

Examining the prevalence of obesity in school children through an on-site obesity outpatient clinics survey based on student's lifestyles

F.A. ALRASHED¹, T. AHMAD², A.M. ALSUBIHEEN³, S.A. ALGHAMDI⁴, S.I. MAZI¹, N.A. MOHAMED⁵, A.M. ALHAYSSONI²

¹Department of Cardiac Sciences, College of Medicine, King Saud University (KSU), P.O. Box 7805, Riyadh 11472, Saudi Arabia

²College of Medicine, King Saud University (KSU), P.O. Box 7805, Riyadh 11472, Saudi Arabia

³Rehabilitation Sciences Department, College of Applied Medical Sciences, King Saud University (KSU), P.O. Box 10219, Riyadh 11433, Saudi Arabia

⁴Central Military Laboratory & Blood Bank, Prince Sultan Military Medical City (PSMMC), P.O. Box 7897, Riyadh 11159, Saudi Arabia

⁵Biomedical Research Center (BRC), Qatar University, Doha P.O. Box 2713, Qatar

Abstract. – OBJECTIVE: The purpose of this study was to identify the prevalence of obesity, overweight, and risk factors in pediatric patients attending outpatient clinics at a public sector hospital in the central province of Saudi Arabia.

SUBJECTS AND METHODS: This cross-sectional study was conducted in Riyadh, the capital of Saudi Arabia, between January 2022 and October 2022. The target population was aged 6-15 years. We conducted on-site obesity assessments utilizing questionnaire-based interviews with patients attending outpatient clinics. Data collection was carried out with the help of parents, where required. Using BMI growth charts for Saudi children and teenagers, the weight, height, and body mass index (BMI) of subjects were computed.

RESULTS: A total of 576 responses with a response rate of 64% were received and included in the study. In the current study, the majority (41.1%) of the patients were aged between 11 and 12 years old, followed by 37.0% of the students aged between 13 and 15 years old, and 21.9% of students aged between 8 and 10 years old. In the current study, 54.2% of the patients had normal weight, 15.6% of patients were underweight, 16.7% of patients were overweight, and 13.5% were obese. In this study, the prevalence of overall obesity was 2.3 times more prevalent in children aged 11 to 12 years (OR=2.30; $p=0.03$), followed by ~2 times higher levels in children aged 13 to 15 years (OR=2.30; $p=0.03$). Moreover, 2.11 times higher prevalence of obesity (OR=2.11; $p=0.77$) in those who regularly took food (especially lunch) from the school cafeteria. A significant ~2.5 high obesity level was recorded for students who consumed fizzy/soft drinks four or more times per week (OR=2.38; $p=0.007$).

CONCLUSIONS: Saudi Arabia still has a high rate of overweight and obesity among children of school-going age, which is a significant public health issue. To properly address and control this issue, policies at the national, local, and individual levels must be implemented. Notably, there was also a high prevalence of being underweight, and this issue needs to be brought up as well.

Key Words:

Child obesity, Child overweight, School student's obesity, Child BMI, Saudi Arabia.

Introduction

Due to its rising tendency, childhood obesity is one of the most prevalent health issues in the globe^{1,2}. Childhood obesity increases the risk of becoming obese as an adult. Currently, pediatric obesity is a substantial public health concern in developed and developing countries increasing the burden of non-communicable diseases (NCDs)³. In 2016, the World Health Organization reported that over 1.9 billion people worldwide, in developing and wealthy nations were overweight or obese, including over 340 million kids and teenagers (5-19 years old). By 2025, there will be 70 million overweight or obese babies and young children worldwide⁴. In light of evidence indicating a nutrition transition has taken place in this region of the world, the World Health Organization (WHO) stated that the rising rate of obesity among children and adolescents in all Eastern

Mediterranean nations should be taken seriously. In low- to middle-income nations, the term “nutrition transition” describes the rise in the consumption of unhealthy foods as well as the prevalence of overweight people. Urbanization, the transition to a modern lifestyle, changes in diet quality, particularly with regard to fast food, and an increase in the use of modern transportation and modern technologies that promote a more sedentary lifestyle are just a few examples of epidemiological transitions that coexist with changes in nutrition⁵. Obese children face immediate adverse effects such as psychosocial problems and education problems and lower academic achievement⁶⁻⁹. Numerous health conditions, including cardiovascular disease, psychological distress, metabolic syndrome, type 2 diabetes, fatty liver disease, and early death, have been proven to be significantly associated with being overweight or obese^{10,11}. A complex series of factors relating to ecological, genetic, and environmental impacts interact to cause childhood obesity¹⁰. Several factors contribute to obesity in children, such as a high-sugar diet, poor oral hygiene, enamel defects, genetic factors, microbial flora in the mouth, prolonged breastfeeding, and sociodemographic factors¹²⁻¹⁴.

Numerous research¹⁵⁻¹⁹ on childhood obesity have been carried out in various Saudi Arabian localities during the past three decades. El-Mouzan et al¹⁵ conducted a study with the intention of estimating the prevalence of obesity and overweight in Saudi Arabian youngsters¹⁵. According to this survey, Saudi Arabia’s development level was in the middle of those of developing and developed nations. Another study¹⁶ conducted in 2015-2016 assessed the prevalence of obesity and overweight at 21.5% using data from 3,613 school-aged children from various locations in Saudi Arabia. According to the same study, obesity started to appear around the age of 10 and grew in importance and complexity until about the age of 19 years¹⁶. In terms of childhood obesity, Saudi Arabia is currently among the countries in the Mideast with the highest rates¹⁷. Furthermore, a nationwide study found that the health effects of childhood obesity in Saudi Arabia are significantly linked to cardio-metabolic risk factors, which in turn affect the likelihood of being linked to other social and psychological outcomes^{18,19}.

The Ministry of Health has a variety of strategic objectives that assist efforts to create an effective disease-free society and advance health status with a goal of realizing the Saudi Vision by 2030, including strategic objective number 13,

which aims to reduce obesity among Saudis²⁰. Accurately determining the prevalence of childhood obesity and the risk factors associated with it is the first step in developing evidence-based, efficient intervention programs to stop the rising rates of childhood obesity. Thus, on-site BMI screening and reporting programs can contribute to an increasing public and professional understanding of the problems associated with children’s weight. It can also be a crucial tool for educating kids and their families about healthy habits and weight issues²¹. Accurately determining the incidence of childhood obesity and creating evidence-based, efficient intervention programs are the first steps in controlling it. The purpose of this study was to identify the prevalence of obesity, overweight, and risk factors in Central Province of Saudi Arabian students attending primary and intermediate schools.

Subjects and Methods

Study Area and Design

This cross-sectional study was conducted in Riyadh, the capital of Saudi Arabia, between January 2022 and October 2022. The target population was aged 6-15 years. School children constitute a significant proportion of the population, as they start attending school at the age of 6 years.

Data Collection

We conducted on-site obesity assessments utilizing questionnaire-based interviews with children attending outpatient clinics. Data collection was carried out with the help of the parents where required. Using BMI growth charts for Saudi children and teenagers, the weight, height, and body mass index (BMI) of subjects were computed.

The sampling method was convenient, and participation was entirely voluntary, and those who agreed to participate in this study signed a consent form. If parents did not agree for their children to participate in the study, those were not included. All participants in this study were interviewed individually by two members of the research team. We also collected the names and contact information of the participants. In order to calculate BMI, weight, and height were used. BMI was used to categorize children as underweight (BMI: 18.5), normal (BMI: 18.5-24.9), overweight (BMI: 25-29.9), or obese (BMI: 30)²². After cleaning and merging the collected data, each record was given a unique serial number.

Question Preparation

A self-administered questionnaire was designed after an exhaustive literature review to achieve the study's objectives related to obesity awareness in school-going students. The prepared version contained ten elements subjected to detailed debate among a panel of three medical consultants from pediatric endocrinology with substantial expertise in dealing with the child obesity problem. The consulting team suggested preparing and utilizing only the most basic questions that students and their parents would be able to understand. The consultant team does not agree with any clinical questions in the first phase of questionnaire development. They suggested that first, we understand and explore the level of child obesity awareness among school-going students. During the second phase, there will be a collection of more clinical-related data from the same subjects. Twenty items were agreed upon after two meetings and significant discussion among the expert panel. It was recommended that a pilot study be conducted before the final study. The research team agreed to conduct a pilot study using the questionnaire. Therefore, a pilot study was conducted with 26 participants at a public sector hospital with the patients visiting pediatric outpatient clinics in Riyadh city from 24th November to 7th December 2021 with 26 participants. The reliability of the questionnaire was $r=0.739$ after the pilot study, which we shared with the Ethics Committee. The questionnaire was divided into two parts. The first part of the questionnaire contains 11 items that describe demographic characteristics, and the second part contains 9 items that describe students' lifestyle factors.

Inclusion and Exclusion Criteria

In this study, we only included students visiting the pediatric outpatient clinics, and who go to school, speak, understand, and communicate on their own or with the help of their parents for the interview with our research team. In addition, we excluded students who are younger than six years old and or do not attend school.

Statistical Analysis

Microsoft Excel was used to enter all acquired data, and SPSS version 24.0 was used to analyze it (IBM Corp., Armonk, NY, USA). With 95% confidence intervals, the prevalence was estimated. To identify and quantify the risk factor and awareness relationships between a specific outcome and the variables taken into consideration,

odds ratios (ORs) were utilized. The statistical significance level for the entire investigation has been set at $p<0.05$.

Results

The demographic information of the current study participants includes nationality, age, obesity problem family members obese, etc. We contacted 850 students for participation in the study. Out of 850 participants, 639 students and their parents agreed to participate in the current study. We collected responses both on paper and online over the course of more than six months. Upon careful evaluation, we found that some of the data was not properly collected and, consequently, was excluded. A total of 576 responses with a response rate of 64% were received and included in the study. Most students (41.1%) in the current study were aged between 11 and 12 years old, followed by 37.0% from 13 to 15 years old, and 21.9% from 8 to 10 years old. Most of the school-going students (81.3%) believed they were healthy. Furthermore, 27.6% of students' family members also suffer from obesity as reported in the current research. The majority of students (68.2%) did not take any special diet program, but 31.8% of students reported they followed some special diet program. 45.3% of students play outdoor games or exercise on a regular basis. Furthermore, the majority of students (93.8%) have no chronic illnesses. In the current study, 54.2% of school students were normal weight, 15.6% of students were underweight, 16.7% of students were overweight, and 13.5% of students were obese (Table I).

Table II summarizes school students' day-to-day activities. Most of the students reported (75.0%) that they take proper nutrition and participate in physical activity. The majority of students always eat breakfast (43.2%), followed by some time (38.0%), rare (13.0%), and never (5.7%). Similarly, 46.9% of students eat three times proper meals a day, and 30.7% of school students take two times proper meals a day. Moreover, 53.6% of school students take (lunch) meals from the cafeteria, followed by home food (45.3%). The majority of students (34.4%) take chocolate more than four times a week. Regarding taking fast food, the majority of students (35.4%) take it two times a week.

Table III summarizes the association between school students' obesity levels and different variables. The prevalence of overall obesity levels was 2.3 times higher in the age of 11 to 12-year-old

Table I. Demographic Information of primary and secondary school students.

Item	Categories	N (%)
Age	8 to 10	126 (21.9)
	11 to 12	237 (41.1)
	13 to 15	213 (37.0)
Nationality	Non-Saudi	54 (9.4)
	Saudi	522 (90.6)
Would you say your health is	Healthy	468 (81.3)
	Unhealthy	108 (18.8)
Do you think obesity is a problem	No	57 (9.9)
	Yes	519 (90.1)
Any family members suffer from obesity	No	417 (72.4)
	Yes	159 (27.6)
Use any special diet program	No	393 (68.2)
	Yes	183 (31.8)
Do you exercise or play outdoor game regular basis	No	315 (54.7)
	Yes	261 (45.3)
Any special diet program follows	No	393 (68.2)
	Yes	183 (31.8)
Do you have any chronic condition	No	540 (93.8)
	Yes	36 (6.25)
Do you spend long periods in front of the TV:	No	300 (52.1)
	Yes	276 (47.9)
UW/N/OW/Obese	No	312 (54.2)
	Under weight	90 (15.6)
	Overweight	96 (16.7)
	Obese	78 (13.5)

school going school (OR=2.30; $p=0.03$), followed by ~2 times higher in the age of 13 to 15 years in Saudi Arabia. Saudi national students had a little higher obesity issue (OR=1.2; $p=0.62$) as compared to other national students found in the current study. Furthermore, the prevalence of being underweight was 6.69 times higher for students who believed themselves to be healthy (OR=6.69; $p=0.001$). When family members suffer from obesity, obesity prevalence was 2.62 times higher (OR=2.62; $p=0.0001$), and overweight prevalence was 2.31 times higher (OR=2.31; $p=0.0002$). Those school students taking a special diet for obesity prevention had significantly higher odds (OR=2.14; $p=0.001$) of becoming obese. Similarly, those students who did not do regular exercises or outdoor games had more obesity issues (OR=1.2; $p=0.43$). Most of the underweight students spend longer time in front of the TV (OR=1.63; $p=0.03$) as compared to other categories of school-going students.

Supplementary Table I summarizes the association between school students' obesity levels and their day-to-day activities. Students

who believed only nutrition was needed for a healthy life had 1.73 times greater chances of being underweight than those who believed both nutrition and physical activity were significant. Similarly, overweight students think more about physical activity (OR=1.6; $p=0.11$) than nutrition and both. In addition, students who don't eat breakfast are 1.67 times more likely to suffer from underweight (OR= 1.67; $p=0.2$) and 1.11 times more likely to suffer from obesity (OR= 1.11; $p=0.81$) problems compared to students who eat breakfast every day. It was found that the prevalence of underweight (two times meals- OR=9.45; three times meals- OR= 6.81) and obesity (two times meals- OR=1.67; three times meals- OR=1.10) was higher in students who have eaten only two and three meals a day, in comparison to students who have taken four meals a day. In addition, those students taking meals from the cafeteria had 2.28 times higher chances of being underweight (OR=2.28; $p=0.57$) as compared to home food. Moreover, 2.11 times higher prevalence of obesity (OR=2.11; $p=0.77$) in those students who

Table II. The school student's life-style factor.

Item	Categories	N (%)
Nutrition vs. Physical Activity, which do you think is more important for your health	Nutrition	87 (15.1)
	Physical Activity	57 (9.9)
	Both	432 (75.0)
How often do you eat breakfast	Never	33 (5.7)
	Rare	75 (13.0)
	Sometimes	219 (38.0)
	Always	249 (43.2)
How many times you take proper meals in a day	1 time	27 (4.7)
	2 times	177 (30.7)
	3 times	270 (46.9)
	4 times and more	102 (17.7)
At school, you usually take meals from	Take fast food	6 (1.0)
	Take full meal from cafeteria	309 (53.6)
	Home food	261 (45.3)
How often fizzy drinks you take per week	No	150 (26.0)
	One time in a week	96 (16.7)
	Two time in a week	171 (29.7)
	Three time in a week	60 (10.4)
	Four or more time in a week	99 (17.2)
How often do you eat chocolates in a week	N0	21 (3.6)
	1 time	96 (16.7)
	2 times	177 (30.7)
	3 times	84 (14.6)
	4 or more times	198 (34.4)
How often do you take fast food in a week	0 time	96 (16.7)
	One time in a week	126 (21.9)
	Two time in a week	204 (35.4)
	Three time in a week	69 (12.0)
	Four or more time in a week	81 (14.1)
How many Cups of water you take a day	1 time	42 (7.3)
	2 times	162 (28.1)
	3 times	54 (9.4)
	4 times and more	318 (55.2)
How much time do you spend watching TV/ playing video games in a day	0 hour	57 (9.9)
	1 hour	66 (11.5)
	2 hours	150 (26.0)
	3 hours	51 (8.9)
	4 hours and more	252 (43.8)

take food from the cafeteria (especially lunch). A significant ~2.5 high obesity level was recorded for students who consumed fizzy/soft drinks four or more times per week (OR=2.38; $p=0.007$). Moreover, overweight (8.5 times) and obesity (7.8 times) levels increased for those students who consumed more chocolate. School students spend more time watching television and playing video games, and they have a very high (2.73 times) prevalence of obesity (OR=2.73; $p=0.03$) as well as being overweight.

Discussion

The prevalence of overweight and obesity among school students was determined by conducting these extensive, representative on-site obesity assessment utilizing questionnaire-based interviews with children attending outpatient clinics. In the current study, it was discovered that the prevalence rate of obesity in the school-going children as 13.5%, overweight 16.7%, and underweight 15.6%. Almost similar, finding reported

Examining the prevalence of obesity in school

Table III. Associations between obese levels and different variables.

Item	Cate- gories	n (%)	Normal (312)	OR (95% CI)	p-value	Under weight (90)	OR (95% CI)	p-value	Over- weight (96)	OR (95% CI)	p-value	Obese (78)	OR (95% CI)	p-value
Age	8 to 10	126 (21.9)	84 (26.9)	Ref.		15 (16.7)	Ref.		18 (18.8)	Ref.		9 (11.5)	Ref.	
	11 to 12	237 (41.1)	105 (33.7)	0.66 (0.46-0.95)	0.02	54 (60.0)	1.91 (1.03-3.52)	0.03	39 (40.6)	1.15 (0.63-2.09)	0.64	39 (50.0)	2.30 (1.08-4.90)	0.03
	13 to 15	213 (37.0)	123 (39.4)	0.86 (0.60-1.2)	0.42	21 (23.3)	0.82 (0.41-1.6)	0.59	39 (40.6)	1.28 (0.70-2.3)	0.41	30 (38.5)	1.97 (0.90-4.28)	0.08
Nationality	Non-Saudi	54 (9.4)	33 (10.6)	Ref.		6 (6.7)	Ref.		9 (9.4)	Ref.		6 (7.7)	Ref.	
	Saudi	522 (90.6)	279 (89.4)	0.87 (0.55-1.38)	0.56	84 (93.3)	1.44 (0.60-3.4)	0.4	87 (90.6)	1 (0.47-2.06)	1	72 (92.3)	1.2 (0.51-2.98)	0.62
Would you say your health is	Healthy	468 (81.3)	273 (87.5)	1.61 (1.08-2.3)	0.017	87 (96.7)	6.69 (2.07-21.5)	0.001	60 (62.5)	0.38 (0.24-0.61)	0.0001	48 (61.5)	0.36 (0.22-0.60)	0.0001
	Unhealthy	108 (18.8)	39 (12.5)	Ref.		3 (3.3)	Ref.		36 (37.5)	Ref.		30 (38.5)	Ref.	
Do you think obesity is a problem	No	57 (9.9)	33 (10.6)	Ref.		3 (3.3)	Ref.		12 (2.5)	Ref.		9 (11.5)	Ref.	
	Yes	519 (90.1)	279 (89.5)	0.92 (0.59-1.4)	0.74	87 (96.7)	3.18 (0.97-10.3)	0.05	84 (87.5)	0.76 (0.39-1.4)	0.43	69 (88.5)	0.84 (0.39-1.7)	0.65
Any family members suffer from obesity	No	417 (72.4)	258 (82.7)	Ref.		69 (76.7)	Ref.		51 (53.1)	Ref.		39 (50.0)	Ref.	
	Yes	159 (27.6)	54 (17.3)	0.54 (0.38-0.77)	0.007	21 (23.3)	0.79 (0.47-1.34)	0.34	45 (46.9)	2.31 (1.48-3.5)	0.0002	39 (50.0)	2.62 (1.62-4.23)	0.0001
Use any special diet program	No	393 (68.2)	228 (73.1)	Ref.		60 (66.7)	Ref.		66 (68.8)	Ref.		39 (50.0)	Ref.	
	Yes	183 (31.8)	84 (26.9)	0.79 (0.58-1.07)	0.13	30 (33.3)	1.07 (0.66-1.7)	0.76	30 (31.3)	0.97 (0.61-1.55)	0.91	39 (50.0)	2.14 (1.33-3.46)	0.001
Do you exercise or play outdoor game regular basis	No	315 (54.7)	159 (51.0)	Ref.		51 (56.7)	Ref.		66 (68.8)	Ref.		39 (50.0)	Ref.	
	Yes	261 (45.3)	153 (49.0)	1.16 (0.88-1.53)	0.28	39 (43.3)	0.92 (0.58-1.44)	0.72	30 (31.3)	0.54 (0.34-0.87)	0.01	39 (50.0)	1.2 (0.75-1.93)	0.43
Do you have any chronic condition	No	540 (93.8)	288 (92.3)	Ref.		87 (96.7)	Ref.		90 (93.8)	Ref.		75 (96.2)	Ref.	
	Yes	36 (6.25)	24 (7.69)	1.25 (0.73-2.1)	0.41	3 (3.3)	0.51 (0.15-1.71)	0.28	6 (6.2)	1 (0.40-2.4)	1	3 (3.8)	0.60 (0.18-1.99)	0.4
Do you spend long periods in front of the TV:	No	300 (52.1)	168 (53.8)	Ref.		36 (40.0)	Ref.		57 (59.4)	Ref.		39 (50.0)	Ref.	
	Yes	276 (47.9)	144 (46.2)	0.93 (0.70-1.22)	0.61	54 (60.0)	1.63 (1.03-2.5)	0.03	39 (40.0)	0.74 (0.47-1.15)	0.18	39 (50.0)	1.08 (0.67-1.74)	0.72

in the local and international studies were the prevalence rate of obesity among Saudi children and adolescents aged 6 to 16 years old grew from 12.7% in 2006 to 18.2% in 2015²³.

This is comparable to the rate of obesity among children in the US. Additionally, within a ten-year period, the obesity rate has doubled compared to the WHO-based national prevalence rate of obesity published in 2004 (9.3%)²⁴. This study supports a number of international studies^{25,26} that have shown a high prevalence of obesity among children aged 10 to 15 as compared to other child age groups. There may be many reasons for this observation, such as hormonal changes during adolescence and persistent obesity in children during this period. The reason for this is that a large percentage of Saudi preschool students are physically inactive. The current findings revealed that obese students were considerably more likely to be fat if they had a history of comorbid conditions, chronic illnesses, or a family history of obesity. The findings of this study are in agreement with those from a previous study published in Pune, India²⁷, who discovered a substantial relationship between family history and the chance of being overweight and obese. These findings may be explained by the substantial relationship between child obesity and a family history of the disease, which is probably influenced by both genetic and environmental factors^{28,29}. Early childhood is a critical period for intervention since preschoolers who have weight issues frequently continue to struggle with their weight throughout adulthood³⁰⁻³². Preschool-aged children are spending less time outdoors due to rising pressure on teachers to place a higher priority on classroom learning than physical activity, despite the fact that outdoor time can benefit children's physical, socio-emotional, and cognitive development³³. According to this study, children who have not participated in any outdoor or exercise-related activities are more likely to be overweight or obese. In some Western countries, especially among children, the prevalence of obesity has declined³⁴ or stabilized despite the rise in the prevalence of obesity globally³⁵. Those school students who do not eat properly have an increased risk of being overweight and obesity, according to the current study³⁶. Many of the studies reporting reducing/managing childhood obesity were school-based interventions, with some addressing the whole community. Correcting the school student's

food activities required proper nutrition guidance³⁷⁻³⁹. Given recent efforts to modify children's food environments (cafeterias, fast food, chocolates, fizzy drinks or soft drinks), particularly in schools, overweight and obesity have increased. The current study found that students who regularly eat in the school cafeteria have 2.11 times more chances of becoming obese. Almost similar finding reported in some studies⁴⁰⁻⁴², the prevalence of obesity due to cafeteria meals were reported to be 15.2% in France⁴⁰, 30.0% in Greece⁴¹, and 14.1% in Denmark⁴². It is possible that the differences between these European studies and ours are due to cultural and lifestyle differences, which may have been based on the definitions of overweight and obesity used in these studies. The intake of fast food by overweight or obese schoolchildren was significantly higher. We found a 1.78 times higher prevalence of them if they ate fast food four times or more a week. Male students at Al Ehsa primary school in Saudi Arabia were found to be more likely to be obese and overweight when they consumed fast foods frequently⁴³. In Dubai, United Arab Emirates, other studies⁴⁴ also reported a significant association between fast food intake and obesity among girls. Furthermore, we also found that drinking less water, watching TV, or playing video games for more than 4 hours a day were associated with being overweight and obese.

Limitations

The current study has several limitations, mainly that it is a cross-sectional study design with only one basic questionnaire. We did not include any technical or clinical questions. In the present study, we conducted on-site obesity assessments utilizing questionnaire-based interviews with children attending outpatient clinics. Participants' lifestyle factors and dietary habits were only observed. Further research about overweight and obesity in Saudi Arabia needs to be longitudinal and more clinical.

Conclusions

The results of this study indicate that the prevalence of overweight and obesity among school students in Saudi Arabia is still high. This is true even though it is comparable to international levels, and is a significant public

health concern. Implementing evidence-based interventions requires the implementation of nutritional policies that support their implementation. Childhood and adolescent obesity can be prevented by promoting teamwork and disseminating detailed information regarding the disease. In addition, video games and television viewing should be limited for children. In order to enhance our current behavioral approaches to pediatric obesity, we may benefit from focusing on targeted strategies that target time periods of increased risk for unhealthy eating, playing outdoor games, taking proper meals, and behavior. Furthermore, students should need to be aggressively counselled on the life-style modification. Our next phase and the second part of this study will target schools and pediatric clinics in Saudi Arabia with more clinical questions.

Conflict of Interests

The Authors declare that they have no conflict of interests.

Funding

This research is funded by Researchers Supporting Project number (RSPD2023R798), King Saud University, Riyadh, Saudi Arabia.

Acknowledgments

The authors acknowledge funding from Researchers Supporting Project number (RSPD2023R798), King Saud University, Riyadh, Saudi Arabia.

Availability of Data and Materials

Data and materials will be provided upon request.

Authors' Contribution

Conception or design: FAA, AMA. TA Acquisition, analysis, or interpretation of data: AMA, SAA, SIM, AMA. Drafting the work or revising: FAA, AMA, TA, NAM, AMA. Final approval of the manuscript: All authors.

Ethics Approval

We explained the questionnaire items individually to each participant and explained the study's objectives. This study was approved (#E-205308) by the Research Ethics Committee of the Faculty of Medicine at King Saud University.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

ORCID ID

F.A. Alrashed: 0000-0001-5975-3275.
T. Ahmad: 0000-0001-6769-1617.
A.M. Alsubiheen: 0000-0001-9891-3390.
S.A. Alghamdi: 0000-0003-4803-7008.
S.I. Mazi: 0000-0002-6723-8756.
N.A. Mohamed: 0000-0001-9537-7721.

References

- 1) Karnik S, Kanekar A. Childhood obesity: a global public health crisis. *Int J Prev Med* 2012; 3: 1-7.
- 2) Song YA, Anette A, Jun MA, Liubai LI, Yuanting LI, Randall SS, Judith JP. National trends in stunting, thinness and overweight among Chinese school-aged children, 1985-2014. *Int J Obes* 2019; 43: 402-411.
- 3) Nittari G, Scuri S, Sagaro G, Petrelli F, Grappasonni I. Epidemiology of Obesity in Children and Adolescents. *Teamwork in Healthcare*, 2020: 20.
- 4) WHO. Obesity and overweight. 2021. Available at: <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>.
- 5) WHO. Plan of action for the prevention and control of noncommunicable diseases in the Eastern Mediterranean Region. Regional Office for the Eastern Mediterranean; 2011.
- 6) Spinelli ABM, Kovacs VA, Yngve A, Spiroski I, Obreja G, Starc G, Pérez N, Rito AI, Kunešová M, Sant'Angelo VF, Meisfjord J, Bergh IH, Kelleher C, Yardim N, Pudule I, Petrauskiene A, Duleva V, Sjöberg A, Gualtieri A, Hassapidou M, Hyska J, Burazeri G, Petrescu CH, Heinen M, Takacs H, Zamrazilová H, Bosi TB, Sacchini E, Pagkalos I, Cucu A, Nardone P, Gately P, Williams J, Breda J. Prevalence of Severe Obesity among Primary School Children in 21 European Countries. *Obes facts* 2019; 12: 244-258.
- 7) Cohen AK, Rai M, Rehkopf DH, Abrams B. Educational attainment and obesity: a systematic review. *Obes Rev* 2013; 14: 989-1005.
- 8) Abdulghani AH, Ahmad T, Abdulghani HM. The impact of COVID-19 pandemic on anxiety and depression among physical therapists in Saudi Arabia: a cross-sectional study. *BMC Med Educ* 2022; 22: 751.
- 9) Abdulghani HM, Noha A, Afnan A, Razan AA, Maha A, Tauseef A, Alshahrani A, Ahmad HA, Nehal K. The validity of the self-directed learning readiness instrument with the academic achievement among the Saudi medical students. *Int J Med Sci Public Health* 2019; 9.
- 10) Kumar S, Kelly AS. Review of Childhood Obesity: From Epidemiology, Etiology, and Comorbidities to Clinical Assessment and Treatment. *Mayo Clin Proc* 2017; 92: 251-265.
- 11) Abdulghani HM, Areej SA, Budoor HA, Lulwah SA, Norah SA, Irshad M, Khalid HA, Yazeed EA, Yazeed AA, Tauseef A. Prevalence of diabetic comorbidities and knowledge and practices of foot

- care among diabetic patients: a cross-sectional study. *Diabetes Metab Syndr Obes* 2018; 11: 417.
- 12) Bell LK, Celeste S, Devenish G, Ha D, Thomson MW, Spencer JA, Do LG, Scott JA, Golley RK. Dietary Patterns and Risk of Obesity and Early Childhood Caries in Australian Toddlers: Findings from an Australian Cohort Study. *Nutrients* 2019; 11.
 - 13) Kirthiga M, Murugan M, Saikia A, Kirubakaran R. Risk Factors for Early Childhood Caries: A Systematic Review and Meta-Analysis of Case Control and Cohort Studies. *Pediatr Dent* 2019; 41: 95-112.
 - 14) Abdulghani HM, Ahmed MM, Al-Rezqi AM, Althunayan SA, Mran AL, Alshaya AK, Alharbi FK, Abdulghani AH, Tauseef A. Knowledge and awareness levels of diabetes mellitus risk factors among nondiabetic visitors of primary health care centers: a multicenter study. *Eur Rev Med Pharmacol Sci* 2021; 25: 7066-7077.
 - 15) El-Mouzan MI, Peter JF, Al-Herbish SA, Al-Salloum AA, Al-Omer AA, Qurachi MM, Keckojevic T. Prevalence of overweight and obesity in Saudi children and adolescents. *Ann Saudi Med* 2010; 30: 203-208.
 - 16) Al-Shaikh A, Farahat F, Abaalkhail B, Kaddam I, Aseri K, Al-Saleh Y, Al-Qarni A, Al-Shuaibi A, Tamimi W. Prevalence of Obesity and Overweight among School-Aged Children in Saudi Arabia and Its Association with Vitamin D Status. *Acta Biomed* 2020; 91: e2020133.
 - 17) DeNicola E, Aburizaiza OS, Siddique A, Khwaja H, Carpenter DO. Obesity and public health in the Kingdom of Saudi Arabia. *Rev Environ health* 2015; 30 :191-205.
 - 18) Al-Hussaini A, Bashir MS, Khormi M, AlTuraiki M, Alkhamis W, Alrajhi M, Halal T. Overweight and obesity among Saudi children and adolescents: Where do we stand today? *Saudi J Gastroenterol* 2019; 25: 229-235.
 - 19) Abdulghani MH, Sattar K, Tauseef A, Akram A. Association of COVID-19 Pandemic with undergraduate Medical Students' Perceived Stress and Coping. *Psycho Res Behav Manag* 2020; 13: 871-881.
 - 20) Arabia KoS. Health Sector Transformation Program - Vision 2030. *Saudi Vis* 2030. Available at: <https://www.vision2030.govsa/v2030/vrps/hstp/> 2016.
 - 21) Nihiser AJ, Sarah ML, Wechsler H, McKenna M, Odom E, Reinold C, Thompson D, Grummer-Strawn L. Body mass index measurement in schools. *J Sch Health* 2007; 77: 651-671.
 - 22) El-Ashker S, Pednekar MS, Narake SS, Albaker W, Al-Hariri M. Blood Pressure and Cardio-Metabolic Risk Profile in Young Saudi Males in a University Setting. *Medicina (Kaunas)* 2021; 57.
 - 23) Al-Alwan I, Al-Fattani A, Longford N. The effect of parental socioeconomic class on children's body mass indices. *J Clin Res Pediatr Endocrinol* 2013; 5: 110-115.
 - 24) El-Mouzan MI, Al-Herbish AS, Al-Salloum AA, Al-Omar AA, Qurachi MM. Regional variation in prevalence of overweight and obesity in Saudi children and adolescents. *Saudi J Gastroenterol* 2012; 18: 129-132.
 - 25) National Health and Nutrition Examination Survey 2017–March 2020 Prepandemic Data Files Development of Files and Prevalence Estimates for Selected Health Outcomes. *National Health Statistics Reports*; 2021.
 - 26) Lazzeri G, Mariano VG, Spinelli A, Pammolli A, Dalmaso P, Nardone P, Lamberti A, Cavallo F. Overweight among students aged 11-15 years and its relationship with breakfast, area of residence and parents' education: results from the Italian HBSC 2010 cross-sectional study. *Nutr J* 2014; 13: 69.
 - 27) Fernandez K, Singru S, Kshirsagar M, Pathan Y. Study regarding overweight/obesity among medical students of a teaching hospital in Pune, India. *Med J DY Patil Univ* 2014; 7: 279-283.
 - 28) Sande MAV, Walraven GE, Milligan PJ, Banya WA, Ceessay SM, Nyan OA, McAdam KP. Family history: an opportunity for early interventions and improved control of hypertension, obesity and diabetes. *Bull World Health Organ* 2001; 79: 321-328.
 - 29) Kral TV, Rauh EM. Eating behaviors of children in the context of their family environment. *Physiol Behav* 2010; 100: 567-573.
 - 30) Bradley RH, Houts R, Nader PR, O'Brien M, Belsky J, Crosnoe R. The relationship between body mass index and behavior in children. *J Pediatr* 2008; 153: 629-634.
 - 31) Krebs NF, Jacobson MS. Prevention of pediatric overweight and obesity. *Pediatrics* 2003; 112: 424-430.
 - 32) Alrashed FA, Sattar K, Ahmad T, Akram A, Karim SI, Alsubiheen AM. Prevalence of insomnia and related psychological factors with coping strategies among medical students in clinical years during the COVID-19 pandemic. *Saudi J Biol Sci* 2021; 28: 6508-6514.
 - 33) Copeland KA, Sherman SN, Kendeigh CA, Kalkwarf HJ, Saelens BE. Societal values and policies may curtail preschool children's physical activity in child care centers. *Pediatrics* 2012; 129: 265-274.
 - 34) Olds T, Maher C, Zumin S, Péneau S, Lioret S, Castetbon K, Bellisle, Wilde JD, Hohepa M, Madisson R, Lissner L, Sjöberg A, Zimmermann M, Aeberli I, Ogden C, Flegal K, Summerbell C. Evidence that the prevalence of childhood overweight is plateauing: data from nine countries. *Int J Pediatr Obes* 2011; 6: 342-360.
 - 35) Farrag NS, Cheskin LJ, Farag MK. A systematic review of childhood obesity in the Middle East and North Africa (MENA) region: Prevalence and risk factors meta-analysis. *Adv Pediatr Res* 2017; 4.
 - 36) Sahoo K, Sahoo B, Choudhury AK, Sofi NY, Kumar R, Bhadoria AS. Childhood obesity: causes and consequences. *J Family Med Prim Care* 2015; 4: 187-192.
 - 37) Bleich SN, Segal J, Wu Y, Wilson R, Wang Y. Systematic review of community-based childhood obesity prevention studies. *Pediatrics* 2013; 132: e201-210.
 - 38) Kain J, Uauy R, Albala, Vio F, Cerda R, Leyton B. School-based obesity prevention in Chilean primary school children: methodology and evaluation.

- tion of a controlled study. *Int J Obes Relat Metab Disord* 2004; 28: 483-493.
- 39) Issanchou S. Determining Factors and Critical Periods in the Formation of Eating Habits: Results from the Habeat Project. *Ann Nutr Metab* 2017; 70: 251-256.
- 40) Thibault H, Conrand B, Saubusse E, Baine M, Maurice-Tison S. Risk factors for overweight and obesity in French adolescents: physical activity, sedentary behavior and parental characteristics. *Nutrition* 2010; 26: 192-200.
- 41) Manios Y, Angelopoulos P, Kourlaba G, Kolotourou M, Grammatikaki E, Cook TL, Bouloubasi Z, Kafatos AG. Prevalence of obesity and body mass index correlates in a representative sample of Cretan school children. *Int J Pediatr Obes* 2011; 6: 135-141.
- 42) Krue S, Coolidge J. The prevalence of overweight and obesity among Danish school children. *Obes Rev* 2010; 11: 489-491.
- 43) Amin TT, Al-Sultan AI, Ali A. Overweight and obesity and their relation to dietary habits and socio-demographic characteristics among male primary school children in Al-Hassa, Kingdom of Saudi Arabia. *Eur J Nutr* 2008; 47: 310-318.
- 44) Bin-Zaal AA, Musaiger AO, D'Souza R. Dietary habits associated with obesity among adolescents in Dubai, United Arab Emirates. *Nutr Hosp* 2009; 24: 437-444.