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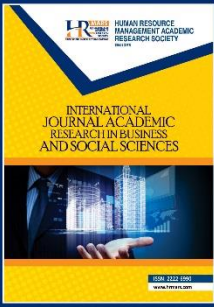
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Prevalence and Socio-Demographic Predictors of Overweight and Obesity Risks among Adolescents Aged 15-18 Years in Kuwait

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Abstract

Objective: Obesity is a contributing factor to various non-communicable diseases. This study is aimed at determining the prevalence and predictors of overweight and obesity among secondary school adolescents in Kuwait, a problem that has not been studied in the past few years.

Methods: This investigation, which adopted a cross-sectional design, was conducted at public secondary schools in all the six Kuwaiti governorates, via. Al- Ahmadi, Jahra, Hawalli, Al Asimah, Al- Farwaniyah and Mubarak Al- Kabeer. Secondary school students aged 15 to 18 years old were recruited using cluster sampling. Data were collected from 4,958 eligible participants and analyzed using Chi-square test for association relation, and multiple logistic regression to determine significant predictors of obesity.

Result: Our findings reported a prevalence of 13.7% of overweight and 2.3% of obesity, they also showed that adolescent males and adolescents in some school districts had a higher tendency to be obese. Also, our findings indicated that only a minority of the adolescents were obese (n=115; 2.3%). A multiple logistic regression analysis showed that the respondents' obesity was significantly associated with gender and school district. Girls were more likely to be non-obese (AOR=1.702, 95%CI: 1.160-2.498, P=0.007). Students from the school district of Al-Ahmadi were less likely to be obese compared to students from Mubarak Al-Kabeer (AOR=2.497, 95%CI: 1.002-6.219, P=0.049).

Conclusion: Gender and school district were significantly associated with obesity.

Keywords: Obesity, Non-communicable Disease, Adolescents, Kuwait, Prevalence, Predictors

Introduction

In this era of the fourth industrial revolution and digital technology, obesity has become a major health problem that leads to increased risk of various non-communicable diseases (Gan et al., 2020). A recent review published in *Nature* points out that the prevalence of obesity has been on the upward trend worldwide since the past 50 years, almost reaching pandemic levels nowadays (Blucher, 2019). Undoubtedly, obesity is a contributing factor to the global increase of morbidity and mortality rates.

Obesity is attributed to changes in dietary habits and physical activity patterns which are often linked to environmental and societal changes (Bluher 2019; World Health Organisation, 2020). These factors are also associated with the lack of supportive public policies such as those in health, urban planning, food processing, and education. Fundamentally, obesity and overweight are often the result of increased intake of energy dense food, such as those containing high amounts of fat and sugar, coupled with a reduction in the energy expended when leading physically inactive lifestyles. Unfortunately, some dietary habits, especially among adolescents, are hard to overcome in the face of aggressive advertisements for energy drinks, junk food and snacks which are high in sugar and salt. According to a review by Khan and Ahmad (2017), a high energy diet combined with reduced physical activity is the main cause of overweight and obesity, that has indirectly resulted in 2.8 million deaths annually (Khan and Ahmad, 2017). According to the authors, although the rates of overweight and obesity are higher in high-income countries, both low and middle-income countries are now beginning to grapple with similar problems.

In Kuwait itself, more than half of the adolescent population (54.3%) in 2012 and 2013 were reported to be overweight or obese, with males having a higher proportion of the problem (Rey-Lopez et al., 2019). Unfortunately, no updated information on this problem is available as there has not been any research on the obesity of adolescents in Kuwait since then.

According to a recent study in Kuwait on dietary habits among college students with a mean age of 21.57 ± 1.99 years, both genders showed equally unhealthy dietary habits as reflected by a low healthy eating score (Alkazemi, 2019). The authors elaborated that more males ate greater quantities of animal protein per day, while females consumed more potato chips, fatty and salty snacks and sweets regularly. Moreover, with the increasing popularity of fast-food restaurants in recent decades, there has been a unsurprising increase in obesity and diabetes (Allen et al., 2017). Besides dietary habits, physical inactivity is another contributing factor to obesity (Gan et al., 2019). Hence, the aim of this study was to investigate the prevalence and socio-demographic predictors of obesity, focusing on that age of adolescents in secondary schools in Kuwait between 15 to 18 years old. The name of that stage is called (high school) in Kuwait which is only for that specific age and separated from other lower stages. The secondary schools in Kuwait have three study levels (10th, 11th and 12th) and considered pre-college stage where the students can choose their study pathways.

Methodology

Study Design

A cross-sectional study design was used, involving participants from public secondary schools in Kuwait.

Study Location

Kuwait educational policy stipulated separate schools for boys and girls in each Governorate (via. Al- Ahmadi, Al Jahra, Hawalli, Al Asimah, Al- Farwaniyah and Mubarak Al- Kabeer). There were 66 public secondary schools for males in Kuwait, with a total of 32,550 students in 403 classes. For female students, there were 77 schools with a total of 40,095 students in 1,692 classes.

Inclusion and Exclusion Criteria

Public secondary schools in Kuwait with adolescents aged 15 to 18 years old were included in the study. While, Secondary school adolescents with special education disability (deaf and blind) and have physical support were excluded in the study.

Sampling Unit

Individual secondary school adolescents were assessed and found to be eligible for the study.

Sampling Method

A total of 4,958 students aged 15 to 18 years were recruited using cluster sampling. The desired cluster size was obtained by getting the mean number of students in the schools with less than 400 students. For male secondary schools, a total number of 22 schools (< 400 students per school) consisting of 6620 students were selected. The mean number was 301 male schools. Nine clusters were obtained by dividing the needed sample size (2479) by the mean of 301.

For female schools, a total number of 25 schools (< 400 students per school) consisting of 7994 students were selected with a mean of 320 students per school. Eight clusters were obtained by dividing the needed sample size (2479) by the mean of 320.

Sample Size

The sample size was calculated using the formula for hypothesis testing of a two group comparison (Lemeshow et al. 1990). Using this formula:

$$n = \frac{Z_{1-\alpha/2}^2 [P_1(1 - P_1) + P_2(1 - P_2)]}{d^2}$$

Independent Variables

The independent variables of the present study were socio-demographic factors (gender, age, parent's education, household size, school grade and socioeconomic status).

Dependent Variable

Data were collected for socio-demographics (gender, age, school grade, parents' educational level, household size, family income and school district) and body mass index (BMI). The anthropometric measurements for students were standardized by using the Sumbow model SM/ZT-120 for weight and height for all respondents. Data on height, weight, gender, and age were used to compute the BMI-for-age Z-score. The BMI was calculated by dividing the body weight in kilograms (kg) by the height in meters squared (m²). The BMI categories were defined using age- and sex- specific cut-off points relative to the WHO 2007 classifications. The interpretation of the cut-offs classifies overweight as having a z-score >+1SD, obesity as having a z-score > +2SD, and thinness as having a z-score < -2SD. The percentile based on the SD are as Obese >97.7%, Overweight 97.7% - 84.1%, Normal 84.1% - 2.3%, Thin 2.3% - 0.1%, and Severely Thin <0.1%.

Operational Definition

Socio demographic:	
Gender	Students' gender were boys and girls.
Age	Students' age were 15 years old, 16 years old, 17 years old, and 18 years old.
School Grades	School grades were Grades 10th, 11th and 12th
Parents' education	Students' fathers' education level and mothers' education level where ranging from non-tertiary to tertiary
Household size	Students' household number of siblings, grouped into 1 – 2, 3 – 4, 5 – 6, and 7 and above
Socio-economic status	Students' family income according to Kuwait Ministry of Finance salaries mean, either <1600 KD or, ≥1600 KD)
School districts	Students' schools' location at the district either at Mubarak Al-Kabeer, Al-Farwania, Al-Asimah, Hawally, Al-Jahraa and Al-Ahmadi.
Obesity	BMI greater than +2SD for age and gender.

Data Collection

Two weeks prior to data collection, all 17 selected-male and female-schools were contacted via telephone calls and school visits on previously fixed appointments. An agreement on the place, date, and time of the questionnaire administration was also secured. A total of 4958 Kuwaiti male and female students from 9 male schools and 8 female schools in 6 different Kuwait Governorates were asked to fill-out the distributed self-administrated anonymous questionnaire, with a closed-ended format, which were handed out to them in the classrooms. The time required to complete and finish the questionnaire was around 50 minutes. Physical measurements (height and weight) have been taken before conducting the questionnaire. The data collection took six months to be completed between December 2018 to May 2019. Prior to the distribution of the questionnaire, all participants were provided with the following guidelines regarding the administration of the questionnaire:

- i. The purpose and benefits of the study were explained to the participants and their agreement on participation was obtained.
- ii. Participants were given the complete right to withdraw from the study questionnaire at any time or any stage if they choose to do so, even after obtaining their approval at the beginning.
- iii. Participants were assured that the questionnaire is anonymous and be only identified by code numbers. They were informed that their answers would not be disclosed to anyone except the researcher for the purpose of the study only.
- iv. iv. Participants were encouraged to do the questionnaire alone and answering all the questions with a complete honesty. They were assured that there is no right or wrong answer in the survey, and that they could provide their best guess for any question they are unsure about, in case they did not recall correctly.
- v. Full questionnaire reading was provided for every participant class in all schools to make sure all questions are understood for all different ages. Explaining that the questionnaire will not provide any physical activities.

- vi. All participants were encouraged to answer all the questions and checking for missing or unanswered questions before submitting and returning the questionnaire to the researcher.
- vii. Participants were also asked to double check if there are any incomplete responses before leaving.

Privacy was established by conducting the questionnaire in the researcher's presence only and excluding teacher's involvement. Confidentiality of the data was assured via the written information sheet of the study and the presentation that precedes the data collection. Anonymity was also assured by asking the participants not to reveal any information such as name or school address in the questionnaire.

Statistical Analysis

The data for this study were analyzed using IBM SPSS Statistics Version 26.0. Descriptive statistics used were (i) percentage and frequency to present categorical data, and (ii) mean with standard deviation to describe normal distributed data. Chi-square test was used to determine the association between the independent variables (socio-demographic) and obesity.

Simple logistic regression was used to determine the relationship between each independent variable with the dependent variable. All the independent variables were entered into the multiple logistic regression model to determine the significant predictors to obesity among the participants. The result was interpreted based on the obtained adjusted odds ratio and p value. A p value less than 0.05 was considered statistically significant.

Results

Table 1 shows the demographic characteristics of respondents. With the age of participants ranging from 15 to 18 years, the overall mean \pm SD of age was 16.43 \pm 0.83. The largest group was the 16-year-olds (n=2328; 47%), followed by the 17-year-olds (n=1531; 30.9%), 18-year-olds (n=561; 11.3%) and 15-year-olds (n=538; 10.9%). School grades ranged from 10th to 12th, whereby the 10th grade had 1,663 (33.5%) students, 11th had 1,684 (34.0%) and 12th had 1,611 (32.5%). The majority of the respondents' fathers had tertiary education (n=3,454; 69.7%), while an even higher proportion of the respondents' mothers had tertiary education (n=3,931; 79.3%).

The mean \pm SD household size and monthly family income were 3.87 \pm 1.51 and 1,520.35KD \pm 346.48 respectively. The majority of the respondents were from households comprising 3-4 (n=1721, 34.7%) and 5-6 (n=1771, 35.7%), followed by 1-2 (n=1299, 26.2%). Only 167 (3.4%) were from households of 7 and above. Regarding family income, the majority of the respondents' families had income that was less than 1,600KD (n=3,746; 75.6%).

The majority of the respondents were from Al-Jahraa (n=1,843; 37.2%), followed by Al-Farwania (n=1,050; 21.2%), Hawally (n=792; 16.0%), Al-ahmadi (n=616; 12.4%), Al-Asimah (n=373; 7.5%); only a minority was from Mubarak Al-Kabeer (n=284; 5.7%).

Table 1

Demographic characteristics of respondents (N=4,958)

	Boys (n=2479) n (%) / mean±SD	Girls (n=2479) n (%) / mean±SD	All (N=4958) n (%) / mean±SD
Age	16.55±0.81	16.31±0.83	16.43±0.83
15	180 (7.3%)	358 (14.4%)	538 (10.9%)
16	1,087 (43.8%)	1,241 (50.1%)	2,328 (47.0%)
17	890 (35.9%)	641 (25.9%)	1,531 (30.9%)
18	322 (13.0%)	239 (9.6%)	561 (11.3%)
School Grade			
10 th	839 (33.8%)	824 (33.2%)	1,663 (33.5%)
11 th	2 (34.4%)	832 (33.6%)	1,684 (34.0%)
12 th	788 (31.8%)	823 (33.2%)	1,611 (32.5%)
Father's Education			
Non-tertiary	697 (28.1%)	807 (32.6%)	1,504 (30.3%)
Tertiary	1,782 (71.9%)	1,672 (67.4%)	3,454 (69.7%)
Mother's Education			
Non- tertiary	409 (16.5%)	618 (24.9%)	1,027 (20.7%)
Tertiary	2,070 (83.5%)	1,861 (75.1%)	3,931 (79.3%)
Household Size	3.85±1.49	3.89±1.54	3.87±1.51
1-2	649 (26.2%)	650 (26.2%)	1,299 (26.2%)
3-4	881 (35.5%)	840 (33.9%)	1,721 (34.7%)
5-6	878 (35.4%)	893 (36.0%)	1,771 (35.7%)
7 and above	71 (2.9%)	96 (3.9%)	167 (3.4%)
Family Income	1,496.53±321.78	1,544.17±368.06	1,520.35±346.48
<1,600KD	1,941 (78.3%)	1,805 (72.8%)	3,746 (75.6%)
>1,600KD	538 (21.7%)	674 (27.2%)	1,212 (24.4%)
School			
Mubarak Al-Kabeer	121 (4.9%)	163 (6.6%)	284 (5.7%)
Al-Farwaniyah	481 (19.4%)	569 (23.0%)	1,050 (21.2%)
Al-Asimah	163 (6.6%)	210 (8.5%)	373 (7.5%)
Hawally	509 (20.5%)	283 (11.4%)	792 (16.0%)
Al-Jahra	928 (37.4%)	915 (36.9%)	1,843 (37.2%)
Al-Ahmadi	277 (11.2%)	339 (13.7%)	616 (12.4%)

* 1 Kuwaiti Dinar (KD) = 14 Ringgit Malaysia (RM) = 3.2 United States Dollar (USD)

Table 2 shows the anthropometric measurements of the respondents. The mean±SD weight, height and BMI were 63.54 with SD±16.81, 161.10 with SD±8.03, and 24.36 SD±5.77 respectively. The readings of BMI for the majority of the respondents were in the normal

group (n=4,052, 81.8%), followed by overweight (n=677, 13.7%), obese (n=115, 2.3%), thin (n=110, 2.2%) and severely thin (n=2;0.01%).

Table 2

Anthropometric Measurements for Respondents

	Boys (n=2479) n (%) / mean±SD	Girls (n=2,479) n (%) / mean±SD	All (N=4,958) n (%) / mean±SD
Weight (kg)	66.90±18.23	60.17±14.50	63.54±16.81
Height (cm)	164.19±7.99	158.02±6.79	161.10±8.03
BMI	24.67±5.81	24.06±5.71	24.36±5.77
Obese	71 (2.9%)	44 (1.8%)	115 (2.3%)
Overweight	373 (15.0%)	304 (12.3%)	677 (13.7%)
Normal	1,970 (79.5%)	2,082 (84.1%)	4,052 (81.8%)
Thin	65 (2.6%)	45 (1.8%)	110 (2.2%)
Severely Thin	0 (0.0%)	2 (0.1%)	2 (0.0%)

Table 3 presents the results of associations between demographic characteristics and body mass index (BMI) among the respondents (N=4.958). The results showed that gender ($X^2=22.214$, $P<0.001$), age ($X^2=13.962$, $P<0.001$), household Size ($X^2=5.873$, $P<0.001$) and school district ($X^2=51.417$, $P<0.001$) were significantly associated with BMI among the respondents. No significant association was found between BMI with school grade, level of father's and mother's education, and family income ($P>0.05$).

More boys (2.9%) were found to be obese than girls (1.8%). The prevalence of obesity was the highest among respondents aged 18, from household size of 5 and 6, and from the governorates of Mubarak Al-Kabeer.

Table 3

Association between demographic characteristics and BMI

Demographic characteristics	Obese (n=115; 2.32%)	Overweight (n=677; 13.65%)	Normal (n=4054; 81.77%)	Thin (n=110; 2.22%)	Severely Thin (n=2; 0.04)	Total (N=4958)	X ² / Fisher exact test	P value
Gender							22.214	<0.001*
Boys	71 (2.9%)	373 (15.0%)	1970 (79.5%)	65 (2.6%)	0 (0.0%)	2479		
Girls	44 (1.8%)	304 (12.3%)	2084 (84.1%)	45 (1.8%)	2 (0.1%)	2479		
Age							13.962	<0.001*
15	11 (2.0%)	69 (12.8%)	444 (82.5%)	13 (2.4%)	1 (0.2%)	538		
16	51 (2.2%)	320 (13.7%)	1911 (82.1%)	46 (2.0%)	0 (0.0%)	2328		
17	43 (2.8%)	194 (12.7%)	1256 (82.0%)	37 (2.4%)	1 (0.1%)	1531		
18	10 (1.8%)	94 (16.8%)	443 (79.0%)	14 (2.5%)	0 (0.0%)	561		
School Grade							6.021	0.645
10th	39 (2.3%)	215 (12.9%)	1371 (82.4%)	37 (2.2%)	1 (0.1%)	1663		
11th	31 (1.8%)	243 (14.4%)	1374 (81.6%)	35 (2.1%)	1 (0.1%)	1684		
12th	45 (2.8%)	219 (13.6%)	1309 (81.3%)	38 (2.4%)	0 (0.0%)	1611		
Father's Education							8.948	0.575
Non-tertiary	36 (2.4%)	219 (14.6%)	1213 (80.7%)	36 (2.4%)	0 (0.0%)	1504		
Tertiary	79 (2.3%)	458 (13.3%)	2841 (82.3%)	74 (2.1%)	2 (0.1%)	3454		
Mother's Education							4.245	0.346
Non-tertiary	17 (1.7%)	133 (13.0%)	853 (83.1%)	23 (2.2%)	1 (0.1%)	1027		
Tertiary	17 (1.7%)	133 (13.0%)	851 (83.0%)	23 (2.2%)	1 (0.1%)	1025		
Household Size							5.873a	<0.001*
1 - 2	31 (2.4%)	175 (13.5%)	1064 (81.9%)	28 (2.2%)	1 (0.1%)	1299		
3 - 4	17 (2.1%)	103 (12.6%)	681 (83.4%)	16 (2.0%)	0 (0.0%)	817		
5 - 6	47 (2.7%)	238 (13.8%)	1395 (81.1%)	41 (2.4%)	0 (0.0%)	1721		
7 and above	22 (1.6%)	188 (13.6%)	1139 (82.5%)	31 (2.2%)	1 (0.1%)	1381		
Family income							2.249	0.684

<1600KD	90 (2.4%)	502 (13.4%)	3066 (81.8%)	86 (2.3%)	2 (0.1%)	3746	
>1600KD	25 (2.1%)	175 (14.4%)	988 (81.5%)	24 (2.0%)	0 (0.0%)	1212	
School							51.417 <0.001*
Mubarak Al-Kabeer	10 (3.5%)	34 (12.0%)	231 (81.3%)	9 (3.2%)	0 (0.0%)	284	
Al-Farwaniyah	34 (3.2%)	105 (10.0%)	877 (83.5%)	34 (3.2%)	0 (0.0%)	1050	
Al-Asimah	11 (2.9%)	64 (17.2%)	290 (77.7%)	7 (1.9%)	1 (0.3%)	373	
Hawally	16 (2.0%)	135 (17.0%)	623 (78.7%)	18 (2.3%)	0 (0.0%)	792	
Al-Jahra	35 (1.9%)	257 (13.9%)	1518 (82.4%)	33 (1.8%)	0 (0.0%)	1843	
Al-Ahmadi	9 (1.5%)	82 (13.3%)	515 (83.6%)	9 (1.5%)	1 (0.2%)	616	

Note: a= Fisher's exact test, *=statistically significant at P value<0.05.

Table 4 presents the simple and multiple logistic regression analyses for the demographic characteristics predicting obesity among the respondents. Simple logistic regression showed that girls were 1.632 times more likely to be non-obese as compared to boys (OR=1.632, 95%CI: 1.116-2.387, $P=0.012$), i.e. boys were more likely to be obese. The school district was also significantly associated with obesity ($P<0.05$). However, obesity was not significantly predicted by age, school grade, father's education, mother's education, household size, family income and school district ($P>0.05$).

A multiple logistic regression analysis showed that the respondents' obesity was significantly associated with gender and school district. Boys were 1.702 times more likely to be obese as compared to girls (AOR=1.702, 95%CI: 1.160-2.498, $P=0.007$). The respondents from the school district of Mubarak Al-Kabeer were 2.53 more likely to be obese as compared to those from Al-Ahmadi (AOR=2.497, 95%CI: 1.002-6.219, $P=0.049$). However, as with the simple regression, no significant association was found of respondents' obesity with age, school grade, level of father's and mother's education, household size, and family income ($P>0.05$). The final model was non-obese (odds) = 2.174 + 0.532 (gender-girls) + 0.915(school-Al-Ahmadi). The model explained 2% (Nagelkerke R squared) of the variance in obesity and correctly classified 97.7% of the cases. Besides, the model satisfied a goodness-of-fit assumption by the Hosmer and Lemeshow test ($P=0.539$).

Table 4

Simple and multiple logistic regression between demographic characteristics predicting obesity (N=4,958)

Demographic characteristics	Simple OR*(95%CI)	Multiple OR*(95%CI)
Gender		
Boys	1	1
Girls	1.632 (1.116-2.387) P=0.012*	1.702 (1.160-2.498) P=0.007*
Age		
15	1	-
16	0.932 (0.482-1.800)	-
17	0.722 (0.370-1.411)	-
18	1.150 (0.484-2.731)	-
School Grade		
10th	1	-
11th	1.281 (0.795-2.062)	-
12 th	0.836 (0.541-1.290)	-
Father's Education		
Non- tertiary	1	-
Tertiary	1.048 (0.703-1.561)	-
Mother Education		
Non- tertiary	1	-
Tertiary	0.658 (0.392-1.107)	-
Household Size		
1 – 2	1	-
3 – 4	0.871 (0.550-1.378)	-
5 – 6	1.213 (0.744-1.977)	-
7 and above	2.017 (0.478-8.505)	-
Family income		
<1,600KD	1	-
>1,600KD	1.169 (0.747-1.829)	-
School		
Mubarak Al-Kabeer	1	1
Al-Farwania	1.091 (0.532-2.235)	1.110 (0.541-2.277)
Al-Asimah	1.201 (0.503-2.869)	1.209 (0.506-2.890)
Hawally	1.770 (0.794-3.947)	1.980 (0.884-4.435)
Al-Jahraa	1.885 (0.923-3.851)	1.967 (0.961-4.023)
Al-Ahmadi	2.461 (0.989-6.126)	2.497 (1.002-6.219) P=0.049*

CI=confidence interval. Variable selection method=Multiple logistic regression Backward conditional applied, Hosmer and Lemeshow (p=0.539), classification table (overall percentage: 97.7%), Cox and Snell R squared (0.004), Nagelkerke R squared (0.018)

Discussion

Numerous studies have found obesity to be one of the risk factors contributing to various ailments such as cardiovascular disease, incontinence, and osteoarthritis that lead to the quality of life of obese individuals being adversely affected (Carbone et al., 2019; Csige et al., 2018; Gan et al., 2020; Jaffar et al., 2020; Poirier et al., 2006; Fu et al., 2020). Hence, it is important to study the prevalence of obesity in order to assess its severity in the community. Unfortunately, there have been no up-to-date data regarding the prevalence of obesity in Kuwait in recent years. In 2012 and 2013, a study reported that more than half of the adolescent population (54.3%) in Kuwait were either overweight or obese (Rey-Lopez et al., 2019). The prevalence numbers in this study were smaller, with only 2.3% being obese and 13.7% of the adolescent population being overweight. However, the results with regard to gender showed a similar trend, i.e. the prevalence of obesity was higher in boys as compared to girls.

Although there is a considerable difference in the prevalence of obesity between this study and that of a previous study in 2012/2013 by Rey-Lopez et al (2019), the mean age of adolescents for both studies were also 16 years of age; there were also similar outcome measures (BMI) (Rey-Lopez et al., 2019). In another study on obesity among adolescents aged between 15-18 years in eight different middle-east countries during the 2013-2014 period, it was reported that the problem was most prevalent among the male population in Kuwait while obesity was the highest in both genders (Musaiger et al., 2016). According to the authors, 23.4% and 24.8% of the total population in Kuwait were overweight and obese respectively. Based on their results, 24.8% of the male population were overweight and 28.6% were obese. With regard to the female population, 22.1% were overweight and 21.1% were obese. In the other hand, another study on adolescent age 13 to 16 had reported where 8.7% of this population were obese and 15.7% were overweight (Baker and Daradkeh, 2010). In the contrary, the study reported where the obesity rate is higher in females, students who live in urban areas and those with working parents. As such, this indicates where sampling methods and sampling location plays a major role in determining the prevalence of obesity.

Our findings reported where 2.9% and 15% of the male adolescents in Kuwait were obese and overweight respectively, while 79.5% of the male adolescents were of normal weight according to their BMI. The prevalence of obesity and overweight was not as serious in girls as compared to boys. According to our findings, only 1.8% and 12.3% of female adolescents in Kuwait were obese and overweight respectively, while 84.1% of the girls had normal BMI. We also found that there were more underweight boys than girls. However, the percentage of obesity depends on the reference standards used for classification. Hence, it is difficult to compare studies relating to BMI measurements as different studies use different reference standards of classification. Nevertheless, it is noticeable that the prevalence of obesity in Kuwait has been trending lower from 2012 to 2019.

Another factor which is associated with obesity is the adolescent's age. Although the respondents' age gap (15-18 years old) used in our study was relatively small, surprisingly our findings showed a significant difference between age and obesity. However, due to the small age gap, it was a challenge to evaluate the trend. Based on our findings, the range of respondents aged 15-17 who were overweight and obese were 14.8% and 15.9% respectively, 82.0% to 82.5% of them had normal BMI. A major difference was observed in respondents aged 18; 18.6% of them were obese and overweight while 79% had normal BMI. However, no study has shown evidence of increase in obesity and overweight based on BMI as the individual grows older. This is probably because as age increases, commitment also increases,

thus leading to stress, and studies have shown that stress is one of the major causes of obesity (Dallman, 2010; Dallman et al., 2003). Eighteen years of age is the minimum working age in Kuwait as well as the transition from school life to university life. This could be one of the contributors to stress, leading to overweight and obesity.

In addition, it was noted that household size and schools attended had a significant impact on the prevalence of obesity in Kuwait, despite the uneven distribution of the number of respondents for each category according to family size.

Strength and Limitation of the Study

The sample size of the present study was relatively large, giving sufficient number to detect small associations. Respondents of the study were relatively heterogeneous, and were selected randomly. Hence the results of this study could be used to generalize to secondary school students in Kuwait. However, the cross-sectional study design was based on the associations which were not the causal effect, and it was an inherent nature of most the designs of cross-sectional study. Information gathered through the survey was based on self-reported data, which potentially contribute to recall bias. One of the major limitations to the present study was the measurement of obesity that did not correlate with BMI findings, such as waist to hip ratio or a more direct approaches such as bioelectrical impedance. The measurement of BMI did not measure the body fat content nor took into account the muscle mass, bone density and overall body composition. Hence, findings of the present study could not accurately represent those who were muscular such as body builders or athletes. Another limitation was that the study did not include confounding variables in the analysis as the study focused on predictors of sociodemographic factors, suggesting that confounding variables be suggested for future study.

Conclusion

The prevalence of overweight and obesity is still a worrying issue in Kuwait. Our findings revealed that adolescent males had a higher tendency to be obese. In addition, the association between obesity and school districts could probably be due to the economic status of the district. Adolescents of certain districts may have different BMI because of diet.

Implication for Services

One strategy to reduce obesity is the change of unhealthy lifestyle behaviors. Lifestyle and health education programs tend to be multidisciplinary with self-care components tailored to individual risk factors.

Implication for Policy

The present study supports the need for a population-based approach to reduce overweight and obesity risk. In particular, population-based methods aimed at improving adolescents' nutrition and physical activities environments. Without an appropriate setting and strategies, it cannot be optimally implemented. School health plans started before school age and extended into high school are likely to affect most Kuwaiti children and adolescents' health. To achieve this goal, policy-makers and community leaders interested in optimizing the schools' environment are part of a population-based strategy to promote physical activity of all children and adolescents and reduce overweight and obesity risks and public health burden.

Implication for Future Research and Recommendations

As obesity is a risk factor caused not only by environmental factors but also genetic factors, complete understanding of the prevalence of overweight and obesity risk is indeed, a challenge. Hence future research should focus on both the environmental and genetic risk factors contributing to obesity. In addition to all the environmental factors, future studies should also focus on various psychological issues such as stress which could possibly regulate hormonal changes such as cortisol in the body which could be other factors contributing to overweight and obesity.

Ethical Issue and Consent

The study obtained approval from Universiti Putra Malaysia Ethics committee and Ministry of Education in Kuwait as follows: Reference (UPM/TNCPI/RMC/1.4.18.2/JKEUPM) Date [03/12/2018], (MOE/Ref:143,02/04/2019). Consent was obtained from both respondents and their guardians.

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Competing of Interests

The authors declare that there is no competing of interests.

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