ORIGINAL CONTRIBUTION

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Overweight and obesity and their relation to dietary habits and socio-demographic characteristics among male primary school children in Al-Hassa, Kingdom of Saudi Arabia

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■ **Abstract** *Background* Several studies were carried out to study the prevalence of overweight and obesity among Saudi children, but those assessed the association between eating habits, socio-demographic differentials and obesity in these children are scarce. *Objectives* To assess the magnitude of obesity and overweight among male primary schoolchildren and to find the possible association between obesity/overweight with dietary habits and socio-demographic differentials among them. *Study design and methods* A cross-sectional descriptive study including 1,139 Saudi male enrolled in the fifth and sixth grades in public primary schools in Al Hassa, KSA, through a multistage random sampling technique, submitted to interview using Youth and Adolescent Food Frequency Questionnaire, gathering data regarding dietary intake, some dietary habits, followed by anthropometric measurements with calculation of body mass index, the interpretation of which was based on using Cole's tables for standard definition of overweight and obesity. Socio-demographics data were collected through parental questionnaire form. Data analysis was carried out using SPSS 12 (SPSS Inc. Chicago, IL, USA), univariate as well as multivariate analyses were conducted. *Results* The age ranged from 10 to 14 years. The prevalence of overweight among the included subjects was 14.2% while obesity was 9.7%, more in urban, older age students, mothers of obese and overweight were less educated, more working. Missing and or infrequent intake of breakfast at home, frequent consumption of fast foods, low servings of fruits, vegetables, milk and dairy product per day, with frequent consumption of sweets/candy and carbonated drinks were all predictors of obesity and overweight among the included male schoolchildren. *Conclusion* The prevalence of childhood obesity is escalating and approaching figures reported in the developed countries. Less healthy dietary habits and poor food choices may be responsible for this high prevalence.

■ **Key words** childhood obesity – body mass index – dietary habits – Saudi Arabia

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Introduction

Obesity is becoming a worldwide problem affecting all levels of society and is being described as a global epidemic [30]. While the highest rates of childhood obesity have been observed in the developed countries, its prevalence is increasing in developing countries as well. The prevalence of childhood obesity is high in the Middle East, Central and Eastern Europe [12]. For example Iran was reported to be one of the seven countries with the highest prevalence of childhood obesity [14], in Saudi Arabia; one in every six children aged 6–18 years old is obese [1].

The numerous psychological, physical, and economic consequences are well known. Childhood overweight affects self-esteem and has negative consequences on cognitive and social development [11, 19]. Conditions such as type 2 diabetes mellitus, hypertension, and hypercholesterolemia, which were seen primarily in adults are becoming more common among children as the prevalence of obesity increases [5]. Because childhood obesity often persists into adulthood, a rising number of adults will be at increased risk of these conditions as well as of cardiovascular disease, osteoarthritis and certain types of cancer [7, 17].

As a whole, the obesity epidemic constitutes a substantial decrease in the quality of life and life expectancy and accounts for billions of dollars in provision of health care [13]. Due to difficulty of curing obesity in adults and the many long-term adverse effects of childhood obesity, the prevention of childhood obesity has been recognized as a public health priority [29].

In many developing countries, the progression of the nutritional transition has been detected, characterized by reduction of the prevalence of nutritional deficiencies and the more expressive occurrence of overweight and obesity, not only in the adult population, but also among children and adolescent [9], which are fundamentally related to changes in lifestyle and eating habits [13].

Food intake has been related to obesity not only in terms of the volume of food ingested, but also in terms of the composition and quality of diet. Furthermore, eating habits have also changed and current habits-including the low consumption of fruits, greens, and milk, increasing consumption of snacks, sweets, and soft drinks as well as not having breakfast—help partially; the continuous increase in adiposity among children [9]. Eating habits in addition to environmental differentials represent the most dominant determinant in increasing the tendency of overweight and obesity among children [21], and modification of eating habits may be singleton tactic strategy to more appropriate weight control [26].

Several studies were carried out to study the prevalence of overweight and obesity among Saudi children [1, 6, 16], but those assessed the association between eating habits, socio-demographic differentials and obesity in these children are very few [2] compared to those obtained from the developed countries. This study provides baseline information for future comparison regarding the possible factors that underlie the high prevalence of childhood obesity among primary schoolchildren in Al-Hassa, Saudi Arabia. In addition, such information may be of value in developing programs and policies to combat the epidemic of childhood obesity among primary schoolchildren in KSA.

Consequently, the objectives of this study were to assess the magnitude of obesity and overweight among male primary schoolchildren and to find the possible association between obesity/overweight with dietary habits and socio-demographic differentials among them.

Population and methods

Setting

The study was carried out in Al-Hassa Governorate located at the Eastern province of Saudi Arabia. The total number of public primary schools was 160: 25 were Hegar "Bedouin scattered communities", 88 urban and 47 rural.

The total population enrolled in these schools was 44,408, according to the local Directorate of Education. Those in the fifth and sixth grades are being selected for better communication. The recorded total number enrolled in these grades was 12,432 students. Hegar schools were excluded for the sake of convenience in the transportation process. The schools in the urban areas were located two districts namely "Hofuf and Mubraz each district is divided into 5 localities", while those in the rural areas were located in the Northern and Eastern villages respectively "6 major villages were identified".

Study design and sampling

A cross-sectional, assuming the expected frequency of obesity among this age group 16% [1] and the worst acceptable frequency 15%, among the total population at this age group (12,432) with a 95% confidence and 80% power; the total estimated sample size should be 1,065 subjects.

To overcome the sampling error of using the cluster sampling technique, 20% was added and the total final sample size was 1,278 males. A proportionate stratified

sampling method was applied as regard the rural/urban distribution.

An updated list of all public primary schools was used as the sampling frame, schools were stratified proportionately according to urban/rural distribution, 16 schools were randomly selected; 6 rural and 10 urban schools.

It was not allowed for male investigators to access female students according to Saudi community traditions, added to this there were no female investigators to be recruited during conduction of the study at our institution.

Data collection tools and techniques

Selected schoolchildren were subjected to the following after brief orientation:

■ Anthropometric measurements

The weight was measured using commercial scale "Seca, Germany" with an accuracy of ±100 g. subjects was weighed barefooted and with minimal clothes. Standing body height was measured with the use of commercial stadiometer with the shoulder in relaxed position and arms hanging freely and without shoes to the nearest 0.5 cm. Scales were re-calibrated after each measurement. Measurements were carried out outside the classroom on an individual and solicited bases after the interview with food frequency questionnaire.

Body mass index (BMI) was calculated "Body weight in kg/Height in meters [12]", we applied the cut-off points recommended by Cole et al. [3] in identifying age and sex-specific cut-off points for BMI with age ranging from 1 to 18 years for the diagnosis of overweight and obesity among the included subjects.

Those ≥85 percentiles were considered overweight, ≥95 percentiles were obese, while those <85 percentiles were considered desirable or lean.

■ Socio-demographic and dietary data

Two forms were used for gathering data regarding:

Food intake and dietary habits which carried out through personal interview using items from the validated Youth and Adolescence Food Frequency Questionnaire [24, 25]. This diet assessment instrument was developed in a multiethnic sample of US children. Alpha coefficient for nutrient ranged from 0.26 for protein to 0.57 for calcium, for food it ranged from 0.39 for meats to 0.57 for carbonated soft drinks.

Food intake was converted into servings per day by multiplying the average portion size by frequency of intake. Inquiries regarding food habits using closed-ended questions were added included: taking breakfast at home, its frequency in the last week, taking food at school and frequency of consumption of fast foods 1 week before the interview. Interviewing students was carried out by two well-trained assistants under the supervision of the investigators.

Field pretest involved 150 primary schoolchildren beyond the sample size using the nearby primary schools to test the contents, phrasing and sequencing of procedure.

Socio-demographic data were collected using a parental form and included items regarding: current residence, date of birth, parental educational and occupational status and family size. These formats were sent to guardians at home to complete.

Data management and data processing

The original total sampled population was 1,282, but for the sake of data validity, 143 subjects were excluded due to low responses of parents in submitting the socio-demographic data. Those excluded form analysis were not significantly different form those included regarding distribution of BMI or dietary habits.

Data entry and data processing was carried out using SPSS version 12 software (SPSS Inc. Chicago, IL, USA). Both descriptive and inferential data analyses were applied using the appropriate statistical tests of significance (Chi-square, *t* test). Multivariate binary logistic regression model was generated by inclusion of significant variables at the univariate analysis. Confidence interval of 95% and significance level of ≤0.05 was found valid and convenient.

Ethical considerations

Permission was obtained from the local School Health and Education Directorate authorities. Prior orientation of the teaching and administrative school staff was carried out. Before commencing the procedures of interviewing and measurements, a brief orientation of the students was carried out.

Results

A total of 1,139 male primary schoolchildren were included with age ranged from 10 to 14 years "mean 11.91 ± 1.00 years", 62.1% of the included students were resided in urban areas.

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Obesity and overweight prevalence

Out of 1,139 male Saudi primary school schoolchildren, 110 (9.7%, 95% confidence intervals, CI = 8.1–11.5%) were obese "for age/gender specific BMI, and 162 (14.2%) were overweight "CI = 12.3–16.4%".

Overweight and obese children were more in urban schools, among older age group (Odds ratio, OR = 2.2), belonged to less educated parents, more working mothers and small family size ($P = 0.001$) as compared to their counterpart with desirable BMI (Table 1).

Dietary habits of the included students

Frequency of eating breakfast at home in the last week before and on the day of the interview was significantly high among lean children, compared to overweight-obese peers.

Eating away from home showed a higher trends among overweight-obese children with an OR increased from 0.2 for low frequency to >4 for frequency of five times/week or more ($P < 0.001$) (Table 2).

Dietary intake and food frequency consumption

The number of servings/day of different foods included in the questionnaire revealed that: lean students consumed more servings of fruits, vegetables and dairy products including milk, while overweight-obese children consumed significantly higher servings of egg, potato (especially fried), carbonated soft drinks, sugary drinks, and sweet-candy per day (Table 3).

Table 1 Socio-demographic and anthropometric characteristics in relation to body mass index (BMI) classification of the included male schoolchildren

Anthropometry and socio-demographics variables	BMI classification		Univariate analysis Odds ratio (95% CI)* and P value
	Total ($N = 1139$) No. (%)	Overweight–obese children ($N = 272$) No. (%)	
Weight in kg (mean ± SD)	42.4 ± 6.7	56.6 ± 11.7	$P = 0.001$*,†
Height in cm (mean ± SD)	148.8 ± 7.5	151.6 ± 8.7	$P = 0.001$*,†
Age in years (mean ± SD)	11.8 ± 0.8	12.1 ± 0.9	$P = 0.001$*,†
BMI (mean ± SD)	20.8 ± 6.4	27.7 ± 6.9	$P = 0.001$*,†
<85th percentiles	867 (76.1)	–	
≥85th to <95th percentiles	–	162 (14.2)	
≥95th percentiles	–	110 (9.7)	
Residence			
Urban	707 (62.1)	190 (26.9)	1.6 (1.2–2.1)*
Rural	432 (37.9)	82 (19.0)	1 (ref)
School grade			
Fifth grade	442 (38.8)	90 (20.4)	0.7 (0.5–0.9)*
Sixth grade	697 (61.2)	182 (26.1)	1 (ref)
Age groups			
10 to <12 years	419 (36.8)	72 (17.2)	0.5 (0.4–0.7)**
12 to <14 years	665 (58.4)	197 (29.6)	2.2 (1.7–3.1)**
14 years	55 (4.8)	3 (5.5)	1 (ref)
Mother education			
Illiterate/read and write	234 (20.5)	70 (30.0)	1.5 (1.1–2.1)*
Primary/preparatory	415 (36.4)	111 (26.7)	1.3 (0.9–1.7)
Secondary	232 (20.4)	50 (21.6)	0.9 (0.6–1.2)
University/higher	258 (22.7)	41 (15.9)	1 (ref)
Father education			
Illiterate/read and write	111 (9.7)	39 (35.1)	1.9 (1.2–2.9)*
Primary/preparatory	392 (34.4)	73 (18.6)	0.6 (0.5–0.9)*
Secondary	295 (25.9)	69 (23.4)	1.0 (0.7–1.3)
University/higher	341 (30.0)	91 (26.7)	1 (ref)
Working mother			
Yes	209 (18.3)	67 (32.1)	1.7 (1.2–2.4)**
No	930 (81.7)	205 (22.0)	1 (ref)
Working father			
Yes	1006 (88.3)	252 (25.0)	1.9 (1.2–3.2)*
No	133 (11.7)	20 (15.0)	1 (ref)
Family size			
>6 per family	709 (62.2)	109 (15.4)	0.3 (0.2–0.4)**
≤6 per family	430 (37.8)	163 (38.0)	1 (ref)

95% CI 95% confidence intervals, *ref* reference group
* $P < 0.05$, † = t test, ** $P < 0.01$ level

Table 2 Some dietary habits as stated by the included primary schoolchildren in relation to their BMI classification

Dietary habits	BMI classification		Univariate analysis Odds ratio (95% CI)* and P value
	Obese and overweight (N = 272) No. (%)	None obese/none overweight (N = 867) No. (%)	
Breakfast at home (frequency/last week)			
Daily	75 (27.6)	441 (50.9)	1 (ref)
3–6 times/week	87 (32.0)	134 (15.4)	2.6 (1.9–3.6)**
<2 times/week	110 (40.4)	258 (29.7)	1.6 (1.2–2.2)**
Taking breakfast at home on the day of interview			
Yes	142 (52.2)	753 (86.9)	1(ref)
No	130 (47.8)	114 (13.1)	6.1 (4.4–8.3)**
Eating at school (frequency/last week)			
Daily	175 (64.3)	502 (57.9)	1 (ref)
3–4 times/week	16 (5.9)	107 (12.3)	0.4 (0.3–0.8)*
<2 times/week	81 (29.8)	258 (29.8)	1.0 (0.7–1.4)
Eating from school on the day of interview			
Yes	85 (31.3)	220 (25.4)	1 (ref)
No	187 (68.8)	647 (74.6)	0.8 (0.6–1.1)
Eating away from home (frequency/week)			
None	17 (6.3)	164 (18.9)	1 (ref)
1–2 times/week	151 (55.5)	472 (54.4)	0.2 (0.2–0.3)**
2–5 times/week	66 (24.3)	189 (21.8)	1.2 (0.8–1.6)
>5 times/week	48 (17.7)	43 (4.9)	4.1 (2.6–6.5)**

95% CI 95% Confidence intervals, *ref* reference group
* $P < 0.05$ level, ** $P < 0.001$

Table 3 Comparison of children intake of selected foods items (servings/day) in relation to their BMI classification of the included male schoolchildren

Food items	BMI classification		t test, P value
	Obese and overweight (N = 272) No. (%)	None obese/none overweight (N = 867) No. (%)	
Green-leafy vegetables	0.24 ± 0.36	0.39 ± 0.47	4.84, 0.002*
Other vegetables[a]	1.39 ± 1.05	1.98 ± 1.44	6.25, 0.001*
Fruits (includes cocktail and mixed fruit)	0.61 ± 1.87	0.66 ± 2.51	0.30, 0.761
Fruits and vegetables	4.23 ± 2.77	5.30 ± 3.05	5.16, 0.001*
Milk and dairy products (include ice-cream)	1.91 ± 1.33	2.60 ± 1.56	2.77, 0.005*
Eggs	0.51 ± 0.65	0.42 ± 0.59	2.14, 0.032*
Juices (fruit and other drinks)	1.06 ± 1.96	1.04 ± 1.23	0.20, 0.841
Potatoes (fried, backed, cooked)	1.22 ± 0.87	0.98 ± 0.65	4.87, 0.001*
Carbonated soft drinks	1.43 ± 0.88	0.51 ± 0.78	16.45, 0.001*
Sugary drinks	2.16 ± 1.57	1.91 ± 1.36	2.55, 0.011*
Sweets and candy (include jello, chocolate)	2.81 ± 2.78	2.11 ± 1.34	4.94, 0.001*
Meat products (any form including fast foods)	1.67 ± 1.35	1.70 ± 1.21	0.35, 0.728
Rice, pasta and pizza	0.64 ± 1.37	0.71 ± 1.18	0.82, 0.412
Packed foods[c]	0.34 ± 0.63	0.28 ± 0.41	1.83, 0.067
Legume (peas, beans and nuts)	0.82 ± 0.79	0.74 ± 0.71	1.58, 0.115
Other cereals[b]	0.63 ± 1.90	0.73 ± 1.81	0.79, 0.432
Bread (white and brown)	1.56 ± 1.19	1.41 ± 1.73	1.33, 0.182
Bakery products (donut, cupcake and biscuits)	1.54 ± 1.87	1.34 ± 1.68	1.67, 0.096

* Statistically significant at 0.05 level
[a]Other vegetables include: tomato, carrot, spinach, green peas and mixed vegetables
[b]Other cereals include: breakfast cereals, oats, lentils and others
[c]Packed food includes: chips, popcorn, nuts, crackers, sweet rolls and others

Also, the food frequency of selected food groups during the last week revealed that: obese and overweight students were frequently consumed meat and alternatives (48.9 vs. 39.8%) while less frequently consumed milk and milk products (12.9 vs. 56% in the lean children) ($P < 0.001$). On the other hand, lean children consumed more frequently fresh fruits (41.4 vs. 26.5%) and vegetables (39.4 vs. 36.8%),

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Table 4 Basic food groups consumption as stated in frequency per week among included male primary schools children distributed according to their BMI classifications

Food group	BMI classification		Univariate analysis Odds ratio and 95% confidence intervals
	Obese and overweight (N = 272) No. (%)	None (N = 867) No. (%)	
Meat and alternatives			
≤Once/week	18 (6.6)	169 (19.5)	1 (ref)
2–4 times/week	121 (44.5)	353 (40.7)	1.2 (0.9–1.6)
5–6 times/week	133 (48.9)	345 (39.8)	1.5 (1.1–1.9)*
Milk, cheese and other dairy			
≤Once/week	69 (25.4)	143 (16.5)	1 (ref)
2–4 times/week	168 (61.7)	248 (28.6)	4.0 (3.0–5.4)**
5–6 times/week	35 (12.9)	485 (54.9)	0.1 (0.08–0.2)**
Fruits			
≤Once/week	98 (36.0)	295 (34.0)	1 (ref)
2–4 times/week	102 (37.5)	213 (24.6)	1.8 (1.4–2.5)**
5–6 times/week	72 (26.5)	359 (41.4)	0.5 (0.4–0.7)**
Vegetables			
≤Once/week	84 (30.9)	332 (38.3)	1 (ref)
2–4 times/week	88 (32.4)	193 (22.3)	1.7 (1.2–2.3)**
5–6 times/week	100 (36.7)	342 (39.4)	0.8 (0.7–1.1)
Bread and other bakery			
≤Once/week	12 (4.4)	52 (6.0)	1 (ref)
2–4 times/week	43 (15.8)	115 (13.3)	1.2 (0.8–1.8)
5–6 times/week	217 (79.8)	700 (80.7)	0.9 (0.7–1.3)
Rice and other cereals			
≤Once/week	38 (14.0)	100 (11.5)	1 (ref)
2–4 times/week	34 (12.5)	156 (18.0)	0.7 (0.4–1.0)
5–6 times/week	200 (73.5)	611 (70.5)	1.2 (0.9–1.6)
Cocked vegetables			
≤Once/week	99 (36.4)	349 (40.2)	1 (ref)
2–4 times/week	93 (34.2)	273 (31.5)	1.1 (0.8–1.5)
5–6 times/week	80 (29.4)	245 (28.3)	1.1 (0.8–1.4)

$* P < 0.05$, $** P < 0.001$

however, 34.5 and 36.5% of the included students stated consumption of less than or equal to once per week for fresh fruits and vegetables (Table 4).

The stated frequency of certain obsegenic food items per week among the different groups in relation to BMI: showed that: obese and overweight students were significantly reported higher frequency of soft drinks (OR = 3.4) although there is an apparent negative association between soft drink and obesity, on re-categorization, overweight–obese subjects consumed soft drinks at higher frequency (60.3% on daily or several per day vs. 30.9% among the lean subjects), sweets and candy (OR = 1.7, 49.3 vs. 35.8%), cakes/cookies/doughnut and alike foods (OR = 2.7, 49.6 vs. 27.1% in the lean students) and potato chips/popcorn/and other packed foods (OR = 5.9, 29.0 vs. 6.5% in the lean students) (Table 5).

Socio-demographic and dietary predictors of obesity

Multivariate logistic regression model generated by inclusion of socioeconomic variables and dietary habits which are significant in the univariate analysis, using the dependent variable overweight and obesity, this model revealed that: urban residence, older age of children, low maternal educational status, maternal occupational status, less family size and frequent consumption of food away from home are positively associated with the development of obesity and overweight, taking breakfast at home had an inverse relationship with the development of the outcome (Table 6).

Discussion

Economic development of Saudi Arabia during the last 3 decades has changed nutritional and lifestyle habits [4], food become more affordable to larger number as the price has decreased substantially relative to income and the concept of food has changed form a mean of nourishment to a marker of lifestyle and a source of pleasure, coupled with physical inactivity have likely contributed to the increase in the prevalence of overweight and obesity in children [16].

Table 5 Last week stated frequency of selected obesogenic food consumption distributed by the presence of overweight and obesity of included primary male schoolchildren

Food items frequency/week	Obesity and overweight		Univariate analysis Odds ratio and (95% confidence intervals)
	Overweight and obese (N = 272) No. (%)	None overweight none obese (N = 867) No. (%)	
Soft drinks (carbonated)			
1–2 times/week	53 (19.5)	324 (37.4)	1 (ref)
3–6 times/week	55 (20.2)	275 (31.7)	0.6 (0.4–0.8)*
Once or more/day	164 (60.3)	268 (30.9)	3.4 (2.5–4.6)*
Sweets/candy			
1–2 times/week	77 (28.3)	328 (37.8)	1 (ref)
3–6 times/week	61 (22.4)	229 (26.4)	0.8 (0.6–1.1)
Once or more/day	134 (49.3)	310 (35.8)	1.7 (1.3–2.3)*
Cakes/cookies/doughnut/biscuits			
1–2 times/week	71 (26.1)	324 (37.4)	1 (ref)
3–6 times/week	66 (24.3)	308 (35.5)	0.6 (0.4–0.8)*
Once or more/day	135 (49.6)	235 (27.1)	2.7 (1.9–3.5)*
Chewing gum			
1–2 times/week	130 (47.8)	413 (47.6)	1 (ref)
3–6 times/week	117 (43.0)	343 (39.6)	1.1 (0.9–1.5)
Once or more/day	25 (9.2)	111 (12.8)	0.7 (0.4–1.1)
Chocolate			
1–2 times/week	146 (53.6)	484 (55.8)	1 (ref)
3–6 times/week	103 (37.9)	345 (39.8)	0.9 (0.7–1.2)
Once or more/day	23 (8.4)	72 (8.3)	1.0 (0.6–1.7)
Potatoes chips/popcorn and packed foods			
1–2 times/week	90 (33.1)	343 (39.6)	1 (ref)
3–6 times/week	103 (37.9)	467 (53.9)	0.5 (0.4–0.7)*
Once or more/day	79 (29.0)	57 (6.5)	5.9 (3.9–8.7)*
Pizza and alike foods			
1–2 times/week	176 (64.7)	557 (64.3)	1 (ref)
3–6 times/week	86 (31.6)	293 (33.8)	1.2 (0.9–1.7)
Once or more/day	10 (3.7)	17 (1.9)	1.9 (0.8–4.5)

* $P < 0.001$

Our study revealed that the combined prevalence of obesity and overweight is 23.9% (9.7% obesity and 14.2% overweight) among the included subjects.

In a household survey included children aged from 1 to 18 years, the overall prevalence of overweight was 10.7% and obesity 4.7% among the included males, and Eastern province had the highest prevalence compared to others in KSA [6], while another school-based survey in the Kingdom showed that the overall prevalence of overweight was 11.7% and obesity 15.8% among the included male aged between 6 and 18 years and the highest prevalence of obesity was recorded in the capital Riyadh [1].

Our results are higher than those reported in the household survey, while, overweight in our study is in concordance with the previously mentioned school survey but lower regarding the prevalence of obesity.

This difference could be explained on the basis of the different age groups included in these studies and/or in the methods used for assessing overweight and obesity.

In one study in Italy, among the 11 to 19-year-old school students, reported a prevalence of obesity of 9.8% and overweight of 21.4% [4], while in Brazil the prevalence of obesity and overweight among 8–10 years male schoolchildren were 7.4 and 17.3% [26].

Our figures as well as other studies [1, 2, 6, 16] conducted in the Kingdom revealed a prevalence that approaching or sometimes exceeding those in many developed countries; Wang in 2001 [28] reported a combined prevalence of overweight and obesity of 25.7% in the US, 11.5% in Russia and 5% in China in males within the age group of 10–18 years. This last notion implies the urgency for intervention to revert and reduce the epidemic of obesity and the possible health hazards with grave repercussions on adult populations and the health system.

Gillis and Bar [8] reported that obese children and adolescents consume significantly more servings of meat and alternatives, grain products, fast foods, sugar sweetened drinks, and potato chips which contribute to a higher calories, fat, and sugar intake compared to non-obese children and adolescents.

Similar studies [18, 20] reported that overweight and obese children consumed more fats and less vegetables, fruits, legumes and dairy products.

Our results are in concordance with the previously mentioned report and studies as obese and overweight students in our study consumed more frequently meat and alternatives, soft drinks, sweets/candy, and potato chips with less milk and dairy products compared to the

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Table 6 Multivariate logistic regression model between overweight and obesity and significant independent variables (socio-demographic and dietary habits)

Covariates	β co-efficient	Multivariate analysis	
		Odds ratio (OR) and 95% confidence intervals (95% CI)	P value
Residence			
Urban	0.811	1.85 (1.31–2.62)	0.011*
Rural		1 (ref)	
Age groups			
10 to <12	−0.342	0.41 (0.31–0.54)	0.002*
12 to <14	0.763	2.1 (1.12–3.90)	0.003*
14 years		1(ref)	
Maternal education			
<Secondary	0.448	1.87 (1.23–2.49)	0.020*
Secondary or higher		1 (ref)	
Working mother			
Yes	0.683	1.85 (1.34–2.55)	0.014*
No		1 (ref)	
Family size			
≤6 per family	0.392	1.95 (1.15–3.31)	0.004*
>6 per family			
Taking breakfast at home			
Yes	−0.042	0.54 (0.33–0.89)	0.018*
No		1 (ref)	
Food away from home			
>3 times/week	.258	1.76 (1.28–2.42)	0.033*
≤3 times/week		1 (ref)	

ref reference group
This model correctly predicts 68.6% of the cases, $\chi^2 = 21.094$, constant = 3.159
* Statistically significant association

lean group, while both groups consumed less fruits and vegetables, much less among the obese group.

Also, our results revealed that in comparison to Healthy People Objectives 2010, the consumption of the included students if far behind the recommended consumption [20], these findings were also confirmed in the logistic regression model as it revealed that low consumption of fruits, vegetables, milk and dairy products are possible predictors to overweight and obesity among the included students.

There is a growing body of evidence suggesting that increasing dairy intake by about two servings per day could reduce the risk of overweight by up to 70% [10].

In addition, calcium intake was associated with 21% reduced risk of development of insulin resistance among overweight younger adults and may reduce diabetes risk [23]. Higher calcium intake and more dairy servings per day were associated with reduced adiposity in children studied longitudinally [10].

Several studies [8, 21, 26, 27] indicated the association between less healthy eating habits and obesity in children. Missing or infrequent intake of breakfast and low frequency of milk consumption had been reported by a school-based study in Brazil and other parts of the world to be positively associated with obesity and overweight in the included primary students.

Niklas et al. [21] argued that regular consumption of breakfast may control body weight due to the decrease of fat in the diet because of the role it plays in minimizing the intake of high energy snacks. Children who eat breakfast would have a greater intake of grains, fruits, and dairy products.

Our results are consistent with both the previous Brazilian study as well as the argument of Niklas, as obese–overweight students were significantly missing or infrequently taking breakfast compared to the non-obese group. In a study comparing the eating habits of obese to non-obese children, it was found that obese children were significantly consuming more fast foods versus the non-obese children. This has been shown to contribute to a significant amount of extra calories and fat in the diets of obese adults [8].

Our study reported a significant difference between obese and overweight children and the lean children in the frequency of consumption of fast food.

In the logistic regression model, less healthy dietary habits were positively associated with obesity and overweight among the included students. These results are consistent with those reported in similar study on a younger age group of schoolchildren in Brazil [27], where less healthier eating habits was associated with two folds risk of overweight and obesity.

Large number of studies on adults has examined the relationship between the socio-economic status and obesity, but less research had used data to examine these relationships on children [15, 22]. It was concluded that a strong inverse relationship between socioeconomic status and obesity among women in developed societies, but the relationship is inconsistent for men and children.

In contrast, in developing countries a strong relationship exists between socioeconomic status and obesity among men, women and children [27]. It is of concern, however, that since different obesity definitions and socioeconomic indicators were used, findings in different studies may not comparable [22].

In the current study, obesity and overweight were associated with urban residence low maternal educational status which are consistent with other studies reporting a higher prevalence of childhood obesity among the low social class while it is conflicting those reported the linkage of obesity to low economic class as our results revealed an association with maternal occupational status which may represents a proxy to higher economic status.

Conclusion

The combined prevalence of overweight and obesity among the included male children is increasing and comparable to those found in the developed countries.

Less healthy dietary habits, poor food choices and socio-economic differentials may be associated with the problem of obesity and overweight among the included schoolchildren in Al-Hassa.

Recommendations

Those involved in childhood obesity prevention may use these findings to implement school-based food programs and nutritional health education messages with incorporation of skills for proper food choices.

Emphasizing the importance of breakfast, the hazards of frequent eating out and the importance of certain food items in prevention of obesity to schoolchildren and their parents in formulation of health education messages.

Further studies involving females and other possible risk factors of obesity are needed.

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