Mal J Nutr 20(1): 51 - 62, 2014

Association of Lifestyle Factors with Obesity Indices among Adolescents in Amman, Jordan

Tayyem RF[1], Al-Hazzaa HM[2], Abu-Mweis SS[3], Bawadi HA[4], Qatatsheh A[5] & Musaiger AO[6]

[1] *Department of Clinical Nutrition & Dietetics, The Hashemite University. P.O. Box 150459, Zarqa 13115, Jordan*
[2] *Pediatric Exercise Physiology Research Laboratory, College of Education, King Saud University Riyadh, Saudi Arabia.*
[3] *Department of Clinical Nutrition & Dietetics, The Hashemite University P.O. Box 150459, Zarqa 13115, Jordan*
[4] *Department of Nutrition and Food Technology Jordan University of Science and Technology*
[5] *Department of Nursing, Princess Aisha Bint Al-Hussein Faculty of Nursing, Al-Hussein Bin Talal University, Ma'an, Jordan, and Department of Clinical Nutrition & Dietetic, Faculty of Allied Health Science, The Hashemite University, Zarqa, Jordan*
[6] *Arab Center for Nutrition, Manama, Bahrain, and Nutrition and Health Studies Unit, University of Bahrain*

ABSTRACT

Introduction: The aim of the study was to evaluate the association between physical activity level, sedentary behaviour and eating habits with obesity indices of body mass index (BMI) and waist-to-height ratio (WHtR)) among Jordanian adolescents. **Methods**: A cross-sectional study was conducted in the capital city of Jordan, Amman. The participants were 735 secondary school males (386) and females (349) aged 14–18 years who were randomly selected using a multistage stratified cluster sampling technique. Weight, height, BMI, waist circumference (WC), WHtR, screen time, physical activity level, and eating habits were assessed. **Results**: Compared with males, females were significantly (p<0.05) less physically active, skipped breakfast more frequently, consumed more sweets and potato chips and had less fruits and milk intake. The results of analysis of covariance showed that overweight and obesity (based on BMI or WHtR categories) were significantly (p< 0.05) different with regard to gender, type of school, lower intakes (<3 d/week) of breakfast, milk and sugar sweetened drinks. **Conclusion**: Knowledge of the factors that contribute to obesity could be used in preventive programmes for the control of obesity among adolescents in Jordan. Promotion of physical activity and healthy dietary habits among Jordanian adolescents is urgently needed.

Key words: Adolescents, BMI, Jordan, lifestyle factors, obesity, waist-to-height ratio

Correspondence author: Reema F. Tayyem; Email: *rtayyem@hu.edu.jo*

INTRODUCTION

Obesity is a growing and alarming health problem in both developed and developing countries. Obesity has a significant effect on adolescents' health status as it increases the chance of developing Type 2 diabetes in early life, as well as cardiovascular disease, hypertension, dyslipidemia, osteoarthritis, reproductive malfunction and some types of cancers in the future (Lobstein, Baur & Uauy , 2004). A study by Freedman *et al.* (2001) reported that an overweight child is 77% more likely to be an obese adult and be at risk of diabetes, high blood pressure, and hyperlipidemias.

In many countries, the problem of childhood obesity is worsening at a dramatic rate (Badran & Laher, 2011). The prevalence of excess weight among adolescents, in particular, is increasing in both developed and developing countries, but at very different rates and patterns (Badran & Laher, 2011). Available data indicates that the prevalence of overweight and obesity among school children is alarming in most countries of the Middle East region (Badran and Laher, 2011). The prevalence of overweight among adolescents ranged from 5.4% in Iran to 32% in Kuwait, whereas the prevalence of obesity ranged from 1.6% in Iran to 24.8% in Kuwait (Kelishadi *et al.*, 2008; Bader *et al.*, 2008; El-Bayoumy, Shady & Lotfy, 2009; Bener & Kamal, 2005). In general, overweight was more prevalent than obesity in both genders. Lately, a study conducted in seven Arab countries by Musaiger *et al* (2012) reported that among males, overweight was highest among Kuwaiti adolescents (25.6%), followed by Jordanian (21.6%), and Syrian (19.7%) adolescents. Among females, the highest prevalence of overweight was reported in Libyan adolescents (26.6%), followed by Kuwaiti (20.8%), and Syrian (19.7%) adolescents. As for obesity, Kuwaiti adolescents showed the highest prevalence of obesity for both males (34.8%) and females (20.6%). Kuwaiti males showed the highest prevalence of overweight and obesity (60.4%), while the lowest prevalence was reported in Algeria (13.4%). As for females, the highest prevalence was also found in Kuwaiti females (41.4%) and the lowest prevalence was in Palestinian females (16%) (Musaiger *et al.*, 2012).

Such high prevalence of obesity among children within a relatively stable population indicates that genetic factors are not the primary reason for change. In other words, some environmental factors may contribute significantly in the development of obesity (Lobstein *et al.*, 2004). These obesity-promoting environmental factors are sometimes referred to as 'obesigenic' factors (Davison & Birch, 2002).

In Jordan, many studies have shown increased prevalence of overweight and obesity among adolescents (Musaiger *et al.*, 2012; Khader *et al.*, 2011). However, no single study has assessed the relationships between obesity indices and eating habits and other lifestyle factors among adolescents. Also, none of the local studies have used a validated instrument to assess lifestyle factors. Therefore, the objective of the present study was to evaluate the association between several lifestyle factors, including physical activity, sedentary behaviours and eating habits and obesity indices, namely body mass index (BMI) and waist-to-height ratio (WHtR), among Jordanian adolescents aged 14–20 years, using a validated instrument and representative samples selected from the capital city of Amman.

METHODS

Sample

The present study is part of the Arab Teens Lifestyle Study (ATLS), a school-based cross-sectional multicentre collaborative project (Al-Hazzaa *et al.*, 2011a). The participants were adolescent males and females recruited from secondary schools in the capital of

Jordan, Amman. The required sample size was determined so that the sample proportion would be within +/- 0.05 of the population proportion with a 95% confidence level. In Amman, the total number of male and female students in the public and private secondary schools during the years 2009/2010 was about 55,000 Therefore, the final sample size consisted of 735 adolescents (386 males and 349 females). To select the required sample, a multistage stratified cluster random sampling technique was used. In the first stage, Amman was geographically divided into East and West areas. The schools in each area were then divided into public and private schools. Further stratification was done based on boys' versus girls' schools. A systematic random sampling procedure was used to select the schools from each of the boys' and girls' schools. The selection of private/public schools was proportional to population size. Finally, four schools (two each from the boys and girls schools) were selected from the two geographical areas in Amman (i.e., East and West).

At the second stage, classes were selected from each grade (level) of the three grades in each of the selected secondary schools, using a simple random sampling design. In this way, one class was randomly selected in each of the three grades (grades 10, 11 and 12) in each secondary school. Thus, we selected at least 24 classes in Amman (12 each from the boys' and girls' schools). All students in the selected classes, who were free from any physical deformity, were invited to participate in the study. The data were collected during the months of October to December of 2009. The study protocol and procedures were approved by the ethical committee of the Jordanian Ministry of Education. A formal letter from the ministry was directed to the schools to facilitate completion of the validated questionnaire. All the schools and students consented to involvement in the survey.

Anthropometric measurements

Body weight was measured to the nearest 100 g, with minimal clothing and without shoes (Lee & Nieman, 2010), using a calibrated portable scale (Seca, Germany). Height was measured to the nearest cm with the subject in the full standing position without shoes (Lee & Nieman, 2010) using a calibrated portable measuring rod (Tanita, Japan). Body mass index (BMI) was calculated as the ratio of weight (kilograms) to the square of height (meters). The International Obesity Task Force (IOTF) age- and gender-specific BMI reference values were used to define overweight and obesity in adolescents aged 14–17 years (Cole *et al.*, 2000). For participants aged 18 years, we used the cut-off points for adults (overweight, 25–29.9 kg/m2; obesity 30 kg/m2). WC was measured horizontally to the nearest centimeter using a non-stretchable measuring tape at the level of the umbilical and at the end of gentle expiration. Waist circumference was measured horizontally at navel level and at the end of gentle expiration to the nearest 0.1 cm using a non-stretchable measuring tape. The participants were asked to breathe normally and the reading was taken at the end of light exhale. Waist-height ratio (WHtR) was calculated as the ratio between WC in cm and height in cm. A WHtR cutoff point of 0.50 was used to define abdominal obesity in males and females (McCarthy & Ashwell, 2006).

Assessment of lifestyle factors

The Arab Teens Lifestyle Study (ATLS) research instrument was used for the assessment of lifestyle factors. Detailed descriptions of the methodology and procedures of ATLS are found elsewhere (Al-Hazzaa *et al.* 2011a). The lifestyle factors that were assessed by self-reported questionnaire included physical activity, sedentary behaviours and dietary habits. The participants completed the ATLS questionnaire in

their classrooms under the supervision of their teachers and at least one research assistant. The dietary habits questions covered some healthy and unhealthy dietary habits and included the number of times per week the participant consumed breakfast, sugar-sweetened beverages (including soft drinks), vegetables (cooked and uncooked), fruits, milk and dairy products, donuts/cakes, sweets and chocolates, energy drinks and fast foods. The fast foods included some examples from Western fast foods and Arabic fast foods. The students had a choice of answers, ranging from zero intake (never) to a maximum intake of 7 days per week (every day).

The physical activity questionnaire covered several domains, including transport, household, fitness and sporting activities. Physical activities were assigned metabolic-equivalent (MET) values based on the compendium of physical activity (Ainsworth*et al.*, 2011) and the compendium of physical activity for youth (Ridley, Ainsworth & Olds, 2008). Moderate-intensity physical activities included activities with metabolic equivalent (MET) values ranging from 3 to 6 METs such as normal pace walking, brisk walking, recreational swimming, household activities, and recreational sports such as volleyball, badminton and table tennis. Vigorous-intensity physical activities and sports included activities with MET values above 6 such as stair climbing, jogging, running, cycling, self-defense, weight training, soccer, basketball, handball, and singles tennis. The sedentary behaviors included questions related to typical daily time in hours spent viewing television (TV), watching video/computer games or spent on computer and internet use. The dietary habits questionnaires were based on a previously established and validated instrument that assessed food frequency (Musaiger *et al.* 2011). The questions covered some healthy and unhealthy dietary habits and were related to how many times per week the participant consumed breakfast, sugar-sweetened beverages (including soft drinks), vegetables (cooked and uncooked), fruits, milk and dairy products, donuts/cakes, sweets and chocolates, energy drinks and fast foods. The fast foods included some examples from Western fast foods and Arabic fast foods. The student has a choice of answers, ranging from zero intake (never) to a maximum intake of 7 days per week (every day).

Statistical analyses

Data were checked and then analysed using SPSS version 15 (SPSS, Inc, Chicago, IL, USA). Descriptive statistics are presented as means ± standard deviation (SD) or standard error of mean (SEM) or proportions. Data that were not normally distributed, such as physical activity scores in METs-min per week, were log transformed before performing parametric analyses. We also used two-way ANCOVA, while controlling for the effects of age, to test for differences in lifestyle variables across sex (males and females) and obesity indicators (for BMI and WHtR categories). The level of significance was set at a p-value of less than 0.05.

RESULTS

The anthropometric characteristics of the participants are shown in Table 1. Males were significantly taller, heavier and had higher mean WC value than females. The combined prevalence of obesity and overweight was significantly higher in males (25.7%) than in females (16.9%). Means ± SEM values for anthropometric and physical activity related to gender and BMI categories are shown in Table 2. Significant ($p<0.05$) differences in anthropometric and lifestyle variables were detected relative to gender and BMI categories. Age, as a covariate, showed significant ($p<0.05$) effects over most anthropometric variables (weight, height, WC, and WHtR), total screen time and METs-min/week of moderate –intensity

Table 1. Characteristics of subjects (mean±SD) (n = 735)

Parameters	*Males(n=386)*	*Females(n= 349)*	*p-value*
Age (Year)	16.1 ± 0.81	16.3 ± 1.1[a]	0.001
Body weight (Kg)	65.3 ± 16.0	56.2 ± 9.4[a]	0.001
Height (cm)	171.3 ± 7.4	160.9 ± 6.3[a]	0.001
BMI	22.1 ± 4.8	21.1 ± 3.4[a]	0.167
WC (cm)	80.1 ± 12.5	76.7 ± 8.5[a]	0.001
Overweight and obesity (%)	25.7	16.9[b]	0.002
Underweight (%)	0.3	1.8	0.001
Normal body weight (%)	74.0	81.3	
Overweight (%)	16.1	12.6	
Obesity (%)	9.6	4.3	

[a] $p < 0.05$ (*t*-test for independent samples)
[b] $p < 0.01$ (chi^2 for proportions)
BMI = body mass index; WC = waist circumference

physical activity. Males exhibited higher (p<0.05) values than females in vigorous-intensity and total physical activity. Total screen time did not show the main effect of sex. Table 3 reveals that females showed a significantly (p<0.05) higher intake of sweets compared to males. On the other hand, males reported higher (p<0.05) values than females in fruit, milk/dairy products, fast food and sweets consumption.

Table 4 shows the ANCOVA results for anthropometric and physical activity levels categorised by gender and WHtR cut-off points. Most of the anthropometric variables (weight, height, BMI, and WC) exhibited significant (p<0.05) differences in gender and WHtR interaction effects. The significant (p<0.05) main effect of gender was shown on vigorous-intensity and total physical activity. However, no significant effect of different physical activity levels on the interaction between gender and WHtR categories was detected. The results of dietary habits relative to gender and WHtR categories are illustrated in Table 5. Consumption of sugar-sweetened beverages and sweets intake showed a significant association with WHtR. Again, potato chips and sweets intake was higher in females than in males.

DISCUSSION

The present study aimed to evaluate the association of several lifestyle factors, including physical activity, sedentary behaviours and dietary habits with obesity indices, namely BMI and WHtR, among Jordanian adolescents aged 14–20 years. The major findings indicated that the rate of overweight (14.3%) among the study sample was double that of obesity (7%). Combined prevalence of overweight and obesity among males (25.7%) was much higher than that of females (16.9%).

The present study findings on the prevalence of overweight and obesity are similar to the prevalence rates that were previously reported for Jordanian adolescents (Khader *et al.*, 2011). Obesity prevalence among children and adolescents are increasing worldwide (Han, Lawler & Kim, 2010). High caloric foods and physical inactivity are considered major contributing factors (Han *et al.*, 2010) for being overweight or obese.

Table 2. Anthropometric and physical activity levels relative to gender and BMI categories among Jordanian adolescents

Variables	*Male*			*Female*		
	Normal	*Overweight*	*Obese*	*Normal*	*Overweight*	*Obese*
Age (years) [d]	16.0 ± 0.05	16.0 ± 0.12	16.2 ±0.16	16.3 ±0.05	16.1 ± 0.15	15.7 ± 0.25
Weight (kg) [a,c,d]	58.2±0.46	78.4± 1.0	99.5 1.28	53.3 ± 0.46	66.2±1.22	80.7± 2.02
Height (cm) [a,b,d]	170.9±0.40	172.6±0.86	173.2±1.11	161.1± 0.40	158.8±1.06	159.6±1.75
Waist circumference (cm) [a, c,d]	74.7± 0.40	89.9±0.87	106.4± 1.13	74.2± 0.40	84.6± 1.07	96.5± 1.8
Waist-height ratio [a,c,d]	0.43± 0.02	0.52 ±0.05	0.61 ±0.06	0.46 ±0.02	0.53 ±0. 06	0.61± 0.09
Total Screen time (hour/day) [a]	6.50±0.16	6.26±0.34	7.51± 0.44	6.88± 0.16	7.03± 0.42	6.79± 0.69
METs-min/week ofModerate -intensity physical activity [a, b]	1259.4±60.8	1199.0±128.7	1550.4±163.6	1040.9±61.3	1089.7±161.4	1174.5±266.4
METs-min/week ofVigorous -intensityphysical activity [b]	3472.9±135.8	3410.9±291.2	2306.0±376.5	941.1±136.8	1152.6±362.1	1063.9± 592.5
Total METs min /week [b]	4664.0±162.4	4570.9±348.2	3851.8±450.2	1914.0±163.2	2189.2±433.0	2179.8±708.6

Data are means and standard error of the mean and were analyzed by ANCOVA controlling for age
BMI = Body mass index
[a] $p < 0.05$ for the effect of age
[b] $p < 0.05$ for the main effect of sex
[c] $p < 0.05$ for the main effect of BMI category
[d] $p < 0.05$ for the effect of the interaction gender × BMI category

Table 3. Dietary habits relative to gender and BMI categories among Jordanian adolescents

Variables	*Male*			*Female*		
	Normal	*Overweight*	*Obese*	*Normal*	*Overweight*	*Obese*
Vegetables intake(frequency/week)	4.48±0.13	4.28±0.27	4.44±0.35	4.52±0.13	4.29±0.33	4.67± 0.55
Fruits intake (frequency/week) [b]	4.46±0.13	4.43±0.28	4.65±0.36	3.95±0.13	3.73±0.34	4.18± 0.56
Milk products (frequency/week) [b]	4.55±0.14	4.03±0.31	3.84±0.40	3.68±0.14	3.66±0.38	2.09 ± 0.63
Sugar-sweetened beverages (frequency/week) [b]	5.52±0.13	5.39±0.29	4.87±0.37	4.83±0.13	5.05±0.35	4.31± 0.58
Fast foods (frequency/week) [b]	2.60±0.11	2.50±0.24	2.62±0.31	2.16±0.11	2.00±0.30	1.83± 0.49
French fries/potatoChips (frequency/week)	3.85±0.14	3.31±0.30	2.43±0.38	4.29±0.14	3.56±0.36	4.62±0.60
Cake/donuts(frequency/week)	3.39±0.14	3.05±0.30	2.76±0.38	3.79±0.14	3.15±0.36	2.14±0.60
Sweets intake(frequency/week) [b]	4.21±0.13	3.41±0.29	3.29±0.37	4.99±0.13	3.66±0.36	4.13±0.59
Energy drinks(frequency/week)	1.12±0.11	1.26±0.23	0.82±0.30	0.86±0.11	0.83±0.29	1.02±0.48

Data are means and standard error of the mean and were analyzed by ANCOVA controlling for age
BMI = body mass index
[a] $p < 0.05$ for the effect of age
[b] $p < 0.05$ for the main effect of sex
[c] $p < 0.05$ for the main effect of BMI category
[d] $p < 0.05$ for the effect of the interaction gender × BMI category

Table 4: Anthropometrics and physical activity levels relative to gender and WHtR categories among Jordanian adolescents

Variables	*Male*		*Female*	
	WHtR < 0.5	*WHtR ≥ 0.5*	*WHtR < 0.5*	*WHtR ≥ 0.5*
Age (years) [b, c]	16.1±0.06	16.1±0.10	16.3±0.06	16.4±0.11
Weight (kg) [a, d]	59.0±0.58	85.4±1.03	53.2±0.60	65.9±1.12
Height (cm) [a, d]	171.2±0.40	172.3±0.71	161.2±0.42	159.2±0.77
BMI [d]	20.0 ± 0.17	28.7 ± 0.30	20.5 ± 0.18	26.0 ± 0.32
Waist circumference (cm) [a,d]	74.7±0.41	97.8±0.73	73.4±0.43	87.0±0.79
Total Screen Time (hour/day) [a]	6.50±0.16	6.74±0.28	6.94±0.16	6.72±0.30
METs-min/week of Moderate –intensity physical activity [a]	1247.7±60.0	1376.4±105.5	1075.1±63.5	976.1±116.7
METs-min/week of Vigorous –intensity physical activity [b]	3444.2±134.7 791.2±262.2	3049.9±239.5	1025.7±142.2	
Total METs min /week [b]	4629.8±160.5	4380.1±285.5	2031.2±169.2	1712.4±312.7

Data are means and standard error of the mean and were analyzed by ANCOVA controlling for age
BMI = body mass index; WHtR = Waist-height ratio
[a] $p < 0.05$ for the effect of age
[b] $p < 0.05$ for the main effect of sex
[c] $p < 0.05$ for the main effect of WHtR category
[d] $p < 0.05$ for the effect of the interaction gender × WHtR category

Table 5. Dietary habits relative to gender and WHtR categories among Jordanian adolescents

Variables	*Male*		*Female*	
	WHtR < 0.5	*WHtR e+ 0.5*	*WHtR < 0.5*	*WHtR e+ 0.5*
Breakfast intake (frequency/week)	3.93±0.15	3.20±0.26	2.87±0.15	2.35±0.28
Vegetables intake (frequency/week)	4.50 ±0.13	4.27±0.22	4.50±0.13	4.50±0.24
Fruits intake (frequency/week)	4.48±0.13	4.44±0.23	3.89±0.13	4.10±0.25
Milk products (frequency/week)	4.55± 0.05	3.92±0.09	3.64±0.05	3.50±0.10
Sugar-sweetened beverages (frequency/week) [b, c]	5.59±0.13	4.97±0.23	4.98±0.14	4.32±0.25
Fast foods (frequency/week)	2.65±0.11	2.38±0.20	2.15±0.12	2.04±0.21
Potato Chips (frequency/week) [b, c]	3.88±0.14	2.82±0.24	4.32±0.14	3.86±0.26
Cake/donuts (frequency/week)	3.47±0.14	2.69±0.24	3.73±0.14	3.33±0.26
Sweets intake (frequency/week) [b, c]	4.21±0.13	3.32±0.24	5.02±0.14	4.06±0.26
Energy drinks (frequency/week)	1.18±0.11	0.90±0.19	0.91±0.11	0.70±0.21

Data are means and standard error of the mean and were analyzed by ANCOVA controlling for ageBMI = body mass index; WHtR = Waist-height ratio[a] p < 0.05 for the effect of age[b] p < 0.05 for the main effect of sex[c] p< 0.05 for the main effect of WHtR category[d] p < 0.05 for the effect of the interaction gender × WHtR category

Adolescent males in the present study were shown to be at higher risk of overweight/obesity (higher BMI or high WHtR) compared with females. The current findings that overweight/obesity was more prevalent among boys than among girls agree with those reported by many other studies (Janssen *et al.*, 2004). However, unlike our findings, a study conducted on Egyptian adolescents found the prevalence of being overweight among female students higher than among boys (Salazar-Martinez *et al.*, 2006).

Physical activity in the present study did not show any significant association with obesity indices. This finding is contrary to what had been reported in a similar study on Saudi adolescents (Al-Hazzaa *et al.*, 2012). On the other hand, total screen time spent by Jordanian adolescents presented near significant association with obesity (p=0.07). A study by Laurson, Eisenmann & Moore (2008) reported that cross-sectional and longitudinal correlations between physical activity, screen time, diet and BMI were low and non-significant (r< 0.15) in boys and girls recruited from three rural states in the western USA. The regression models explained between 8% and 22% of the variance in the change in BMI but none of the predictor variables were statistically significant (Laurson *et al.*, 2008).

Results of the dietary habits in the current study showed that only breakfast can significantly be associated with BMI. The study finding indicated that the proportion of female adolescents who were skipping breakfast was higher than that of males. It is possible that the increased breakfast skipping among females might be due to a higher concern on the part of females for their weight status (Carriere *et al.*, 2012). Skipping breakfast is associated with overweight and obesity (Horikawa *et al.*, 2011). Given the global health epidemic of obesity, promoting breakfast consumption may provide a helpful tool to address the obesity problem. In Jordan, 77.1% of college students consume an unhealthy diet with breakfast skipping (Suleiman *et al.*, 2009).

Most of the dietary habits showed a trend toward reduced intake (though insignificanly) among obese participants compared to those having normal BMI. The same results could be seen among the participants in WHtR $\geq$0.5 as compared to those with WHtR $\leq$0.5.

The finding that obese adolescents showed slightly reduced (though insignificant, p 0.362) frequency of sugar-sweetened beverage intake (4.7 day/week) compared with overweight (5.2 day/week) and normal weight (5.2 day/week) participants needs to be noted. The slight decrease in sweetened beverages intake in both obese male and female adolescents could be attributed to the fact that short term experimental and cross-sectional studies are not well-suited to capture long-term patterns since many changes may take place with increasing duration. It is possible that obese adolescents might have been dieting to lose weight and therefore could have been temporarily reducing their intake of the soft beverages. In addition, the present study did not estimate total energy intake, rather it was a dietary habit assessment. Te Morenga, Mallard & Mann (2012) reported that cohort studies in children confirmed a link between intake of sugar sweetened beverages and the risk of becoming overweight, but showed no consistent associations between other measures of sugars intake and adiposity. However, comparison of groups with the highest versus lowest intakes in cohort studies was compatible with a recommendation to restrict intake to below 10% of total energy (Te Morenga *et al.*, 2012).

In relation to milk/dairy products consumption, our findings showed that obesity rates increased if participants consumed milk less than three times per week. Several previous studies support such findings (Van Loan, 2009; Dougkas *et al.*, 2011). Subjects consuming a higher amount of low-fat dairy products have been shown to have better diet quality, gained less body

weight, and had reduced waist circumference and percentage total body fat compared to those with lower intake (Van Loan , 2009). Satiety, increased insulin sensitivity and calcium content of dairy products are thought to be the main factors that may help in managing body weight and preventing its increase (Dougkas *et al.*, 2011). In contrast, other studies could not detect any association between dairy product consumption (including milk) and body weight gain (Dougkas *et al.*, 2011).

LIMITATIONS OF THE STUDY

Although we used a valid and reliable instrument in the present study, the questionnaire is self-reported and therefore is dependent upon student's memory to recall. In addition, no portion estimation was used to assess the real quantity of consumed food. Other confounders that were not controlled in the present study were maturity and socio-economic status. The cross-sectional design of the present study just indicates associations between the study variables and does not infer any causality from the current findings.

CONCLUSIONS

This study confirmed a high prevalence of overweight and obesity among Jordanian adolescents, especially in males. Jordanian adolescent females are at much higher risk of physical inactivity than males. Among the selected lifestyle factors, skipping breakfast, low frequency intake of milk/dairy and sugar-sweetened beverages were found to affect obesity indices. Promotion of physical activity and healthy dietary habits among Jordanian adolescents are warranted.

This is the first study to investigate the effect of some dietary and lifestyle factors on weight gain among adolescents in Jordan. Based on our findings, multi-dimensional intervention programmes should be developed to stop the dramatic increase in obesity. School and family-based interventions may have positive effects on adolescents' eating and physical activity pattern.

Funding

This research was funded by the Hashemite University.

REFERENCES

Ainsworth BE, Haskell WL, Herrmann SD, Meckes N, Bassett DR Jr, Tudor-Locke C, Greer JL, Vezina J, Whitt-Glover MC & Leon AS (2011). Compendium of physical activities: a second update of codes and MET values. *Med Sci Sports Exerc* 43:1575–1581.

Al-Hazzaa HM, Abahussain NA, Al-Sobayel HI, Qahwaji DM &Musaiger AO (2012). Lifestyle factors associated with overweight and obesity among Saudi adolescents. *BMC Public Health* 1612(1): 354.

Al-Hazzaa HM, Musaiger AO & ATLS Research Group (2011*a*). Arab Teens Lifestyle Study (ATLS): Objectives, design, methodology and implications. *Diabetes Metab Syndr Obes* 4: 417–426.

Bader Z, Musaiger A, Al-Roomi K & D'Souza R (2008). Overweight and obesity among adolescents in Bahrain. *Anthropologischer Anzeiger* 66(4): 401–408.

Badran M, Laher I (2011). Obesity in Arabic-speaking countries. *J Obes.* 2011: 686430. doi: 10.1155/2011/686430

Bener A& Kamal A (2005). Growth patterns of Qatari school children and adolescent aged 6-18 years. *J Hlth Pop Nutr* 23(3): 250–258.

Carriere C, Langevin C, Lamireau T, Maurice S & Thibault H (2012). Dietary behaviors as associated factors for overweight and obesity in a sample of adolescents from Aquitaine, France. *J Physiol Biochem* doi: 10.1007/s13105-012-0194-7

Cole T, Bellizzi M, Flegal K & Dietz W. (2000). Establishing a standard definition of child overweight and obesity worldwide: International survey. *BMJ* 320:1240–1243.

Davison KK & Birch LL. (2002). Obesigenic families: parents' physical activity and dietary intake patterns predict girls' risk of overweight. *Int J Obes* 26: 1186–1193.

Dougkas A1, Reynolds CK, Givens ID, Elwood PC & Minihane AM (2011). Associations between dairy consumption and body weight: a review of the evidence and underlying mechanisms. *Nutr Res Rev* 15: 1-24.

El-Bayoumy I, Shady I & Lotfy H (2009). Prevalence of obesity among adolescents (10 to 14 years) in Kuwait. *Asia-Pacific JPub Hlth* 21(2): 153–159.

Freedman DS, Kettel KL, Serdula M, Srinivasan S & Berenson G (2001). BMI rebound, childhood height and obesity among adults: the Bogalusa Heart Study. *Int J Obes* 25: 543–549.

Han JC, Lawlor DA, Kimm SY (2010). Childhood obesity. *Lancet.* 375:1737-1748.

Horikawa C, Kodama S, Yachi Y, Heianza Y, Hirasawa R, Ibe Y, Saito K, Shimano H, Yamada N & Sone H (2011). Skipping breakfast and prevalence of overweight and obesity in Asian and Pacific regions: a meta-analysis. *Preventive Medicine* 53(4): 260-267.

Janssen I, Katzmarzyk P, Boyce W, King M & Pickett W (2004). Overweight and obesity in Canadian adolescents and their effect on with dietary habits and physical activity patterns. *J Adoles Hlth* 35(5): 360–367.

Kelishadi R, Ardalan G, Gheiratmand R, Majdzadeh R, Hosseini M, Gouya M M, Razaghi EM, Delavari A, Motaghian M, Barekati H, Mahmoud-Arabi M S, Lock K & Caspian Study Group.(2008). Thinness, overweight and obesity in a national sample of Iranian children and adolescents: CASPIAN Study. *Child: Care, Hlth Dev* 34(1): 44–54.

Khader YS, Batieha A, Jaddou H, Batieha Z, El-Khateeb M & Ajlouni K (2011). Metabolic abnormalities associated with obesity in children and adolescents in Jordan. *Int J Pediatr Obes* 6(3-4): 215-22.

Laurson K, Eisenmann JC & Moore S (2008). Lack of association between television viewing, soft drinks, physical activity and body mass index in children. *Acta Paediatr* 97(6): 795-800.

Lee RD & Nieman DC (2010) Nutritional Assessment (5th ed.). New York: McGraw Hill.

Lobstein T, Baur L & Uauy R (2004). for the IASO International Obesity Task Force. Obesity in children and young people: a crisis in public health. *Obesity Reviews* 5(Suppl. 1): 4–85.

McCarthy HD & Ashwell M (2006). A study of central fatness using waist-to-height ratios in UK children and adolescents over two decades supports the simple message–'keep your waist circumference to less than half your height'. *Int J Obes* 30:988–992.

Musaiger AO, Bader Z, Al-Roomi K, D'Souza R (2011). Dietary and lifestyle habits amongst adolescents in Bahrain. *Food Nutr Res* 55. doi: 10.3402/fnr.v55i0.7122.

Musaiger AO1, Al-Mannai M, Tayyem R, Al-Lalla O, Ali EY, Kalam F, Benhamed MM, Saghir S, Halahleh I, Djoudi Z & Chirane M (2012). Prevalence of overweight and obesity among adolescents in seven Arab countries: A cross-cultural study. *J Obes* 2012: 981390. doi: 10.1155/2012/981390.

Ridley K, Ainsworth B & Olds T. (2008). Development of a compendium of energy expenditure for youth. *Int J Behav Nutr Phys Act* 5: 45.

Salazar-Martinez E, Allen B, Fernandez-Ortega C, Torres-Mejia G, Galal O & Lazcano-Ponce E. (2006). Overweight and obesity status among adolescents from Mexico and Egypt. *Arch Med Res* 37(4): 535–542.

Suleiman A, Alboqai K, Yasein N, El-Qudah J, Bataineh M & Obeidat B. (2009). Prevalence of and factors associated with overweight and obesity among Jordan university students. *J Biol Sci* 9: 738-745.

Te Morenga L, Mallard S & Mann J (2012). Dietary sugars and body weight: systematic review and meta-analyses of randomised controlled trials and cohort studies. *BMJ* 15; 346:e7492. doi: 10.1136/bmj.e7492.

Van Loan M. (2009). The role of dairy foods and dietary calcium in weight management. *J Am Coll Nutr* 28(Suppl 1): 120S-9S.