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Factors Influencing Exceed Weight Among Adolescents in the United Arab Emirates: A Cross-Sectional Descriptive Survey of Ajman's Secondary Schools

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Abstract: *Background:* The study aimed to discover factors influencing prevalence rates of overweight and obesity among adolescents in Unite Arab Emirates and their correlation with physical sport activity, socio-economic circumstances and eating habits. *Methods:* Overweight and obesity were defined using age and sex-specific Body Mass Index. Physical sport activity, socio-economic conditions and eating practices were assessed with a standardized questionnaire. Factors influencing overweight/obesity were known by Cross-Sectional Descriptive Survey. Statistical significance was adopted for P <0·05. *Results:* Overweight and obesity respectively affected 5·2 and 1·9% of adolescents surveyed. On sex-wise comparison, 35% of males were overweight compared to 24% of females. 61 (25.21%) of females reported not to participate in any sports compared to 16 (15.1%) of males ($X^2(1) = 5.31$., p= 0.025**). In addition, 11 males (10.38%) reported to spend less than 15 minutes in each self-physical sport session compared to 51 (21.07%) of females while 63 (59.43%) males reported to spend more than 30 minutes per session compared to 109 (45.04%) of females ($X^2(3) = 11.003$, p= 0.01**). Furthermore, we found only 22.7% of Ajman's adolescents had daily Food/Vegetable (F/V) intake and significantly (P<0.05) reduced the menace of overweight/obesity. 10 (9.43%) of males reported fruits among their favorite foods. *Conclusion:* Overweight/ Obesity were highly correlated with sedentary behavior; insufficient self-physical sports activities and unhealthy food preferences. Therefore, urgent approaches are needed to provide healthier meals to students at secondary schools; limit their access to low-nutrient, energy-dense foods during the school day; and increase the frequency, intensity, and duration of physical activity.

Keywords: Adolescent, Overweight/Obesity, Physical Sport Activity, Eating Habits

1. Introduction

Although definition of obesity and overweight has changed over time, it can be defined as an excess of body fat [1]. Overweight/ Obesity are caused by a chronic energy imbalance relating both dietary intake and physical activity patterns [2]. The strongest impact in development of obesity was found for policies focusing on physical activity and diet that were conducted in secondary school settings [3, 4]. Also, optimal growth during adolescence is important for maintaining good health during the life course.

United Arab Emirates (UAE) is part of the Gulf Cooperation Council (GCC) countries and ranks 18 on 2020 World Health Organization (WHO) lists of the fattest countries with 68.3% of its people with an unhealthy weight [5]. The UAE youth's frequency of being more obese is twice to be thrice greater than the published international standards [5].

Furthermore, according to World Health Organization report in the global news, the UAE was considered as the

second highest for obesity rates in the world. Consequently, adolescents with obesity are prone to various associated diseases, which tend to plague the UAE adults later, for example hypertension, diabetes, cardiovascular disease, respiratory complaints, metabolic syndrome, gastrointestinal problems and others [6].

The UAE has also marked rapid socioeconomic development and matching changes in lifestyles, leading to a noticeable increase in obesity in children/adolescents. The UAE schoolchildren/youth (ages 10-18) are supposed to be 1.8 times more obese than those in the USA, according to statistics from the First United States National Health and Nutrition Examination Survey [7, 8]. Recently, the Global School-based Student Health Survey reported the obesity prevalence in the UAE youth population (aged 13–15 years) was 16.2% [8, 9]; such that national agenda indicator targets to reduce the existing value by 17% [8, 10].

The increasing prevalence overweight/obesity rates of adolescents a likely result of behavioral changes in transitional countries [11]. Urbanization can get better adolescent's diets but can also lead a number of unhealthy dietary changing, such as increased uptake of saturated fats, sugars and processed foods containing excessive amounts of these components [12]. Joined with sedentary behavior, they look to have contributed to the theatrical ascend in overweight and obesity prevalence in developed countries [13].

In addition, new technology has also led to change of lifestyle from being active to sedentary ways of living. Activities such as television watching and computer games consume children's time, interest, and avoid them to participating in physical activities [14, 15].

Thus, prevention of non-communicable diseases (NCDs) such as obesity should start early in childhood through behavior change strategies and endorsement of healthy life style.

World Health Organization (WHO), recommends at least 60 minutes of moderate to vigorous intensity activities on Physical Activities for Health daily for adolescents. Moreover, it is recommended to incorporate vegetables, fresh fruits and whole grain based carbohydrates while avoiding high fatty foods and high calorie beverages [16]. However, these healthy behaviors have been found to be low among adolescents [17]. Most of risk factors for NCDs are modifiable such as unhealthy diets, lack of physical activity. Usually, exposure to these risk behaviors started in early childhood and adolescence [18].

The general trend of obesity was previously studied in UAE secondary school adolescents using different methods for BMI interpretation [19]. However, adolescent's obesity in Ajman was not clear, because it could not be estimated using general studies [20].

In order, to make a success policy of controlling weight excess among adolescents in secondary school. We planned to conduct this study, but there was lack of data on factors influencing overweight and obesity among this age group (ages 13-19). Therefore, we conducted this cross section survey to verify the magnitude of overweight/obesity, deficient self-physical activity and food/drink preference among adolescents in secondary school of Emirate of Ajman.

2. Materials and Methods

2.1. Study Settings

This cohort study was carried out in the Emirate of Ajman (EA), which is one of the seven emirates of UAE. It is the fourth most populous emirate in the country.

2.2. Study Design and Sampling Techniques

The sample included male and female adolescents (aged 13–19 years) from grades 9–12 in private and public secondary schools of whose parents provided permission for them to participate. This cross sectional descriptive survey was adopted among adolescents in secondary schools in UAE's Ajman with a total of 2000 participants. Secondary schools were arbitrarily selected from a list of 35 schools (16 public vs 19 private schools) obtained from the Ministry of Education. This study was conducted according to the Strengthening the Reporting of Observational Studies in Epidemiology checklist for reports of cross-sectional studies [21].

2.3. Sample Size Calculation

Based on Israel (2003), we determined the appropriate sample size. Usually, three criteria were specified: the level of precision, the level of confidence or risk, and the degree of variability in the attributes being measured [22, 23].

2.4. Method for Calculating Appropriate Sample

For populations that are large, Cochran (1963) developed the Equation (1) to yield a representative sample for proportions as below:

$$n_0 = pq/e^2 \quad (1)$$

n_0 is the sample size; Z^2 is the abscissa of the normal curve that cuts off an area α at the tails (1 - α equals the desired confidence level, e.g., 95%); e is the desired level of precision; p is the estimated proportion of an attribute that is present in the population and q is 1-p. The value for Z is found in statistical tables (1.96). Therefore, assume p=.5 (maximum variability). Furthermore, we desire a 95% confidence level and ±5% precision.

The resulting sample size is demonstrated in Equation (2).

$$n_0 = z^2pq/e^2 = (1.96)^2 \text{ x } (.5) \text{ x } (.5) / (.5)^2 = 385 \quad (2)$$

2.4.1. Finite Population Correction for Proportions

If the population is not large (small), the sample size can be reduced. This is because a given sample size provides proportionately more information for a small population than for a large population.

The sample size (n_0) can be adjusted using Equation (3).

$$n = n_0/ [1 + (n_0 -1)]/N) \quad (3)$$

Where n is the sample size and N is the population size

(2000).

The sample size that was necessary to our survey is shown in Equation (4).

$$n_0 = n_0/[1+(n_0-1)]/N=385/[1+(385-1)]/2000= 323 \text{ pupils} \quad (4)$$

This adjustment (called the finite population correction) can substantially reduce the necessary sample size for small populations.

Finally, the sample size formulas provide the number of needed responses that should be obtained. Many researchers usually add 10% to the sample size to compensate for persons that the researcher is not capable to contact. The sample size also is often increased by 30% to recompense for non-response. Thus, the number of mailed surveys or planned interviews can be substantially larger than the number required for a desired level of confidence and precision. Therefore, 400 participants were selected. However, 348 only filled the questionnaire and presented themselves for anthropometric measurements. Those who did not turn out were not replaced.

2.4.2. Sampling Procedure

Based on students' availability a convenience sample of secondary schools was chosen. All adolescents were invited to partake in this study. All participants who accepted were given the written consent forms in Arabic language for their parents to permit them to participate and return the filled approval form on the fixed date. For those who did not assent and whose parents did not give consent were excluded. Systematic random sampling was used to select:

348 students from 500 who met the criteria to take part in the survey. No stratification was done based on schools, age, and gender.

2.5. Data Collection

A survey was used to collect data such as age, gender, nationality, type of school, mother's employment economic status and BMI. Information on time spent in physical activities and preferred sport were also enquired.

Data on favorite food/dishes and drink consumption were recorded. Eating habits were also expected by the 24 h recall questionnaire. Adolescents were asked to report consumed food and nutrient intake in the last 24 h for breakfast, morning snack, lunch, afternoon snack, dinner and any other snacking that had occurred during the day [24].

2.6. Anthropometric Measurements

Standard measuring board (Wood Stadiometer) was used to determine participant's height and recorded in meters (m). Salter Mechanical stand on weighting scale (SECA Corporation, Humberg, Germany) was used to record the participant's weight in kilograms. The Body Mass Index (BMI) was calculated in kilograms (kg) /height (m)².

World Health Organization (WHO) reference charts for adolescents were used for interpretation of BMI (Figure 1). These reference charts have horizontal curved lines that show the range of percentiles in relation to the BMI on the vertical axis. Those below 5th percentile on the charts are considered underweight, 5th to 85th percentile normal, 85th to 95th percentile overweight and those above 95thpercentile are classified as obese. Detail of the measurement process has been described in more detail elsewhere [25-27].

Data were collected from September 2020 to May 2021, which was a regular school period excluding the summer holiday.

2.7. Statistical Analysis

Statistical data were analyzed with Statistical software Package for Social Sciences (SPSS version 20, SPSS Inc., Chicago, USA). Continuous variables were summarized by Mean and standard Deviation. Categorical variables were summarized by frequencies and percentages. Chi Square test was used to compare frequencies in categorical variables, and p value ≤ 0.05 was considered statistically significant. Data were presented using tables and bar charts.

3. Results

A total of 348 adolescents from public (45.71%) and private (54.29%) secondary schools in Ajman were enrolled in the survey Table 1. Median age was 15.27 years, and 37.60% of the adolescents were under 14 years old. Participants between 15-17 years of age were 172 (49.40%) forming majority of participants (Table 1). Girls outnumbered boys (69.60% and 30.40%, respectively). Household income was average (59·77%), despite percentages of working mothers (28%).

Table 1. *Baseline Characteristics of Participating Adolescents and Obesity-Related Indices (N: 348).*

Variable	Frequency	Percentage	Mean± SD
Age (years)			15,27±2,68
13-14	131	37,60	
15-17	172	49,40	
18-19	35	10,00	
>19	10	3,00	
Gender			
Females	242	69,60	
Males	106	30,40	
Nationality			
UAE National	262	75,30	
Non- UAE National	86	24,70	
Type of school			
Public	16	45,71	
Private	19	54,29	
Mother's employment			
Employed	98	28,00	
Unemployed	250	72,00	
Economic status			
Below average	15	4,31	
Average	208	59,77	
Above average	125	35,20	
BMI (kg/m²)			19,10 ± 4,34
Underweight (< 5th per.)	45	13	
Normal (5th-85th per.)	190	54,6	
Overweight (85th-95th per.)	95	27,3	
Obese (>95th per.)	18	5,1	

Abbreviations: BMI= Body Mass Index, UAE= United Arab Emirates.

The prevalence rate of overweight/obesity for adolescents sample (N=348) was 32.40% (BMI ≥85th percentile). BMI ranged from 12 to 40 kg/m² with a mean of 19.10 kg/m², (Figure 1). Values of anthropometric parameters were much higher in boys than in girls (Table 2).

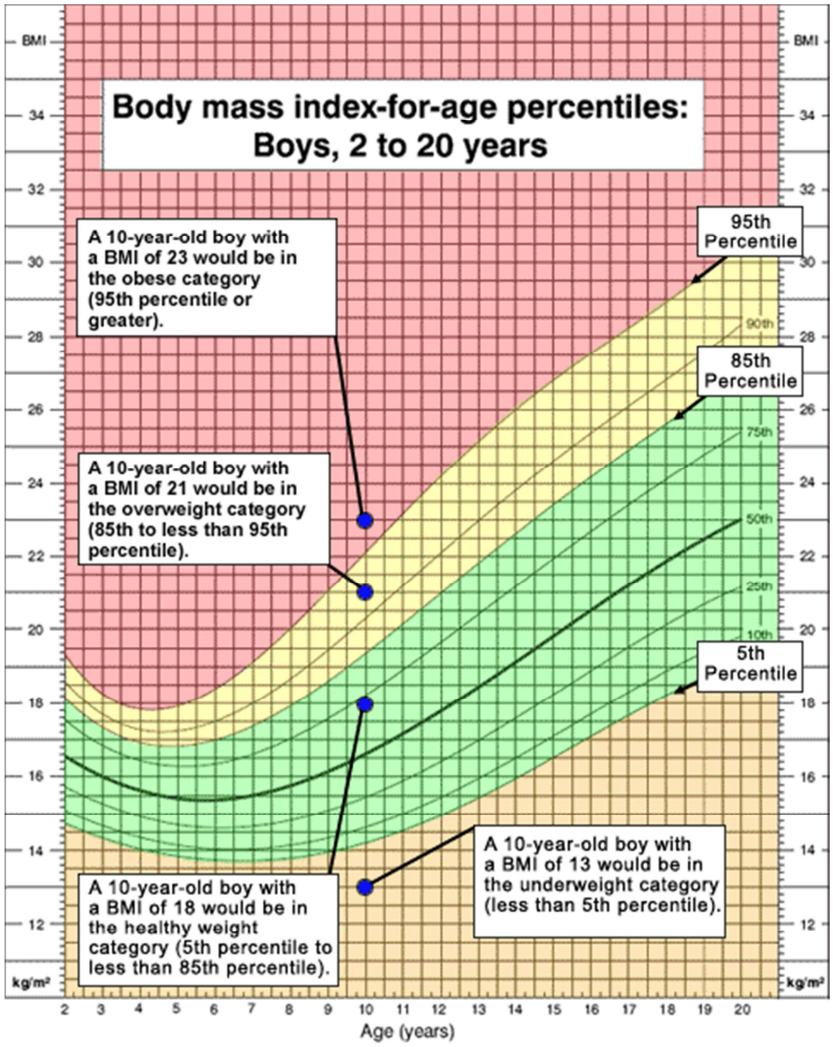

Figure 1. *Body Mass Index (BNI) for Age Growth Percentiles (Reference: Center for Disease Control charts/USA).*

The overall prevalence of thinness, overweight and obesity among the included children was 13, 27.3 and 5.1%, respectively (Figure 2). On sex-wise comparison, 37 (35%) of males were overweight compared to 58 (24%) of females. However, the difference was not statistically significant ($X^2(3) = 468.83$, $p = 0.199$).

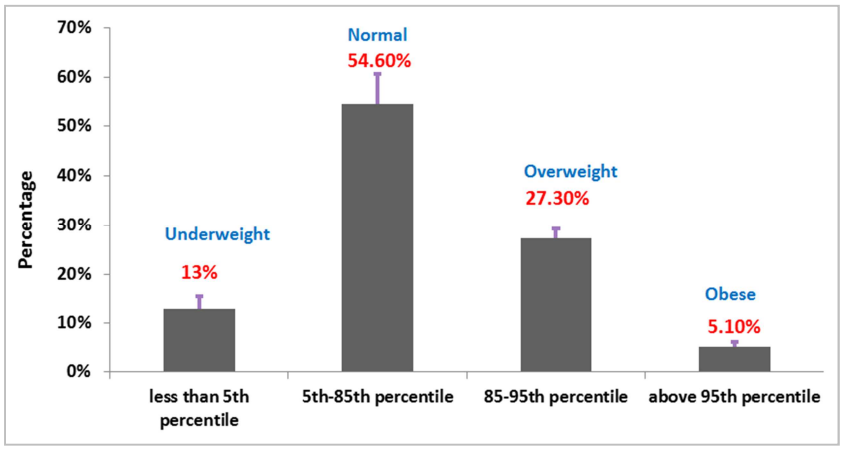

Figure 2. *Body Mass Index (BMI) Interpretation.*

Table 2. *Sex-Wise Comparison of BMI Interpretation of Participating Adolescents.*

BMI interpretation	Sex of participating adolescents						X^2 (df)	P-value
	Girls (N=242)	Percentage	Boys (N=106)	Percentage	Total N	Percentage		
Underweight (less than 5th percentile)	30	12,5	15	14	45	13	468,8 (3)	$0,99^{ns}$
Normal (5th-85th percentile)	142	58,5	48	45	190	54,6		
Overweight (85th-95th percentile)	58	24	37	35	95	27,3		
Obese (above 95th percentile)	12	5	6	6	18	5,1		
Total	242	100	106	100	348	100		

Abbreviations:
X^2 =Chi-Square Test, df=Degree of Freedom
Ns= no signification (not influenced by participants' sex)
BMI=Body Mass Index

Results indicated that the majority of the participating adolescents showed low involvement in sports activities (77.87%) and more than half (57.47%) had low Physical Sports Activities/week. 90 males (84.9%) are involved in sports activities compared to 181 (74.7%) of females. Furthermore, 61 (25.21%) of females reported not to participate in any sports compared to 16 (15.1%) of males ($X^2(1) =5.31$., p= 0.025**). Table 3 enumerates the data on Participants' involvement in sports activities.

According to our survey, a total of males 59 (55.66%) reported to be participating in physical sports once per weeks compared to 141 (58.26%) of females (Table 3). Reported frequency was also influenced by sex of participants ($X^2(3) =0.5$, p= $0,9^{ns}$). In addition, 11 males (10.38%) reported to spend less than 15 minutes in each physical sports session compared to 51 (21.07%) of females while 63 (59.43%) males reported to spend more than 30 minutes per session compared to 109 (45.04%) of females ($X^2(3) =11.003$, p= 0.01**).

Table 3. *Sex-wise Comparison of Participants Involvement in Self-Physical Sports Activities (N=348).*

Variable	Sex of participating adolescents						X^2 (df)	P-value
	Girls (N=242)	Percentage	Boys (N=106)	Percentage	Total N	Percentage		
Participants' involvement in sports activities								
Yes	181	74,79	90	84,90	271	77,87	5,31 (1)	0,025**
No	61	25,21	16	15,10	77	22,13		
Time Spent by Participants Per Sports Session (in minutes)								
< 15	51	21,07	11	10,38	62	17,82	11,003 (3)	0,01**
15-20	39	16,12	21	19,81	60	17,24		
21-30	43	17,77	11	10,38	54	15,52		
>30	109	45,04	63	59,43	172	49,42		
Participants' Number of Self-Physical Sports Activities/week								
Once	141	58,26	59	55,66	200	57,47	0,50 (3)	$0,9^{ns}$
Twise	49	20,25	21	19,80	70	20,11		
Thrice	28	11,57	15	14,16	43	12,36		
More than thrice	24	9,92	11	10,38	35	10,06		
Participants' Preferred Sports								
Football	22	9,09	61	57,55	83	23,85	105,91 (5)	0,005**
Basketball	31	12,81	8	7,55	39	11,21		
Kriket	12	4,96	10	9,43	22	6,32		
Netball	65	26,86	9	8,49	74	21,26		
Jogging	92	38,02	13	12,26	105	30,17		
Others	20	8,26	5	4,72	25	7,18		

Abbreviations:
X^2=Chi-Square Test, ns= no signification (not influenced by participants' sex)
df=Degree of Freedom, **= Significant (highly influenced by participants' sex).

In reporting favorite sports, 61 (57.55%) males reported to participate more in football while 92 (38.02%) of female reported jogging as their most favorite physical sport. The choice of type of sports was highly influenced by participants' sex ($X^2(5) =105.91$, p= 0.005**).

30 (28.30%) of males reported traditionally rice as their favorite food compared to 68 (28.1%) females, while 44 (18.8%) of females reported to prefer meat compared to 21 (19.81%) males. in addition, we found only 22.7% of Ajman's adolescents had daily F/V intake. 10 (9.43%) of males reported fruits among their favorite foods compared to 36 (14.88%) of females forming a total of 46 (13.22%) participants who reported fruits as their favorite food (Table 4). The choice was influenced by the participants' sex ($X^2(6) =12.52$, p < 0.005**). Both males and females reported fresh vegetable juice as their favorite drinks while 21 (19.81%) of males reported to prefer water compared to 60 (24.79%) of females (Table 4). However, the difference was not statistically significant ($X^2(6) =7.53$, p = $0,25^{ns}$).

Table 4. *Sex-wise Comparison of Participant's Favorite Foods, Drinks and Eating Habits (N=348).*

Variable	Sex of participating adolescents						X^2 (df)	P-value
	Girls (N=242)	Percentage	Boys (N=106)	Percentage	Total N	Percentage		
Participant's favorite Food								
Traditionally rice	68	28,10	30	28,30	98	28,16	12,52 (6)	0,05**
Meat	44	18,18	21	19,81	65	18,68		
Fish	36	14,88	13	12,26	49	14,08		
Shawarma	19	7,85	20	18,87	39	11,21		
Fruits	36	14,88	10	9,43	46	13,22		
Vegetables	27	11,16	6	5,66	33	9,48		
Others	12	4,96	6	5,66	18	5,17		
Participant's favorite Drink								
Water	60	24,79	21	19,81	81	23,28	7,53 (6)	$0,25^{ns}$
Fresh fruit juice	87	35,95	32	30,19	119	34,20		
Commercial indutrial juice	13	5,37	12	11,32	25	7,18		
Tea	24	9,92	10	9,43	34	9,77		
Coffee	36	14,88	18	16,98	54	15,52		
Soft drinks	17	7,02	12	11,32	29	8,33		
Others	5	2,07	1	0,94	6	1,72		
Eating Habits per 24 Hours							1138,73 (5)	$> 0,91^{ns}$
Breakfast	230	95,04	58	54,72	288	82,76		
Morning Snack	24	9,92	12	11,32	36	10,34		
Lunch	240	99,17	99	93,40	339	97,41		
Afternoon Snack	102	42,15	30	28,30	132	37,93		
Dinner	120	49,59	87	82,08	207	59,48		
Other Snack	24	9,92	11	10,38	35	10,06		

X^2=Chi-Square Test, ns= no signification (not influenced by participants' sex)
df=Degree of Freedom, **= Significant (highly influenced by participants' sex).

Previously study [26] showed that 48·4% of adolescent in Ajman ate three principal meals, usually at home. Dairy products, fruits and vegetables were consumed daily by 12.13, 25·6 and 74·12% respectively. We noticed that 35·3 and 13·1% of children, respectively, consumed sweets and fats daily.

4. Discussions

This study presents new information regarding the epidemiology and factors associated with overweight/obesity among Ajman's secondary schools pupils. We found a considerably high prevalence of overweight/obesity among participants (32.4%), which supported previous UAE-based epidemiological studies that used BMI to define overweight/obesity [8, 9]. This mentioned prevalence rate obtained in our study was also consistent with studies from other Arab countries that used BMI to classify obesity, including Saudi Arabia 39% [29], Kuwait 44.3% [30, 31] and Egypt 35% [32]. Conversely, the magnitude of obesity rates is relatively lower compared to other studies conducted in Western countries and USA. For example, the obesity rate among adolescents in European countries was between 22% and 25%, with the rate for Italy [32] being 23.3% (either overweight or obese) and rates for Greece being 19.1% (overweight) and 3.2% (obesity), [33] In the USA, 30% of adolescents were overweight/obese [34, 35].

Predictors of overweight/obesity

In our study, variations were noted in socio-demographic factors, nationality, and economic status between participants from private and public schools. These personal factors could play an important role in determining obesity rates in adolescents [36] and therefore warrant further attention. Understanding the differences between private and public schools and the socio-demographic structure among adolescents is essential to build focused interventions that overcome barriers to healthy choices, especially in public schools that demonstrated increased obesity rate [27, 28].

Sport involvement, Time Spent by Participants per Sports Session, Participants' preferred Sports and Participant's Favorite Foods were significant determinants of overweight/obesity, and showed independent relationships with BMI indicator.

Low levels of physical activity and unhealthy dietary practices predicted obesity among adolescents [37]. This trend has been attributed to rapid urbanization and lifestyle changes with increased use of modern private and public transportation such as cars, motor cycles, trains, school buses as well as other entertainments that encourage sedentary lifestyle such as computer games and television [38-40]. Furthermore, promoting healthy lifestyles for adolescents is a public health priority as the WHO recommends at least 60 min of moderate-to-vigorous physical activity each day, and a dietary intake of at least 400 grams of F/V each day (roughly equivalent to five servings of F/V per day). Without an awareness of proper nutrition, the foods and amount of foods consumed can lead to obesity and other health related conditions. Therefore, there is a need to enforce school policies that motivate adolescents to consume the recommended intake of F/V and engage in physical activities for better health outcomes. In the school environment, guidelines for food consumption inside schools, canteen food menus, and diet and exercise self-efficacy must be explored in future studies.

Results from the present study concerning the high obesity prevalence and its correlates confirm the need for a strong and unified policy that considers students diverse socio-demographic characteristics, school type and environment, and educational policies when initiating campaigns to combat obesity. Government health campaign interventions and strategies must be established at the federal level to support schools to identify overweight and obese adolescents and increase their awareness about the negative impact of obesity on health outcomes in adolescent [8]. A unified and collaborative health promotion model is needed where UAE health officials, teachers, parents, students and social media are involved as early as possible [9]. Furthermore, it is recommended that a surveillance system for obesity indicators for Ajman's adolescents is implemented to monitor the effectiveness of policies aiming to counteract obesity in this population.

Pertaining to the other assets to reduce this health scourge, we can take advantage of the use of mass media. In Emirate of Ajman, 98% among schoolchildren used Social-Networking Sites (SNS) daily, indicating persistent growth and pervasive usage of SNS within Ajman's adolescents [40]. Consequently, SNS would be best useful and effective to promote the Healthy Eating & Active Living (HEAL) public health campaign at the universities/schools among adolescents within Ajman and the UAE at large. This public health campaign could be conducted over a semester long as a general-education course at the first-year of any Bachelor's degree program at the universities/schools across the UAE.

5. Conclusions

Obesity and overweight are prevalent among secondary school adolescents in the Emirate of Ajman, UAE with high linked with sedentary behavior, inadequate physical sports activities and unhealthy food preferences. In addition, preventive approaches in the social environment of adolescents should be considered. Adolescents should not be sidelined in National NCDs control programs. Therefore, a campaign has to be aligned with the main objective of promoting a healthier lifestyle through healthy eating and active living activities, in an effort to reduce obesity among adolescents within secondary schools setting in Ajman, United Arab Emirates.

Conflict of Interest

Authors have no conflicts of interest to declare.

Ethics Approval and Consent to Participate

The Ministry of education granted permission and provided a list of secondary schools in the Ajman's urban areas. The directors of the schools selected were contacted and approved their participation. The National Ethics Committee and the Ministry of Education in UAE approved the study.

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