconomic status have a correlated relationship, obesity influences children's SES levels, and the prevalence of obesity may affect SES as well. The study revealed that families with higher SES are more likely to be obese than those with a lower SES. As a result (Mahmoud et al., 2019), school students from higher-income households have a broader selection of eating options, including meals offered in restaurants. Restaurant meals are often higher in fat and salt content, as well as greater in calorie density. Furthermore, students with a higher daily pocket income may result in less strict parental control of the child's food habits, which may lead to an increased intake of carb and sugar "fast" food.

Traditionally, rural participants consume a higher percentage of kcal from fat due to rural cultural eating patterns and limited access to healthy foods, which may play a causal role in their higher obesity prevalence (Befort et al., 2013). This is consistent with our findings, which show that students from rural areas are more significant to be obese than those from urban areas.

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Interestingly, in our study obesity was highly significant among adolescents in governmental schools than in private, According to (Wajihah & Ghazalli, 2020), 35 to 47 percent of children's and adolescents' dietary intake begins at school; eating less healthy foods at school was positively associated with obesity/overweight.

However, (Provenzano et al., 2018) A major study about rates of obesity among students in Palermo, discovered more students in public schools are overweight or obese than those in private schools. While another study (Kyallo et al. 2013) found that overweight/obesity rates in private school children were significantly higher (29%) than in public school children. According to (Dighe et al., 2020), the disparities in obesity rates between private and public schools may be due to differences in the sociodemographic, environmental, and cultural characteristics of the students who attend. Additionally, providing unhealthy items in vending machines and a lack of facilities for physical activity in schools may contribute to obesity.

El Kabbaoui et al.,2018 conclude that (overweight and obesity) were correlated with mode of transportation to school; walking has been shown to be beneficial to health and weight control, but motorized vehicle use is associated with overweight and other problems. The majority (57.0) percent of adolescents used taxi transport to school in the present study.

Adolescents should engage in physical activity for 60 minutes or more every day of the week because a lack of physical activity is a major lifestyle factor linked to being overweight and obese (Mohammed et al., 2019). According to a supported study conducted in Egypt by (Mosleh et al.2011), people who are overweight or obese are more likely to be inactive.

Additionally, in our study, participants who engaged in vigorous physical activity had a lower risk of becoming overweight or obese than participants who did not. This might be a result of the fact that vigorous exercise burns off body fat and is linked to a lower risk of being overweight or obese, according to (Janssen et al., 2019), (Anteneh et al., 2015).

Further to that, there was a statistical association between the frequency of vigorous physical activity and the prevalence of overweight and obesity. Students who engaged in vigorous physical activity less frequently had a higher likelihood of being overweight or obese (WHO, 2014). (Li et al., 2020).

A study conducted in the USA (Al-momen, 2022) found that one hour of TV watching was associated with a decreased obesity incidence, compared to four hours of watching.

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According to Abduelkarem et al., 2020, increasing the hours spent on cellphones or tablets increases the risk of obesity, and there is a link between time spent on the phone and gender, with the male being more engaged in electronic devices than the female.

Finally; Certain studies show an inverse relationship between fruits and vegetables intake and weight gain; fruits contain a high concentration of soluble dietary fibers, which may increase postmeal satiety and lower the glycemic index and glycemic load of consumed foods, resulting in decreased energy absorption. So, vegetables have the same characteristics; therefore, people who consumed more than four vegetable servings per day had an 82 percent and 73 percent lower risk of weight gain >3.4 and 3 kg, respectively (Yu et al., 2018), (Nour et al., 2018).

CONCLUSION

The study conclude that around (43%) of adolescent school students were either overweight or obese. So, it was predominant at age (16-17) among Iraqi students aged 14-19 years. Boys are more risky to be overweight and obese than girls. Also, there is a positive relationship between the overweight and time hours spent on TV, whereas the weight increases when the time spent on TV increases. In addition, the analysis showed that there is a negative relationship between overweight with number times fruit intake the day, number times of vegetable intake during the day. However, adolescents who did vigorous physical activity were less risky to be obese one time compared to those with non-vigorous activity.

RECOMMENDATION

The study suggested increasing the public's awareness about childhood obesity by organizing educational programs specifically for adolescent students to gain more information about the risks of diseases related to obesity. Furthermore, the school curriculum should be included topics about healthy nutritional habits and promotion of the physical activity. Further investigation is required in the near future, to achieve a decrease in obesity progression and to reduce the morbidity of non-communicable diseases that are associated with obesity. More attention should be paid by health authorities to this important health problem including the endorsement of a well-designed preventive program.

Abbreviation: *BF: breast-feeding, OW:overeweight, OB: obesity, WHO: world health organization.*

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