Original Article

Physical activity, sedentary behaviors and dietary patterns as risk factors of obesity among Jordanian schoolchildren

Hayder A. Al-Domi [a, *], Ahmad Faqih [a], Ziad Jaradat [b], Anfal AL-Dalaeen [a], Saied Jaradat [b], Batool Amarneh [b]

[a] Department of Nutrition and Food Technology, School of Agriculture, The University of Jordan, Amman, 11491, Jordan
[b] Department of Biotechnology and Genetic Engineering, Faculty of Science, Jordan University of Science and Technology, Jordan

ARTICLE INFO

ABSTRACT

Objective: To identify certain risk factors associated with childhood obesity related to lifestyle; dietary patterns, physical activity, and sedentary behavior.

Methods: A cross-sectional study was conducted among 977 schoolchildren (473 boys and 449 girls) aged 7–18 years. Children were selected randomly from three main cities in Jordan: Amman, Irbid, and Mafraq by using multistage cluster sampling method. Sedentary behaviors, physical activity and child eating behaviors were measured by using validated questionnaires. Overweight and obesity were defined by International Obesity Task Force (IOTF) criteria.

Results: Sedentary activities increase the risk of overweight among schoolchildren by 2-fold [RR(Relative risk) = 2.0, 95% CI(Confidence interval) (1.1–3.6), $p = 0.02$]. Whereas, sedentary activities for less than 3 h increased the risk of overweight by 0.8-fold [RR = 0.8, 95%CI (0.6–1.3), $P = 0.388$], Schoolchildren who spent<30 min/day in exercising decreased the risk of overweight by 0.5-fold [RR = 0.5, 95% CI (0.2–1.0), $P = 0.06$)]. Both Students who ate one meal daily and daily ate snacks from schools cafeterias had a higher tendency to be obese [(RR = 1.8, 95%CI (0.5–5.9), $P = 0.368$], and [RR = 1.5, 95%CI (0.9–2.5), $P = 0.169$] respectively.

Conclusions: Physical activity, eating meals regularly and homemade food, all together play a significant role in decreasing obesity among Jordanian schoolchildren, thus a national policy that promoting active living and healthy eating among schoolchildren is warranted.

© 2018 Published by Elsevier Ltd on behalf of Diabetes India.

1. Introduction

The prevalence of childhood obesity has been increasing alarmingly; it constitutes a serious global public health challenge [1]. Globally, the prevalence of overweight and obesity in children aged rose by 47.1% between 1980 and 2013 [2]. Prevention of childhood obesity is critical as it is associated with the development of unfavorable health outcomes during adulthood [3] such as cardiovascular diseases [4], type 2 diabetes and other chronic diseases later in life [5].

Obesity is a multi-gene condition and the expression of obesity is modulated by environmental factors, but above all by a number of modified genes interacting with each other [6]. The rapid increase in body weight results from a positive energy balance when energy intakes exceeds energy expenditure [7]. However, behaviors that may influence the energy balance have been referred to as "energy balance-related behaviors" (EBRBs) [8]. In children and adolescents, the most important behavioral determinants of overweight and obesity include over consumption of energy-dense foods, levels of physical activity and sedentary behavior [9]. Dietary and physical activity habits are formed at early life stages and have been to track into later life indicating the urgency of increasing our understanding of the origin and development of EBRBs in children [10]. A recent report showed that the total deaths attributable to low physical activity from 1,489,000 in 1990 to 2,182,000 in 2013 (465%, 640% age-standardized) [11].

Rapid changes in eating habits, lifestyle, and lack of physical activity have led to an increase in the prevalence of overweight and obesity in the Arab countries and consequently has led to a significant increase increase in chronic obesity-related non-

communicable diseases [12]. In Jordan, between 1980 and 2013, 24% of boys and 25.4% of girls (<20 years) were either overweight or obese, and 8.0% were obese [2]; yet, there are limited studies in Jordan aimed to determine risk factors for obesity related to life-style, dietary habits and physical activity patterns [13]. As such, the objective of the current study was to assess the strength of the association of risk factors for childhood obesity related to lifestyle including dietary pattern, physical activity and sedentary behavior among Jordanian schoolchildren aged 7–18 years old attending public schools in Amman, Irbid, and Mafraq.

2. Material and methods

2.1. Study population

A cross-sectional study was conducted during 2009–2011. A total of 922 schoolchildren (473 boys and 449 girls) aged 7–18 years were selected randomly from 20 Jordanian public schools, by using multistage cluster sampling method, in three major cities in Jordan; Amman, Irbid, and Mafraq. Amman is the capital city of Jordan and is the largest and most populated city in the country. Irbid is the largest city in Irbid governorate which is also heavily populated but its inhabitants are less wealthy. Mafraq is the largest city in Mafraq governorate located to the North-East of Jordan. It is sparsely populated, making less than 5% of total Jordan population, and still has a Bedouin population with a nomadic lifestyle who are only semi-settled.

The study protocol was approved by the Research Review Committee, Deanship of Scientific Research, The University of Jordan, and the Ministry of Education. A written consent was obtained from parents of every study child. Data were collected and reported in confidentiality. The population sample size was determined according to the number of population of young schoolchildren from public schools in the selected governorates for the academic years 2009/2010, The Jordanian Ministry of Education.

A total of 922 schoolchildren approved to participate in the study. Unreturned consent forms were considered dropouts, constituting a rate of 15.6% for boys and 18.0% for girls. A total participants of 922 schoolchildren (473 boys and 449 girls) participated in the study. The 922 sheets of questionnaires distributed, 767 (399 boys and 368 girls) were fully completed with a response rate of 83.2% as shown in Table 1. The dropout rate for the boys was 2.6% for the normal weight, 18.2% for the overweight, and 35.1% for the obese. A similar trend was obtained for the girls with the following respective values of 2.5%, 21.8%, and 33.6%.

2.2. Data collection

The data were collected by using questionnaire consisted of three main groups: (1) demographic data, (2) dietary history and eating practices, and (3) physical activity practices. Questions required short answers such as: yes, no, or short statements. Multiple-choice questions included three to five different choices including "I don't know" choice. The survey questionnaire took approximately 20 min for a student to complete.

To assess the content validity, a panel that included Academics of Nutrition and Physical Sciences as well as nurses, parents and young adults was asked to revise the developed questionnaire which was in Arabic language. Certain comments of the panel group were taken into consideration. In addition, a pilot study was undertaken by thirty six children comprised of two girls and two boys from each participating schools. The estimated value of internal consistency and reliability of the developed questionnaire was 0.79 using Cronbach's alpha statistics.

2.3. Anthropometric measurements

In a follow-up session, body weight (kg), height (cm) and waist circumference (cm) were measured using standard procedure. Body mass index (BMI) was calculated. The International Obesity Task Force (IOTF) age- and sex-specific BMI cutoff reference standards were used to identify overweight and obese adolescents between the ages of 2 and 17 years [14].

2.4. Statistical analysis

Data were analyzed using the graduate pack SPSS 17.0 for windows 2007. Differences among participants were examined using analysis of variance (ANOVA) for continuous variables, and chi-square tests for categorical variables. Association was tested using binary logistic regression. Data are presented as means ± standard deviation (SD) and as frequency distributions. The degree of internal consistency of ordinal scales was determined using Cronbach's alpha statistics. All p values of less than 0.05 were considered statistically significant.

3. Results

Table 2 presents the anthropometric indicators for schoolchildren. Obviously, BMI and waist circumference were significantly higher among obese boys and girls as compared to normal weight and overweight children counterparts ($p < 0.05$). Table 3 shows that normal weight girls maintained regular exercise significantly higher than normal weight boys (49%, 26.5%; respectively, $p < 0.01$). The percentage of obese girls (28%) who performed physical activity for <30min three to four times weekly tended to be higher than normal weight and overweight girls (23.5% and 10.2%). Moreover, obese school children were more sedentary than normal weight with no significant differance ($p = 0.117$).

Table 4 shows that normal weight girls consumed more homemade food than boys regardless of body weight ($p = 0.003$). Regardless of body weight status, the highest proportion of study

Table 1
Distribution of the population sample according to body weight status.

	Normal weight	Overweight	Obese	Total
Boys (n=473)				
Approved to participate, n(%)	192 (97.4)	135 (81.8)	72 (64.9)	399 (84.4)
Dropouts, n(%)	5 (2.6)	30 (18.2)	39 (35.1)	74 (15.6)
Study participants	197	165	111	473
Girls (n=449)				
Approved to participate, n(%)	196 (97.5)	115 (78.2)	57 (66.4)	368 (82.0)
Dropouts, n(%)	5 (2.5)	32 (21.8)	44 (33.6)	81 (18.0)
Study participants	201	147	101	449
Total Study participants	388	250	129	

Table 2
Anthropometric indicators of the population sample.

Variable	Normal Weight[a] (n = 388)		Overweight[a] n (n = 250)		Obese[a] (n = 129)	
	Boys	Girls	Boys	Girls	Boys	Girls
Age (year)	15.8 ± 2.1	15.3 ± 1.9	15.7 ± 1.9	15.5 ± 1.7	16.1 ± 1.6	15.6 ± 1.6
Weight (kg)	58.0 ± 10.4	55.1 ± 7.9	75.6 ± 12.3	68.4 ± 7.4	85.9 ± 14.9	83.2 ± 10.4
Height (cm)	163.2 ± 12.6	158.7 ± 8.7	165.9 ± 12.6	159.2 ± 7.8	160.9 ± 16.5	158.9 ± 9.9
BMI(kg/m^2)	21.7 ± 2.0	21.8 ± 1.8	27.3 ± 1.4	26.9 ± 1.5	33.1 ± 2.7	32.9 ± 2.7
Waist circumference (cm)[b]	59.2 ± 26.4	60.9 ± 22.8	68.4 ± 30.3	66.5 ± 26.9	77.9 ± 30.1	86.4 ± 31.3

[a] Body mass index (BMI) equals weight in kilograms divided by height in meters squared, which was used to classify the participants to: normal weight (BMI: 18.5—24.99 kg/m^2), overweight (BMI: 25—29.99 kg/m^2), and obese (BMI: ≥30 kg/m^2) (Cole et al., 2000, and IOTF, 2011).
[b] Waist circumference equals midway between the lowest rib and the superior border of the iliac crest (Zhao et al., 2011).

Table 3
Physical activity and sedentary behavior state of normal weight, overweight, and obese boys and girls jordanian schoolchildren aged 7—18 Years.*

Variable	Normal weight (n = 388)		Overweight (n = 250)		Obese (n = 129)		P- value	
	Boys (n = 192)	Girls (n = 196)	Boys (n = 135)	Girls (n = 115)	Boys (n = 72)	Girls (n = 57)	Overweight vs. normal weight	Obese vs. normal weight
Exercising regularly	52(26.5)**	94(49.0)	42(36.5)	41(30.4)	23(40.4)	23(31.9)	0.905	0.411
Exercise Once/day (Minute) <30	28(14.6)	19(9.7)	18(13.3)	13(11.3)	6(8.3)	4(7.0)	0.082	0.707
≥30	33(17.2)	6(3.1)	12(8.9)	1(0.9)	4(5.6)	6(10.5)		
1-2 times/week (Minuts) <30	18(9.4)	7(3.6)	7(5.2)	3(2.6)	4(5.6)	1(1.8)	0.243	0.855
≥30	4(2.1)	0(0.0)	4(3.0)	0(0.0)	1(1.4)	0(0.0)		
3-4 times/week (Minuts) <30	32(16.7)	20(10.2)	18(13.3)	27(23.5)	8(11.1)	16(28.1)	0.488	0.205
≥30	1(0.5)	0(0.0)	2(1.5)	0(0.0)	1(1.4)	1(1.8)		
Once/month (Minuts) <30	6(3.1)	1(0.5)	6(4.4)	4(3.5)	1(1.4)	0(0.0)	0.412	0.953
≥30	0(0.0)	0(0.0)	1(0.7)	0(0.0)	0(0.0)	0(0.0)		
Regularly active <30	13(6.8)	4(2.0)	14(10.4)	10(8.7)	6(8.3)	3(5.3)	0.009	0.243
Regularly Sedentary	179(93.2)*	192(98.0)	121(89.6)	105(91.3)	66(91.7)	54(94.7)		
Sedentary behavior <3 h/day	31(16.1)	32(16.3)	21(15.6)	27(23.5)	16(22.2)	12(21.1)	0.189	0.117
≥3 h/day	149(77.6)	160(81.6)	100(74.1)	78(67.8)	50(69.4)	42(73.7)		

*Data is presented as frequency (%), and is considered statistically significant at $P < 0.05$. ** P-value<0.001. Physical activity is a bodily movement produced by skeletal muscle that results in energy expenditure above basal levels (Caspersen et al., 1985).

population that ranged from 50.4% of overweight girls to 66.1% of normal weight boys reported that they ate three meals per day with no significant difference between weight groups ($P = 0.474$). Overall, the proportion of overweight and obese boys who consumed daily homemade food was significantly higher than that consumed by their normal weight girls ($p = 0.011$ and $p = 0.006$, respectively). There was no significant difference between all study groups regarding consumption of homemade meals on weekly basis ($p = 0.472$).

Table 5 shows that students who reported that they ate one meal daily had a higher tendency to be obese [RR = 1.8, 95%Cl (0.5—5.9), $p = 0.368$] compared to students who ate more than three meals per day. In addition, there was a tendency for students who did not consume healthy snacks from cafeterias to become obese [RR = 1.5, 95% Cl (0.9—2.5), $p = 0.169$] and for those who consumed homemade foods to become overweight [RR = 1.7, Cl (0.9—3.2), $p = 0.116$]. The risk of being overweight and obese decreased with eating fast food less than four times weekly [RR = 0.5, 95% Cl (0.3—0.9), $p = 0.032$; RR = 0.6, Cl 95% (0.3—1.3), $p = 0.224$], respectively. While students who spent >30 min undertaking daily exercise showed increase the tendency risk of being obese [RR = 1.5, 95% Cl (0.6—3.9), $p = 0.400$], schoolchildren who

was sedentary activities had significantly higher odds of being overweight [RR = 2.0, 95% Cl (1.1—3.6), $p = 0.02$], and those who spent <3 h in sedentary activities daily decrease the risk of being overweight [RR = 0.8, 95%, Cl (0.6—1.3), $p = 0.388$], and obese [RR = 0.8, 95%, Cl (0.6—1.2), $p = 0.228$].

4. Discussion

The significance of childhood obesity pandemic has provided the impetus for urgent action with much attention focusing on prevention [15]. Yet, due to the complex nature of the obesity epidemic, evidence describing which strategies is likely to prevent childhood obesity remains limited. Hence, it seems pivotal to investigate the current eating practices and physical activities among Jordanian schoolchildren aged 7—18 years old attending public schools from three major cities of the main Jordanian governorates: Amman, Irbid, and Mafraq.

In the current study, there was no significant difference between groups regarding the number of hours during which student maintained sedentary lifestyle. Yet, the proportion of normal weight boys and girls students (77.6% and 81.6%, respectively) who spent 3 h or more daily without physical activities was higher than

Table 4
Eating habits among a group of obese and overweight jordanian schoolchildren aged 7–18 Years.*

Variable n (%)	Normal weight (n = 388)		Overweight (n = 250)		Obese (n = 129)		All	P- value	
	Boys	G Girls	Boys	Girls	Boys	Girls		Overweight vs. Normal weight	Obese vs. Normal weight
Eating homemade foods	179(93.2)	194(99.0)	126(93.3)	106(92.2)	65(90.3)	56(98.2)	0.168	0.062	0.265
P- value	0.003		0.724		0.724				
Eating homemade foods Daily (meal) 1	7(3.6)	10(5.1)	2(1.5)	7(6.1)	0.00	3(5.3)	0.474	0.215	0.477
2	36(18.8)	46(23.5)	20(14.8)	31(27.0)	8(11.1)	17(29.8)			
3	127(66.1)	120(61.2)	89(65.9)	58(50.4)	46(63.9)	33(57.9)			
>3	21(10.9)	16(8.2)	22(16.3)	15(13.0)	13(18.1)	4(7.0)			
P- value	0.454		0.011		0.006				
Eating homemade foods Weekly ≤4	53(27.6)	66(33.3)	35(25.9)	37(32.2)	23(31.9)	22(38.6)	0.472	0.823	0.283
>4	126(65.6)	128(65.3)	91(67.4)	69(60.0)	42(58.3)	34(59.1)			
P- value	0.361		0.242		0.658				
Dining at specific times	35(18.2)	28(14.3)	15(11.1)	14(12.2)	11(15.3)	10(17.5)	0.357	0.178	0.926
P- value	0.222		0.665		0.897				
Eating fast foods regularly	126(65.6)	127(64.8)	90(66.7)	72(62.6)	46(63.9)	36(63.2)	0.945	0.891	0.735
P- value	0.864		0.503		0.932				
Eating fast foods weekly ≤4 times	102(53.1)	104(53.1)	80(59.3)	68(59.1)	42(58.3)	32(56.1)	0.013	0.009	0.060
>4 times	24(12.5)	23(11.7)	11(8.1)	4(3.5)	4(5.6)	4(7.0)			
P- value	0.848		0.152		0.714				
Eating unhealthy FFO weekly[a]	160(83.3)	190(96.9)	113(83.7)	107(93.0	58(80.6)	52(91.2)	0.245	0.327	0.102
P- value	0.001		0.024		0.089				

*Data is presented as frequency (%), and is considered statistically significant at $P < 0.05$. ** P-value<0.001.
[a] Falafel, shawerma, pittza, burger, fried potato, chocolate, chips, sweets, soft drink, artificial juice.

Table 5
Binary logistic regression analysis of factors associated with overweight and obesity among young jordanian students.

Variable		Overweight	P-value	Obese	P-value
		RR (CI 95%)		RR (CI 95%)	
Number of meals consumed daily	1	1.0 (0.5–2.4)	0.864	1.8 (0.5–5.9)	0.368
	2	1.0 (0.7–1.5)	0.949	1.1 (0.7–1.7)	0.793
	3	1.2 (0.9–1.6)	0.281	0.9 (0.7–1.4)	0.854
	>3	1		1	
Consuming not healthy snacks outdoors	Yes	0.9 (0.6–1.4)	0.637	1.5 (0.9–2.5)	0.169
	No	1		1	
Consuming home-made food	Yes	1.7 (0.9–3.2)	0.116	1.2 (0.6–2.7)	0.636
	No	1		1	
Number of home-made meals consumed weekly	≤4	0.9 (0.7–1.3)	0.562	1.3 (0.9–1.9)	0.229
	>4	1		1	
Consuming outdoors fast meals	Yes	1.0 (0.7–1.4)	0.999	1.1 (0.7–1.6)	0.748
	No	1		1	
fast meals consumed outdoors weekly	≤4	0.5 (0.3–0.9)	0.032	0.6 (0.3–1.3)	0.224
	>4	1		1	
Exercise regularly	Yes	0.9 (0.7–1.3)	0.815	0.9 (0.7–1.5)	0.927
	No	1		1	
Exercise regularly:	≤30	0.5 (0.2–1.0)	0.061	1.5 (0.6–3.9)	0.400
	>30	1		1	
Lifestyle	Sedentary	2 (1.1–3.6)	0.018	1.1 (0.5–2.3)	0.817
	Active	1		1	
Sedentary time	<3 h	0.8 (0.6–1.3)	0.388	0.8 (0.5–1.2)	0.228
	≥3 h	1		1	

Data is presented as frequency (%), and is considered statistically significant at $P < 0.05$. CI, confidence interval; RR, relative ratio.

that spent by boys and girls (74.1% and 67.8%, respectively) or boys and girls obese students (69.4% and 73.7%, respectively; $p = 0.210$). A study in Spain reported that each additional hour of time spent watching TV was associated with an increased risk of overweight and excess body fat by 15.8% and 26.8% among children and adolescents respectively. In A Korean study report that TV waching increased risk is by 17% overweight and 27% central adiposity [16]. A Canadian study of school children aged 5–17 year showed

evidence that daily TV viewing in excess of 2 h is associated with reduced physical and psychological health, and that lowering sedentary times leads to the reduction of BMI [16].

Notably, with regards to physical activity practices by students, no significant regression was found with obese students [RR = 0.9, (0.7–1.5), $p = 0.927$]. Furthermore, students who do not perform physical activity daily have higher tendency to be obese. Our results were in contrast to the results of Jabre et al. [17] who found that low physical activity was not associated with overweight and obesity among 6-8 year-old children in Beirut. Children and adolescents should do 60 min or more of physical activity daily and should engage themselves in vigorous aerobic physical activity, muscle strengthening, physical activity, and bone strengthening for at least three days per week [18].

The present study shows eating fast food more than four times per week is associated with overweight ($p = 0.032$) Consistent to a Saudi study of school children, aged 6–11 yrs who found that eat outside the home for more than 5 times a week increased the proportion of obesity from 52.7% [19].In contrast, Janssen et al. [20] reported that there was no clear association between dietary habits between overweight and obese Canadian adolescents. While Ludwig et al. [21] showed that the consumption of each additional serving of a sugar-sweetened drink led to increased BMI and obesity, moreover meals consisting of junk food were likely to result obesity [22]. Findings of An American carried out over a fifteen-year period established that there is a definite link between the consumption of fast food and increase in obesity. It was found that people who ate fast food more than twice a week weighed four and a half pounds more than those who ate these foods occasionally [23]. Fast food is associated with weight gain and obesity epidemic [24,25].

Rapid changes in dietary habits, lifestyle, and lack of physical activity have led to an increase in the prevalence of overweight and obesity in Arab countries, and consequently an increase in chronic non-communicable diseases [26]. .Data from WHO (Regional Office in Cairo) indicated that of adults between 79% to 96% in six Arab countries (Egypt, Jordan, Iraq, Kuwait, Saudi Arabia, and Syria) eat less than 5 servings of fruit and vegetables per day [27], while the recommendation is five to nine serving per day. These include an increase in the intake of unhealthy fast food and sugary drinks, skipping breakfast, consumption of foods rich in calories and fat between meals, and a high percentage of people who consume foods outside the home, which exposes them to more high-calorie foods [28].

A high proportion of overweight and obesity was found among Irbid students, which is expected that the nutritional status of adolescents in north Jordan is different from other governorates in the central or southern parts of Jordan including the capital city, Amman, where the average socioeconomic status is likely higher; as well as, the percentage of working mothers and students are most likely exposed to a greater number of fast-food, in contrast to the southern region of Jordan and students are more likely to benefit from home-cooked meals [29]. A study in Jordan was found that 40% of energy intake of obese children (6–12 yrs) came from fat intake compared to 28% among non-obese children [26]. Carbonated drinks are favorites of 60.7% of boys and 54.8% of girls [30].

In conclusion, sedentary behavior and consumption of fast foods increased the risk of overweight and obesity among Jordanian children, whereas, regular physical activity decreased the risk of overweight. Programs that increase awareness about overweight and obesity in children and adolescents and its adverse effects are recommended. Combination of dietary modification increased physical activity, decreased sedentary lifestyle and behavior modification is highly recommended. Finally, in the context of primary care, for decades sedentary lifestyle or behavior has been used to describe a type of lifestyle with little or no physical activity; yet with the rampant universal sedentary state, and lack of awareness.

Among doctors, dieticians and patients, and the ethical duty of clinicians to act to prevent or at least ameliorate the incidence of overweight and obesity and its related/induced non-communicable diseases and therefore minimize harm to patients, we would like to posit "sloth syndrome" as an alternative descriptor for "sedentary lifestyle".

Acknowledgement

References

[1] Rachel D, Eric A, David B. Complementary hypothesis on contributors to the obesity epidemic. Obesity 2018;26(1):17–21.

[2] Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, Mullany EC, Biryukov S, Abbafati C, Abera SF, Abraham JP. Global,regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet 2014;9945:766–81. https://doi.org/10.1016/s0140-6736(14)60460-8.

[3] Hoffmann SW, Tug S, Simon P. Obesity prevalence and unfavorable health risk behaviors among German kindergarten teachers: cross-sectional results of the kindergarten teacher health study. BMC Publ Health 2013;13:127. https://doi.org/10.1186/1471-2458-13-927.

[4] Ayer J, Charakida M, Deanfield JE, et al. Lifetime risk: childhood obesity and cardiovascular risk. Eur Heart J 2015;36:1371–8.

[5] Lakshman R, Eiks CE, Ong Kk. Childhood obesity. Circulation 2012;14:1770–9.

[6] Al-Domi HA. Genetic factors that act as an effect modifier for environmental risk factors of obesity. Dirasat Agric Sci 2013;1:27–37.

[7] Hill JO, Wyatt HR, Peters JC. Energy balance and obesity. Circulation 2012;126(1):126–32.

[8] De Craemer M, Lateva M, IotovaV, et al. Differences in energy balance-related behaviours in European preschool children: the ToyBox-study. PLoS One 2015;10(3), e0118303.

[9] Al-Dalaeen AM, Al-Domi HA. Factors associated with obesity among school children in Amman, Jordan. Malays J Nutr 2017;23(2):211–8.

[10] Te Velde SJ, Van Nassau F, Uijtdewilligen L, et al. Energy balance-related behaviours associated with overweight and obesity in preschool children: a systematic review of prospective studies. Obes Rev 2012;13:56–74.

[11] Forouzanfar MH, Alexander L, Anderson HR, et al. Global, regional, and national comparative risk assessment of 79 behavioral, environmental and occupational, and metabolic risks or clusters of risks in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study. Lancet 2013;386:2287–323.

[12] Musaiger AO. Overweight and obesity in eastern mediterranean region: prevalence and possible causes. J Obes 2011;2011:1–17.

[13] Khader Y, Irshaidat O, Khasawneh M, et al. Overweight and obesity among school children in Jordan: prevalence and associated factors. Matern Child Health J 2009;13:424–31.

[14] Cole TJ, Bellizzi MC, Flegal KM, et al. Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ 2000;320: 1240–7.

[15] Pereira M, Nogueira H, Padez C. Association between childhood obesity and environmental characteristics: Testing a multidimensional environment index using census data. Appl Geogr 2018;92:104–11.

[16] Byun W, Dowda M, Pate RR. Associations between screen-based sedentary behavior and cardiovascular disease risk factors in Korean youth. J Kor Med Sci 2012;27:388–94.

[17] Tremblay MS, LeBlanc AG, Janssen I, Kho ME, Hicks A, Murumets K, Colley RC, Duggan M. Canadian sedentary behaviour guidelines for children and youth. Appl Physiol Nutr Metabol 2011;36:59–64.

[18] Jabre P, Sikias P, Khater-Menassa B, Baddoura R, Awada H. Overweight children in Beirut: prevalence estimates and characteristics. Child Care J health dev 2005;31:159–65.

[19] U.S. Department of Health & Human Services. 2008 Physical activity guidelines for Americans. At- A – glance: a fact sheet for professionals. Retrieved October 16 2008, from, www.health.gov/PAGuidelines/guidelines/summary.apx; 2008.

[20] Amin HE. Relationship between overall and abdominal obesity and periodontal disease among young adults. East Mediterr Health J 2010;16:429–33.

[21] Janssen I, Katzmarzyk PT, Ross R. Waist circumference and not body mass index explains obesity-related health risk. Am J Clin Nutr 2004;79:379—84.

[22] Ludwig DS, Peterson KE, Gortmakr SL. Relation between consumption of sugar- sweetened drinks and childhood obesity: a prospective, observational analysis. Lancet 2000;1357:505—827.

[23] Jamison W. Fast food - obesity and eating habits. 2007. Retrieved from, http://ezinearticles.com/?Fast-Food—Obesity-and-Eating-Habits&id=562034.

[24] Binkley JK, Eales J, Jekanowski M. The relation between dietary change and rising US obesity. Int J Obes 2000;24:1032—9.

[25] Rosenheck R. Fast food consumption and increased caloric intake: a systematic review of a trajectory towards weight gain and obesity risk. Obes Rev 2008;9:535—47.

[26] Musaiger AO, Al-Hazzaa HM, Takruri HR, et al. Change in nutrition and lifestyle in the eastern mediterranean region: health impact. Journal of Nutrition and Metabolism 2012;2012:1—3.

[27] WHO/EMRO Regional data on non-communicable diseases risk factors World Health organization, Regional Office of East Mediterranean. Non-communicable diseases. http://www.emr.who.int.ncd. [Accessed 10 April 2010].

[28] Arab Center for Nutrition. Nutrition situation in the Arab countries. Bahrain: Manama; 2009.

[29] Abu Baker N, Daradkeh S. Prevalence of overweight and obesity among adolescents in Irbid governorate, Jordan. East Mediterr Health J 2010;16: 657—62.

[30] Sayegh A, Dini EL, Holt RD, Bedi R. Food and drink consumption, socio-demographic factors and dental caries in 4-5-year-old children in Amman, Jordan. Br Dent J 2002;193:37—42. https://doi.org/10.1038/sj.bdj.4801478a.