

Childhood Overweight and Obesity Among the Saudi Population: A Case-Control Study Among School Children

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Research

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Abstract

Background

Childhood obesity is a global public health concern with major consequences. In Saudi Arabia, the percentage of children who are overweight or obese have significantly increased in the past 2 decades, raising concerns about the physical and psychosocial consequences of this burden. This study aimed at investigating the different risk factors contributing to childhood obesity in Saudi Arabia.

Methods

A case-control study was conducted among 492 school children (246 overweight/obese cases and 246 normal control aged 5-9 years old). Using valid and reliable instruments, parental and children characteristics, behavioural practices, screen use, and other activities were assessed as risk factors for childhood obesity using logistic regression analysis.

Results

An unemployed father (OR=11.90; 95%CI: 7.47-18.93), an overweight/obese father (OR=2.04; 95%CI: 1.40-2.96), an incorrect parental perception of child's weight status (OR=2.54; 95%CI: 1.75-3.68), Caesarean delivery (OR=2.52; 95%CI: 1.56-4.09), daily time in active play for less than 30 minutes (OR=2.18; 95%CI: 1.44-3.28), frequent snacking (OR=1.74; 95%CI: 1.05-2.93), and screen time use for more than 2 hours per day outside of school (OR=1.62; 95%CI: 1.12-2.34) were all independent risk factors for being overweight or obese among the selected cases.

Conclusion

Efforts to prevent childhood overweight and obesity in this population should focus primarily on the early identification and addressing of risk factors, such as parental characteristics and awareness of the magnitude of the burden of obesity, behavioural practices such as frequent snacking, screen time use, and physical activity.

Background

Obesity is one of the most pressing global public health challenges of the 21st century. Among children in developing countries, the number of those who are overweight or obese is 30% higher than in developed countries[1]. In 2025, the number of overweight or obese infants and young children worldwide is estimated to reach 70 million[2].

Being overweight or obese during childhood are known to have negative impact on physical and mental health [3]. Obese children are usually more likely to stay obese into adulthood and more likely to have chronic disease such as diabetes, hypertension, and other cardiovascular disease, musculoskeletal

disorders, and certain types of cancer (endometrial, breast, and colon) [1, 4]. Additionally, being overweight or obese affects self-esteem of children and impairs social development [3].

In Saudi Arabia, the percentage of childhood and adolescents who are overweight or obese have significantly increased in the past 2 decades, raising concerns about the physical and psychosocial consequences of childhood obesity [2]. In Saudi Arabia, nearly 20% of Saudi males aged 5–9 years and 24% aged 10–14 years are obese. The prevalence among females is 40% in ages 5–9 years and 41% in ages 10–14 years [4].

During the last decade, Saudi Arabia has experienced a prosperous economy and affluence that has led to drastic changes in lifestyle and rapid urbanization [5]. Newly acquired purchasing power facilitated the adoption of emerging technology such as smart phones and electronic toys that contributed tremendously to sedentary behaviour, low physical activity, and eventually, to the rising trends in Saudis who are overweight or obese in the country [5].

The country is currently facing a public health concern due to childhood obesity because children who are currently overweight or obese will most likely carry the burden of disease and disability associated with obesity till adulthood [2, 6].

Evidence from the literature suggests that school-based interventions are suitable to address and contain the childhood obesity epidemic [7]. Researching risk factors associated with children being overweight or obese would help the design and implementation of interventions that target and reduce the burden associated with being overweight or obese among this vulnerable age group in Saudi Arabia. Recognizing the risk factors for obesity among children will also help address changes in lifestyle factors and identify modifiable factors that could lead to a lifetime of healthy living. The objective of this study was to identify the risk factors associated with being overweight or obese among school-age children in Riyadh, Saudi Arabia.

Methods

A case-control study was conducted in Riyadh, Saudi Arabia from September through December of 2017. Cases were overweight or obese children and matched controls were normal weight children between the ages of 5-9 years attending school from kindergarten to fifth grade. Children and their parents were enrolled in the study to examine a broad range of factors related to being overweight or obese in childhood. The study was conducted according to the ethical standards of the institutional and national research committee. Informed consent was obtained from all participants. The study was approved by the Institutional Review Board (IRB) at the sponsoring institution.

Sampling

A total of 492 children were enrolled in the study (246 cases and 246 controls) exceeding the required sample size of 288 participants (95% confidence, and 80% power, 1:1 ratio for cases and controls, and a

least detected an odds ratio of 2.0). Participants were recruited from 22 public schools (10 elementary schools for girls, 7 elementary schools for boys, and 5 co-educational kindergartens). Coded questionnaires and consent forms were sent to the parents and all those who signed the consent forms and returned the filled questionnaire to the school administration within 2-3 days were considered for the study. Any children whose parents reported a major health condition (such as heart disease or diabetes) or any type of disability were excluded from the study sample. We attempted to recruit between 11 to 15 cases from each school, matched with the same number of controls from the same school. For every case student, a control student was matched by class grade, gender, age, and socioeconomic status. The height and weight of all the children were measured, their Body Mass Index (BMI) was calculated, and they were classified as underweight, normal weight, overweight, or obese according to the Centres for Disease Control and Prevention (CDC) guidelines. [8] Underweight children were excluded from the sample for the purpose of this study.

Survey development

A valid and reliable self-administered questionnaire was used in the study. The instrument was composed of material from previously conducted studies and published in the literature and from widely used valid and reliable scales such as the Children's Eating Behaviour Inventory (CEBI) [7-13]. The questionnaire collected information about parents' demographic characteristics (level of education, employment status, monthly household income, and residence type), their self-reported weight and height, and whether they had any morbidities. In addition to questions regarding child feeding practices since infancy (breastfeeding history, consumption of fruits and vegetables, consumption of fast food, soda intake, other eating behaviours, and purchase of junk food), the instrument included questions regarding the child's daily physical activity, frequency of daily use of screens (i.e., tablets, computers, smart phones, and television), and the type of behavioural reward system applied by the parents. Parental attitude regarding childhood obesity and how they perceived their child's weight status (underweight, normal weight, overweight, or obese) were also included in the instrument. The developed questionnaire was translated into Arabic by a professional translator and reviewed by two bilingual research assistants for appropriateness of the terms used and inconsistencies. A group comprising of two nutritionists, two health educators, a paediatrician, and a public health practitioner reviewed the Arabic version of the instrument for content validity, relevance, and suitability of the different measures. Face validity was assessed by asking fifteen individuals to complete the survey and report any encountered difficulties. Questionnaire items were revised according to all recommendations and further tested among 25 parents of school-aged children for a final check of overall clarity. Test-retest reliability was established, and 90% agreement was reported among two administrations of the survey within a 10-day interval to the same group of participants (N=30). Internal consistency of the instrument was determined as Cronbach's alpha coefficient of 0.79.

Data analysis

Questionnaire responses were coded, entered, and analyzed using the statistical software package STAT13 (College Station, Texas). Descriptive statistics were calculated for all study variables including demographic characteristics and socioeconomic status, parental calculated BMI, and children's calculated BMI. Logistic regression analysis was conducted to examine the individual and combined effects of the study variables on the likelihood of being overweight/obese cases versus normal weight controls. Odds ratios and 95% Confidence Intervals were estimated for all probable risk factors for overweight/obesity in this population. The significance level was set at $P < 0.05$ for all analyses.

Results

Characteristics of study participants

The mean age of the study participants was 7.27 years (SD= ± 1.38). Of 492 respondents, 212 (43.09%) were male. Approximately one third of the sample (36.59%) reported unemployment status for the father and 76.82% of the mothers were reported as homemakers. The overall reported prevalence of overweight and obesity (according to reported weight and height) among participating parents was 82.49% (85.77% among mothers and 82.26% among fathers). Approximately half of the respondents (53.05%) were in the lower-income category with a cumulative monthly family income between 5,000 Saudi Riyals (SR) and 10,000 SR.

Bivariate analysis showed that significantly greater proportion of overweight/obese children (cases) compared to normal weight children (controls) had fathers who were overweight or obese (86.99% vs. 78.87%; $p < 0.001$). Also, overweight/obese children varied significantly from normal weight children according to caesarean section delivery mode (25.02% vs. 11.79%; $p < 0.001$). There was a significant difference in the cases and controls regarding the fathers' employment status; participating cases had fathers that reported being unemployed at higher proportions than controls (61.38% vs. 11.79%; $p < 0.001$). Results for this section are displayed in Table 1.

Child's feeding practices, parenting style, and perception regarding child weight status

The percentage children who were frequent consumers of snacks was significantly greater among the overweight/obese cases as opposed to normal weight controls (58.54% vs. 18.70%; $p = 0.001$). Also, significantly greater proportion of overweight/obese children was among the excessive users (>2 hours per day) of screens (television, computer, tablet, and phone) compared to normal weight children (43.90% vs. 32.32%; $p = 0.009$). Participants who reported that their children spent 30 minutes or more in active play on a daily basis were more likely to have a normal weight child than an overweight/obese child (34.55% vs. 19.51%, $p < 0.001$). Additionally, there was a significant difference between the cases and controls regarding their parental perception of their body weight with the highest percentage of incorrect perceptions being among the overweight/obese children (51.22% vs. 29.27%; $p < 0.001$). Breastfeeding the child during infancy, consumption of sugary drinks, consumption of fruits and vegetables, eating breakfast regularly, eating fast food, and rewarding the child with sugary treats did not significantly vary between cases and controls. Results for this section are displayed in Table 2.

Risk factors associated with overweight and obesity

All the factors shown to be significantly associated with being overweight or obese in this group of children in bivariate analysis were entered into a multivariate logistic model to assess the independent risk factors for childhood obesity. Results for this section are displayed in Table 3. Having an unemployed father (OR=11.90; 95%CI: 7.47-18.93), an overweight/obese father (OR=2.04; 95%CI: 1.40-2.96), an incorrect parental perception of child's weight status (OR=2.54; 95%CI: 1.75-3.68), Caesarean delivery (OR=2.52; 95%CI: 1.56-4.09), daily time in active play for less than 30 minutes (OR=2.18; 95%CI: 1.44-3.28), frequent snacking (OR=1.74; 95%CI: 1.05-2.93), and screen time use for more than 2 hours per day outside of school (OR=1.62; 95%CI: 1.12-2.34) were all independent risk factors for being overweight or obese among the selected cases.

Discussion

Due to its high negative impact on the health and well-being of the world population, childhood obesity is a major global health issue. This study assessed a variety of risk factors contributing to childhood obesity in a sample of overweight/obese children cases and normal weight children controls residing in Saudi Arabia. Findings of this study showed that paternal Body Mass Index (BMI) is a risk factor for being overweight or obese among children. Saudi children with an overweight/obese father were almost twice at risk for being overweight/obese compared to those with a normal weight father. These findings coincide with other studies that reported that parental BMI was a significant factor associated with young children and teens obesity [14-16]. Previous local studies tackling childhood obesity reported from the Al-Hasa region in Saudi Arabia that there was a higher prevalence of being overweight or obese among children whose parents were also overweight and obese [17]. Our current study was more specific and has shown that the father's BMI is actually a risk factor for childhood obesity in this population and not necessarily the mother's BMI. Contrary to our current findings for this sample, other studies have supported the claim that maternal BMI is a more significant predictor of children's weight than paternal BMI [7, 18-21]. Authors of childhood obesity literature have argued that the influence of maternal BMI can be explained by the fact that mothers are mainly the caregivers for their children, and they influence the behaviour and lifestyle of their children such as food intake and physical activity [18]. It is understandable that the paternal BMI would have a stronger impact on the child's BMI in a gender-segregated society such as Saudi Arabia where most of the decision-making regarding household conduct and activities are the responsibility of the father [13]. Our findings showed the prevalence of being overweight or obese among fathers to be alarmingly high in this sample. Regarding eating behaviour, children in the sample who were frequent snack eaters were significantly more likely to be overweight or obese compared to those who did not snack. These findings highlight the importance of planning and implementing awareness campaigns targeted towards parents with special emphasis on dietary behaviour and how it affects weight gain and lifetime health. Results from a national survey showed that obese children between the ages of 2–5 years old are at greater risk of becoming obese adults [22]. Health Promotion campaigns should also tackle physical activity for all ages and all socioeconomic groups.

Daily screen use as a risk factor for overweight and obesity was established in this study. Using screens for more than two hours per day increased the risk of being overweight/obese among this group of children. Screen time has been associated with increased risk of being overweight or obese among children in the literature [23, 24]. Children who spend long hours using screens tend to snack while doing so, and eventually, gain weight because they increase their energy intake while seated for a long time. Additionally, excessive media exposure has been repeatedly linked to unhealthy life choices [25, 26]. It is worth noting that significant time spent watching television or playing video games was associated with physical inactivity, which in turn is a major risk factor for being overweight or obese in all age group [2, 19, 20, 27, 28]. Children who spent 30 minutes or more in active play on a daily basis were almost twice less likely to be overweight or obese in our study. It is important that parents abide by the recommendations for screen time use among children and employ strict parenting when it comes to the excessive use of screens [29].

Additionally, findings from this study suggested caesarean section delivery as risk factor for childhood obesity, which is consistent with a prospective cohort study in the literature that reported a five-fold higher odds of childhood obesity associated with caesarean delivery [30, 31].

Although not all indicators had a significant link with childhood obesity in this study, some family characteristics, such as father unemployment status showed to be a factor. Unemployment could be a proxy for low family income. This finding coincides with a previously conducted study linking a low socioeconomic status with childhood obesity [32, 33].

Parental perception about their child's weight status was significantly associated with child's weight. These results are in accordance with findings from other studies [7]. A meta-analysis suggested that almost 50% of all the parents underestimate their children's weight status [34, 35]. This proportion was even more among parents of young children (aged 2–6 years) [34, 36]. It has been previously documented that precise parental recognition of the weight of their children is related to a willingness to make changes [34, 35].

Conclusion

Obesity among children is a serious global health concern and has profound negative implications that can extend into adulthood. Our findings indicate that the main risk factors contributing to childhood obesity in this population sample from Riyadh include paternal BMI, paternal unemployment, dietary behaviour in form of frequent snacking, screen time for more than 2 hours per day, daily active play time for less than 30 minutes, caesarean delivery, and incorrect parental perception of child's weight status. The evidence from this study suggests the importance of educating and raising awareness about childhood obesity, starting with the family, school, and the larger community.

Change must occur at a multitude of levels, and policy makers should support this effort to better implement and regulate such campaigns. Further research is needed at the national level to better address the risk factors associated with obesity among children.

Abbreviations

CI: Confidence Interval

OR: Odds Ratio

BMI: Body Mass Index

CEBI: Child Eating Behaviour Inventory

IRB: Institutional Review Board

Declarations

Ethics Approval and Consent to Participate

This research was approved by the Institutional Review Board at King Abdullah International Medical Research Centre. All participating parents signed a consent form prior to enrolment in the study.

Consent for Publication

Consent for publication of this study is granted by the authors, Hanan Abdulsalam Aljassim and Hoda Jradi.

Availability of Data and Material

The datasets analysed during the study are available from the corresponding author on reasonable request and after approval of the concerned authorities in the organization.

Competing Interests

The authors declare that they have no competing interests.

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Author's Contribution

HA collected the data from the schools. HJ designed the study and analysed the data. HA and HJ contributed to data interpretation and drafting of the manuscript.

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Tables

Table1. Characteristics of study participants

Characteristics	Total N=492	Cases N=246	Controls N=246	p-value
Child's age in years, mean (SD)	7.27 (1.38)	7.27(1.38)	7.27(1.38)	1.00
Child's gender				0.74
Male	212 (43.09)	106(43.17)	106(43.17)	
Female	280 (56.91)	140(56.91)	140(56.91)	
Number of children in the home				0.66
1	48 (9.76)	28 (11.38)	20 (8.13)	
2-3	184 (37.40)	93 (37.80)	99 (40.24)	
≥4	260 (52.84)	125 (50.81)	135 (50.81)	
Type of house				0.06
Apartment	68 (13.82)	38 (15.44)	30 (12.19)	
House	424 (86.18)	208 (84.55)	216 (87.80)	
Family Income per month (SR)				
<5000	89 (18.09)	43(17.48)	46(18.70)	
5000 – 10,000	261 (53.05)	120 (48.78)	141(57.32)	
>10,000 S	142 (28.86)	83 (33.74)	59 (23.98)	
Mother's age ($\mu=36.51$; $SD=5.42$) (years)				0.93
≤30	76 (15.45)	37 (15.04)	39 (15.85)	
31 - 40	327 (66.46)	163 (66.26)	164 (66.66)	
> 40	89 (18.09)	46 (18.70)	43 (21.54)	
Mother's BMI ($\mu=29.61$; $SD=6.31$)				0.095
Normal weight	85 (17.30)	35 (14.23)	50 (20.32)	
Overweight/obese	407 (82.72)	211 (85.77)	196 (79.67)	
Mother's education				0.92
Middle school or less	183 (37.19)	92 (37.40)	91 (36.99)	
High School	146 (29.67)	71 (28.86)	75 (30.49)	
University and above	163 (33.13)	83 (33.74)	80 (32.52)	
Mother's employment status				0.05

Employed	114 (23.17)	66 (26.83)	48 (19.51)	
Homemaker	378 (76.82)	180 (73.17)	198 (40.24)	
Type of child delivery				<0.001
Vaginal	401 (81.50)	182 (73.98)	217 (88.21)	
Caesarean	91 (18.50)	62 (25.20)	29 (11.79)	
Gestational diabetes				0.44
Yes	70 (14.23)	38 (15.45)	32 (13.01)	
No	422 (85.77)	208 (84.55)	214 (86.99)	
Father's age ($\mu=42.28$; $SD=6.06$) (years)				0.28
≤ 30	17 (3.46)	10 (4.06)	7 (2.85)	
31 - 40	202 (41.06)	108 (43.90)	94 (38.21)	
> 40	273 (55.49)	128 (52.03)	145 (58.94)	
Father's BMI ($\mu=29.40$. $SD=6.66$)				0.029
Normal weight	82 (16.73)	32 (13.00)	50 (20.32)	
Overweight/obesity	408 (82.92)	214 (86.99)	196 (78.86)	
Father's education				0.72
Middle school or less	84 (17.07)	44 (17.89)	40 (16.26)	
High School	265 (53.86)	128 (52.03)	137 (55.69)	
University and above	143 (29.07)	74 (30.08)	69 (28.05)	
Father's employment Status				<0.001
Employed	312 (65.41)	95 (38.62)	217 (88.21)	
Non-employed	180 (36.59)	151 (61.38)	29 (11.79)	

Table 2. Parental reported child's feeding practices, parenting style, and perceptions regarding child weight status

Variable	Total	Cases	Controls	p-value
Feeding practices				
Breastfeeding duration (months)				0.26
None	88 (17.89)	51(20.73)	37 (15.04)	
≤ 6	226 (45.93)	109 (44.31)	117 (47.56)	
>6	178 (72.36)	86 (34.96)	92 (37.40)	
Frequent snacking				<0.001
Yes	236 (47.97)	92 (18.70)	144 (58.54)	
No	256 (52.03)	154 (31.30)	102 (41.46)	
Consumption of sugary drinks				0.93
Yes	271 (55.08)	136 (55.28)	135 (54.88)	
No	221 (44.92)	110 (44.71)	111 (45.12)	
Consumption of vegetables/fruits				0.97
Yes	432 (87.80)	215 (87.40)	217 (88.21)	
No	60 (12.19)	31 (12.60)	29 (11.79)	
Eating breakfast regularly				
Yes	454 (92.28)	227 (92.28)	227 (92.28)	1.00
No	38 (15.45)	19 (7.72)	19 (7.72)	
Eating fast food				0.50
≤ 1 time/week	337 (68.50)	165 (67.07)	172 (69.92)	
>1 time/week	155 (31.50)	81 (32.93)	74 (30.08)	
Parenting style				
Child is rewarded with candy/sweets				0.07
Yes	129 (26.22)	67 (27.23)	62 (25.20)	
No	363 (73.78)	179 (72.76)	184 (74.80)	
Child allowed to buy junk food				0.06
Yes	62 (12.60)	24 (9.76)	38 (15.45)	
No	430 (87.39)	222 (90.24)	208 (42.28)	
Child's allowed screen time*				0.009

≤2 hours/day	304 (61.79)	138 (56.10)	166 (67.48)	
>2 hours/day	188 (38.21)	108 (43.90)	80 (32.52)	
Child's daily time in active play**				<0.001
<30 minutes	359 (72.97)	198 (80.49)	161 (65.44)	
≥30 minutes	133 (27.03)	48 (19.51)	85 (34.55)	
Parental perception of child's weight***				<0.001
Correct	294 (59.75)	120 (48.78)	174 (70.73)	
Incorrect	198 (40.24)	126 (51.22)	72 (29.27)	

*Screen time includes time spent watching television or using tablets, computers, and mobile phones outside school.

** This question was specific for activities outside the school; including home, park, or gym activities.

***Parental estimates of their current child weight status.

Table3. Results of final multivariate logistic regression analysis for factors associated with childhood overweight and obesity.

Variable	Reference	OR (95%CI)	Wald	p-value
Caesarean Delivery	Vaginal delivery	2.52 (1.56-4.09)	3.76	<0.001
Overweight/Obese father	Normal weight	2.04 (1.40-2.96)	3.74	<0.001
Unemployed father	Employed	11.90 (7.47-18.93)	10.44	<0.001
Frequent snacking	Not frequent	1.75 (1.05-2.93)	2.13	0.03
Screen time for > 2 hours/day	≤2 hours/day	1.62 (1.12-2.34)	2.59	0.01
Daily time in active play for <30 minutes	≤30 minutes	2.18 (1.44-3.28)	3.72	<0.001
Incorrect parental perception of child weight status	Correct perception	2.54 (1.75-3.68)	4.91	<0.001