

Factors Associated with Obesity among School Children in Amman, Jordan

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ABSTRACT

Introduction: This study aimed to investigate the association between obesity, sedentary behaviour, television (TV) watching, small screen recreation (SSR), and perinatal life influences (breast-feeding, birth weight) among Jordanian school children. **Methods:** A total of 117 school children (56 obese and 61 normal weight) aged between 11 and 15 years were selected by using multistage cluster sampling method. Parents were requested to complete the first part of a questionnaire on family background, while the second part on adolescent sedentary behaviour was completed by the participants in the school. Anthropometric data were collected and presence of fat mass (%FM) was measured using bioelectrical impedance analysis. **Results:** Sedentary behaviour (hours/day) was significantly higher in obese school children compared to normal weight (4.43 ± 0.60 , 3.29 ± 0.68 , respectively; $P < 0.05$), and positively associated with BMI ($r = 0.270$, $P < 0.05$). Normal weight children spent less time on watching TV (hours/day) compared to obese children (2.01 ± 0.10 , 2.34 ± 0.16 , respectively; $P < 0.05$), and spent 2.55 ± 1.6 (hours/day) in small screen recreation (SSR) compared to 3.89 ± 1.0 (hours/day) of obese children. Both watching TV and SSR was significantly associated with BMI ($r = 0.260$, $r = 0.201$, respectively; $P < 0.05$). Duration of exclusive breastfeeding (months) was significantly higher in normal weight than obese children (7.70 ± 3.01 , 5.05 ± 2.01 , respectively; $P < 0.05$), and negatively associated with BMI ($r = -0.254$) and %FM ($r = -0.330$). **Conclusion:** Sedentary behaviour and watching TV were important risk factors for obesity among 11-15 years old Jordanian school children. A national policy promoting active living and reducing sedentary behaviour among school children is recommended.

Key words: Birth weight, breastfeeding, obesity, school children, sedentary behaviour

INTRODUCTION

The prevalence of obesity among children and adolescents has been increasing alarmingly in developed and developing populations, regardless of socio-economic or geographic variations (Stefan *et al.*, 2013). Between 1980 and 2013, the prevalence of overweight and obesity increased in children and adolescents (<20 years) from 8.1% to 12.9% in boys and from 8.4% to 13.4% in girls. In developed countries, 24% of boys and 23% of girls (<20 years) are overweight or obese. In Jordan, it has been estimated that more than 24% of boys

and 25.4% of girls (<20 years) are either overweight or obese and 8.0% are obese (Ng *et al.*, 2014). Moreover, a recent report showed that the total deaths attributable to low physical activity increased from 1,489,000 in 1990 to 2,182,000 in 2013 (Forouzanfar *et al.*, 2015).

The expression of obesity is modulated by environmental risk factors, but above all by a number of modified genes interacting with each other (Al-Domi, 2013). The "toxic" environmental risk factors implicated in the pathogenesis of obesity are twofold; the abundance of

energy-dense foods and beverages leading to a pervasive "passive overconsumption" of energy and an environment that limits opportunities for physical activity, which leads to a universal sedentary state (Marti, Martinez-Gonzalez & Martinez, 2008).

Sedentary behaviour is emerging as one of the most important risk factor of obesity and should be recognised as activities that are distinct from physical activities (Wong & Leatherdale, 2009). The definition of sedentary state as absence of physical activity fails to acknowledge both the magnitude and complexity of the problem; for instance, each of the activities of watching television (TV), playing video games, using the computer for fun and/or study, reading, and doing homework may have different implications for obesity (Biddle, Gorely & Stensel, 2004).

The studies that examine the magnitude of obesity in childhood, adolescents or adults and its associated risk factors in Jordan are scarce (Hamad *et al.*, 2016; Manal Ibrahim, Mousa Ali & Erika Sivarajan, 2010; Khader *et al.*, 2009). Identification of risk factors associated with obesity among school children could help to develop appropriate interventions to reduce the future burden of obesity among the young population in Jordan and elsewhere. Therefore, the objective of this study was to assess the association between risk factors for childhood obesity related to lifestyle and perinatal life influences (sedentary behaviour, TV watching, duration of exclusive breastfeeding and birth weight) among schoolchildren aged 11-15 years in Amman, Jordan.

METHODS

Human participants and data collection

A cross-sectional study was conducted between April and October 2016. A total of 56 obese (26 boys and 30 girls), and 61 normal weight (29 boys and 32 girls) school children (11-15 years) were selected by cluster sampling method. The Governorate of Amman is divided into four zones (North, South, East, and West). Two public schools for boys and two public schools for

girls were selected using simple random sampling method from a list of twenty public schools provided by the Ministry of Education, Jordan. Each list contained the school's name, range of grades within each school, total number of students, school's site and phone number. All classes from the fourth to the eighth grade in each selected school were included in the study, classrooms were selected randomly, and all the students in a classroom were invited to participate in the study; Consent forms signed by the schoolchildren's parents were obtained. Parents who consented were kindly asked to fill a questionnaire. Five parents of obese children did not give consent.

In a follow-up visit, students' height (cm), weight (kg), waist circumference (cm), and hip circumference (cm) were measured using standard procedures. BMI and waist-to-hip ratio (WHR) were calculated. The 2007 World Health Organization BMI-for-age criteria were used to classify obese and normal weight schoolchildren (de Onis *et al.*, 2007). Percent fat mass (% FM) and percent fat free mass (% FFM) were measured by using calibrated BIA (Bodystat@1500 MD unit (Body Stat Ltd®, UK) following standard procedures (Meeuwssen, Horgan & Elia, 2010).

This study was approved by the Research Review Committee, Deanship of Scientific Research, University of Jordan and the Ministry of Education, Jordan. Students were asked to fill two parts of the questionnaire. The first part was completed by their parents at home; it included information regarding educational level, family income, family size, and the dietary pattern of parents as well as birth weight and duration of exclusive breastfeeding of the participating schoolchildren.

The second part was the Adolescent Sedentary Activity questionnaire (ASAQ) (Hardy, Booth & Okely, 2007). The questionnaire was translated into Arabic language and revised by

a panel of academicians in Nutrition, Physical Activity and Sport Sciences and Arabic Literature. Officers from the Ministry of Education assessed its content validity and ensured correct translation. The questionnaire was pre-tested on 24 students conveniently selected with an equal number from a private and public school (11-15 years). The intra-class correlation (ICC) of the translated questionnaire was 0.78.

The questionnaire consisted of 32 items on a variety of sedentary behaviours related to entertainment, education, travel, and social activities. Students were asked to think about a normal week during school term, and to report how long they usually spend in specific sedentary behaviours, before and after school hours at weekdays and weekends. The time spent in sedentary behaviours was summed across weekdays and weekend days to obtain the total time spent in sedentary behaviours per day. A score of ≥ 4 h/day indicated high sedentary behaviour (Ybarra, Alexander & Mitchell 2005).

Statistical analysis

Statistical analysis was performed using SPSS version 17 (SPSS® for Windows, Rel. 17.0.1. 2008 Chicago: SPSS Inc). Data are presented as means \pm standard deviation. Differences in mean values were evaluated by using one-way analysis of variance (ANOVA). The partial correlations test was used to test associations between variables. Statistical significance was considered at $P < 0.05$.

RESULTS

Anthropometric, family, and lifestyle characteristics of obese and normal weight children are presented in Table 1. As expected, anthropometric measurements showed statistically significant differences between obese and control subjects. There was no significant difference between

groups in eating habits; number of meals, daily consumption of breakfast and eating snacks. The duration of exclusive breastfeeding was lower in the obese in comparison to normal weight children (5.05 ± 2.01 and 7.70 ± 3.01 , respectively).

Figure 1 shows the hours means per day of sedentary behaviour, watching TV and SSR for obese and normal weight children. Obese children were more sedentary than normal weight counterparts (4.43 ± 0.60 , 3.29 ± 0.68 h/day, respectively); they spent 2.34 ± 0.10 h/day in watching TV and 3.89 ± 2.0 h/day in SSR, while normal weight spent 2.00 ± 0.10 h/day in watching TV and 2.55 ± 1.6 h/day in SSR. Table 2 shows that both sedentary behaviour and SSR are positively associated with anthropometric parameters and % FM while breastfeeding is significantly negatively correlated with BMI and % FM.

DISCUSSION

The findings of the present study show that total sedentary behaviour was significantly higher in obese schoolchildren compared to normal weight counterparts, and was positively associated with BMI ($r=0.270$). These findings are consistent with the findings of Berkey *et al.* (2003), which demonstrated that sedentary behaviour was higher in obese than normal weight children (10-15 years). In contrast to the findings of Jabre *et al.* (2005), we found a positive correlation between time spent on watching TV, and obesity among schoolchildren regardless of gender which is consistent with other reports (Janssen *et al.*, 2004; Vandewater *et al.*, 2015). Sedentary behaviour and watching TV could be associated with obesity through at least one of the following mechanisms: (1) decreased physical activity, (2) increased calorie consumption while watching TV as a result of advertising, and (3) reduced resting metabolism (Vandewater *et al.*, 2015; Harris, Bargh Brownell, 2009).

Table 1. Demographics, anthropometric characteristics and dietary habits of school children aged 11–15 years in Jordan.

	Number of school children		
	Obese (n=56)	Normal weight (n=61)	P-value
Boys (%)	48.3	49.2	
Girls (%)	51.7	50.8	
Age (years)	12.62 ± 1.14	12.21 ± 1.24	0.065
Weight(Kg)	68.59 ± 16.55	42.08 ± 9.53	0.001
BMI (Kg/m ²)	28.11 ± 4.09	18.30 ± 2.18	0.001
Waist circumference (cm)	86.06 ± 12.99	64.22 ± 6.50	0.001
Hip circumference (cm)	101.21 ± 9.78	80.57 ± 8.56	0.001
WHR	0.84 ± .08	0.799 ± .06	0.001
Fat mass(%)	31.86 ± 6.14	21.97 ± 6.22	0.001
Fat free mass (%)	67.66 ± 9.151	77.33 ± 19.01	0.001
Family size	6.48 ± 1.855	6.36 ± 1.558	0.679
Family income (JD _s)	581.58 ± 220	414.19 ± 200	0.001
Daily pocket money (Piaster ^a)	43.9 ± 20.8	35.9 ± 18.41	0.984
Number of meals	2.8182 ± 0.732	2.6061 ± 0.61	0.163
Daily eating breakfast			
Yes	56.5	56.2	
No	43.5	43.8	0.984
Snacks	1.7273	1.4875	0.143
Education level of mother			
High school	68	60	
College/university	32	40	
Education level of father			
High school	44	66	
College/university	56	34	
Duration of exclusive breastfeeding (month)	5.05 ± 2.01	7.70 ± 3.01	0.04
Birth weight (Kg)	2.80 ± 1.04	2.06 ± 1.10	0.25

*Data are present as mean ± SD and frequency (%); †P value is significant for values less than 0.05. P value represents the difference between groups. BMI: body mass index; WHIP: waist-to-hip ratio.

^a 1 piaster = 1.42 cents.

In our study, we found that obese boys and girls spent more time (3.89 h/day) in using electrical devices compared to normal weight counterparts (2.1 h/day, $p < 0.05$). Moreover, using electrical devices was significantly correlated with BMI and %FM ($r = 0.260$ and $r = 0.215$, respectively; $P < 0.05$). Two Portuguese studies found a significant association between obesity and other sedentary behaviours among children. The first study found that normal weight children spent significantly less time using computers than overweight/

obese children aged 7–9 years old (Mota *et al.*, 2006). Meanwhile, the second study found a significant relationship between the use of electronic games and higher BMI in adolescent children aged 12–18 years (Carvalho *et al.*, 2007). Furthermore, another report found a strong positive relationship between interactive media (internet surfing and video games) and % FM and BMI among adolescents aged 14–17 years (Schneider, Dunton & Cooper, 2007). Marshall *et al.* (2004) found no association in their meta-analysis between

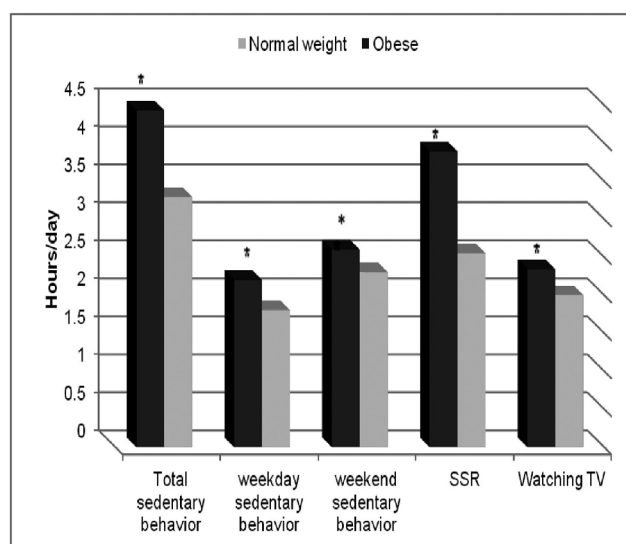


Figure 1. Mean value for sedentary behaviour and other behaviour in obese and normal weight schoolchildren. Data are presented as mean \pm SD. (*). P value is significant for values less than 0.05. P values represent the difference between groups. SSR (Small screen recreation) Watching TV+ playing video games+ using a computer for fun

Table 2. Association of sedentary behaviours, TV watching, small screen recreation, duration of exclusive breastfeeding and birth weight with anthropometric parameters and %FM[†]

	Sedentary behaviours	TV watching [†]	Small screen recreation [†]	Breast-feeding	Birth weight
BMI	0.270**	0.201*	0.260**	-0.254*	0.162
Waist circumference(cm)	0.283**	0.135	0.247**	-0.144	0.123
Hip circumference(cm)	0.216*	0.142	0.201*	-0.214	0.036
Waist/hip ratio	0.231*	0.293**	0.205*	-0.012	0.154
FM (%)	0.237**	-0.012	0.215*	-0.330*	0.115
FFM (%)	0.198*	-0.046	0.216*	0.134	0.03

[†] Values are presented as correlation coefficient(r). P value is significant for values (*) $p < 0.05$ and (**) $p < 0.001$. P value represented the difference between groups. BMI: body mass index, FM: fat mass, FFM: fat free mass.

[‡] Small screen recreation (Watching TV+ playing video games+ using a computer for fun).

[†] Control sedentary behaviour, small screen recreation.

playing electronic games and body fatness using six independent samples ($n=1722$).

The findings of the present study demonstrate a significant ($P < 0.05$) correlation between children's BMI and birth weight, which is in agreement with the majority of studies that reported a strong association between birth weight

and obesity among children (Reilly *et al.*, 2005). Birth weight could be one of the independent risk factors for childhood obesity for 7-year-old Spanish children (Koletzko *et al.*, 2009). Moreover, birth weight of Chinese children was linearly and positively associated with childhood BMI at 3-6 years of age, independent of

maternal BMI and other confounders (Ye *et al.*, 2010).

We investigated the association of the duration of infant breastfeeding and BMI for schoolchildren at 11-15 years of age ($r=-0.254$). An inverse association between breastfeeding and BMI at one year of age attenuated to the age of seven years which disappears later in childhood or adulthood has been reported (Reilly *et al.*, 2005; Koletzko *et al.*, 2009). Therefore, other risk factors such as genetic predisposition and environmental risk factors such as eating practices, socio-cultural, economic status, and parental characteristics could diminish or undo the effects of breastfeeding on BMI after one year of age. Scott, Ng & Cobiac (2012) found that children breastfed for six or more months were 36% less likely to be overweight and 49% less likely to be obese compared to those who were never breastfed.

The possible mechanisms that underlie the relationship between breastfeeding and obesity remain unclear; two possible explanations have been postulated. The first explanation is that breastfed and bottle-fed infants exhibit differences in control of appetite. Bottle-feeding is mother-led and bottle-fed infants are usually fed on a regular basis and could be made to finish the bottle even when satiated (Schack-Nielsen *et al.*, 2010). The second explanation is the metabolic consequences of ingesting breast milk and the differences in the composition and constituents between breast milk compared with infant formula (Koletzko *et al.*, 2009).

CONCLUSION

Sedentary behaviour, watching TV and small screening are important risk factors for obesity in young Jordanian school children regardless of gender, whereas other factors including birth weight do not appear to play an important role in the

development of childhood obesity. Thus, a national policy promoting active living and reducing sedentary behaviours among schoolchildren is warranted

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Conflict of interest

The authors have no conflict of interest to declare in relation to this article.

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