Association between dietary habits and body mass index of adolescent females in intermediate schools in Riyadh, Saudi Arabia

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الترابط بين العادات الغذائية و مؤشر كتلة الجسم لدى المراهقات في المدارس المتوسطة في الرياض، المملكة العربية السعودية

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الخلاصة: تعتبر السمنة بين الشباب السعودي من التحديات المتنامية التي تواجه الصحة العمومية. وتستعرض هذه الدراسة المستعرضة قياس منسب كتلة الجسم، مع تحديد العادات الغذائية، وأنماط حياة 107 من المراهقات اللاتي تم اختيارهن بصورة عشوائية وتتراوح أعمارهن بين 12 و15 عاماً في مدارس الرياض. وتم قياس طول ووزن الطالبات، واستخدام استبيان تم اختباره مسبقاً لتجميع البيانات حول النظام الغذائي ونمط الحياة. وقد كان الدخل الشهري لغالبية أسر الطالبات يتجاوز 10 000 ريال سعودي (الدولار الأمريكي يعادل 3.75 ريال سعودي). وكان نصف الطالبات تقريباً (53.3٪) في حدود الوزن السَّوي، و28.6٪ ناقصات الوزن، و12.4٪ زائدات الوزن، و5.7٪ سمينات. وغالبية الطالبات لم يكن لديهن عادات غذائية أو بدنية صحية. ولم يكن هناك تفاوت كبير بين منْسَب كتلة الجسم، ونمط النظام الغذائي، وأسلوب الحياة. ومن ثمَّ يوصى بزيادة البرامج التثقيفية حول المفاهيم الغذائية الصحية من أجل تحسين الأنماط الغذائية للمراهقات.

ABSTRACT Obesity among Saudi youth is a growing public health challenge. This cross-sectional study measured body mass index (BMI) and determined the eating habits and lifestyle of 107 randomly selected female adolescent students (age 12–15 years) at schools in Riyadh. The students' heights and weights were measured and a pre-tested questionnaire was used to collect data on diet and lifestyle. The majority of the students' families had monthly income > 10 000 rials (US$ 1 = 3.75 rials). About half the students (53.3%) were within normal weight, 28.6% were underweight, 12.4% overweight and 5.7% obese. The majority of the students did not have healthy dietary or exercise habits. There were no significant differences between BMI category and dietary pattern and lifestyle. Increasing educational programmes with healthy dietary concepts to improve the dietary pattern of female adolescents is recommended.

Association entre les habitudes alimentaires et l'indice de masse corporelle chez des collégiennes à Riyad (Arabie saoudite)

RÉSUMÉ L'obésité chez les jeunes saoudiens est une préoccupation de santé publique croissante. La présente étude transversale a mesuré l'indice de masse corporelle puis a déterminé les habitudes alimentaires ainsi que le style de vie de 107 adolescentes sélectionnées aléatoirement (âgées de 12 à 17 ans) dans des collèges à Riyad. Le poids et la taille des collégiennes ont été mesurés et un questionnaire prétesté a été utilisé pour recueillir des données sur leur alimentation et leur style de vie. La majorité des familles des collégiennes disposait d'un revenu mensuel supérieur à 10 000 rials (1 USD = 3,75 rials). Environ la moitié des adolescentes (53,3 %) avaient un poids normal, 28,6 % souffraient d'insuffisance pondérale, 12,4 % présentaient une surcharge pondérale tandis que 5,7 % étaient obèses. La majorité des collégiennes n'avaient pas d'habitudes alimentaires ni sportives saines. Aucune différence significative n'a été observée entre la catégorie d'indice de masse corporelle, les habitudes alimentaires et le mode de vie. Une intensification des programmes d'éducation présentant des concepts sur une alimentation saine visant à améliorer les habitudes alimentaires des adolescentes est recommandée.

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Introduction

During adolescence, hormonal changes lead to accelerated growth, which is faster than at any other time in postnatal development, except for the first year of life [1]. Concern over adolescent obesity has mounted due to its rapid increase in prevalence, its persistence into adulthood, and its associated morbidity and mortality [2]. Numerous studies have demonstrated an association between body weight and eating behaviour [3], and cultural and socioeconomic factors also play an important role in the development of eating behaviour [4].

Al-Hazzaa et al. concluded that 84% of male and 91.2% of female Saudi adolescents spent >2 h daily on screen, and ~50% of boys and ~75% of girls did not meet daily physical activity guidelines [5]. The majority of adolescents did not have a daily intake of breakfast, fruit, vegetables and milk. Compared with boys, girls were significantly more sedentary, much less physically active, especially for vigorous physical activity, and there were fewer days per week when they consumed breakfast, fruit, milk and dairy products, sugar-sweetened drinks, fast foods, and energy drinks. However, girls' intake of French fries and potato chips, cakes and doughnuts, and candy and chocolate was significantly higher. There was a significant inverse correlation between screen time and intake of breakfast, vegetables and fruit. Conversely, physical activity had a significant positive relationship with fruit and vegetable intake.

Eating behaviour of adolescents can be influenced by both exogenous and endogenous factors. The most important exogenous factors are probably parents, peers, and the media [6]. Gender, intellectual ability, self-concept, and personality are among the endogenous factors that may influence the eating behaviour of adolescents [5].

The adverse health consequences that may result from excessive intake of soft drinks, sugared drinks and fast food; inadequate intake of fruit, vegetables, whole grain foods, dairy products and other calcium-fortified foods; reduced levels of exercise; and increasing obesity rates indicate a need to revisit the diet and lifestyle characteristics of this age group [7]. The present study investigated how the dietary habits of adolescent girls affected body mass index (BMI), which may be an indicator of future weight gain, and estimated the prevalence of overweight and obesity among students at intermediate schools in Riyadh.

Methods

Study design and participants

A cross-sectional study was carried out using a predesigned questionnaire to assess the relationship between dietary habits and BMI in 107 randomly selected adolescent female students; aged 12–15 years. The students were enrolled at intermediate levels of government schools in different areas of Riyadh, Saudi Arabia. There were 36 first level, 35 second level and 36 third level students.

Data collection

Body weight was recorded to the nearest 0.2 kg on a Digital Person Scale (ADAM Equipment, Danbury, CT, USA) without shoes and with light clothing. Body height was recorded to the nearest 0.5 cm using the same scale, and BMI was calculated as kg/m^2. $BMI > 35 kg/m^2$. Other patient data were collected by a questionnaire consisting of four sections and 36 items. Sociodemographic data included: age, parental education level, family size, type of house, and average family monthly income. Dietary data included: main meal, breakfast, water consumption, daily fruit and vegetable intake, daily snack consumption, daily milk consumption, satisfaction with body weight, attitude to weight loss and gain, effect of media on food choices, favourite food at school, drink preferences, and preferred food when watching television.

Analysis

Data were analysed using *SPSS* statistical software. The chi-squared test was used to assess the statistical significance of the association between BMI category and other variables. $P < 0.05$ was considered statistically significant.

Results

Sociodemographic data

Table 1 shows the sociodemographic characteristic (age, father and mother education, number of the family members, type of the house and average of family monthly income). The mean age of the sample was 13 years. For the majority of the participants their parents were university educated (90.7% for fathers and 67.3% for mothers). About half of the sample (53.3%) had between 7 and 10 family members. The majority lived in villas (86.0%) and their families had an average monthly income of > 10 000 rials (76%). More than the half of the sample had a normal BMI (53.3%), 28.6% were underweight, 12.4% overweight and 5.7% were morbidly obese.

Adolescents' dietary pattern

Table 2 shows that the main meal for the majority of the participants was lunch (76.2%); there was a non-significant difference between the BMI categories with regard to main meal ($P > 0.05$). Over half of the total number of participants ate breakfast (53.2%) with no significant relationship between the BMI categories and eating breakfast ($P > 0.05$). More than half of the studied sample (58.9%) drank less than 6 cups of water per day, again with no significant variation between daily intake of water and BMI category ($P > 0.05$). Just over 20% of the adolescents did not eat fruits and vegetables daily with a non-significant difference among

Table 1 Distribution of the studied adolescent females in some intermediate schools in Riyadh according to their sociodemographic characteristics

Sociodemographic characteristic	% (n = 107)
Age group (years)	
12–13	29.9
14–15	58.9
> 15	11.2
Father's education	
Illiterate	0.9
Primary	9.0
Secondary	7.5
University	90.7
Mother's education	
Primary	2.9
Preparatory	5.7
Secondary	22.9
University	68.6
Number of family members	
< 3	1.9
4–6	39.3
7–10	53.3
10+	5.6
Type of the house	
Villa	86.0
Apartment	3.7
Floor	3.7
Others	6.5
Family monthly income (Saudi rials)	
< 3000	1.0
3000–5000	5.0
5000–10 000	18.0
> 10 000 SR	76.0
BMI category	
Underweight	28.6
Normal weight	53.3
Over weight	12.4
Morbid obesity	5.7

BMI = body mass index.

the BMI categories ($P > 0.05$). There was nonsignificant difference between BMI categories and drinking milk daily with 26.2% of the total sample drinking milk daily. A large majority of the sample (89.5%) ate snacks daily with non-significant differences ($P > 0.05$) between BMI categories.

Table 3 shows the distribution of the studied sample according to the food and drinks they consumed at school: cheese sandwich, chips, chocolate and juice, were the food moist frequently eaten (45.5%, 39.9% ,36.6% and 35.6% respectively), with a nonsignificant difference between BMI categories ($P > 0.05$). Fizzy drinks and low-calorie fizzy drinks were the preferred beverage of the sample (78.2%, 59.4% respectively) with a nonsignificant difference

between the BMI categories ($P > 0.05$). The preferred foods consumed by the studied sample when watching television were: fast foods followed by desserts/fizzy drinks (86.3% and 22.5% respectively). There was no significant variation between BMI categories ($P > 0.05$).

Approximately two-thirds (69.8%) of the adolescents reported that they were not satisfied with their weight Table 4). The majority of the sample (71.7%) wanted to lose weight while 88.6% said they did not want to gain weight. There was significant difference between BMI category and satisfaction with body weight, and the same pattern was found for increasing or decreasing body weight ($P < 0.05$).

Our results show that 61.0% of the sample thought that people were affected by the media.. Only 15.0% of the sample exercised daily, while 53.3% exercised about once a week

Discussion

Our study showed that the adolescent in this study, irrespective of BMI category, had some bad eating habits, including drinking < 6 cups of water per day, only eating fruits and vegetable sometimes, skipping meals, especially breakfast, eating snacks daily such as chocolate, sandwiches, chips, packed juices; they also had low daily milk consumption. Most also did not take part in regular exercise. These sorts of habits for the adolescents can lead to increases body weight in the future, and are likely to become regular habits for them and their families. Our findings are in agreement with other studies regarding unhealthy dietary, exercise and sleep habits of adolescents.

During adolescence hormonal changes accelerate growth in height. Growth is faster than at any other time in the individual's postnatal life except the first year so this may negatively or positively affect the consumption of food and dietary habits which may be related

Table 2 Distribution of the studied adolescent females in some intermediate schools in Riyadh according to adolescents eating pattern

Adolescents' eating pattern	Underweight (%) (n = 30)	Normal weight (%) (n = 56)	Overweight (%) (n =15)	Morbidly obese (%) (n =6)	Total (%) (n = 107)	Chi-squared	P-value
Main meal of the day							
Breakfast	10.0	11.1	0.0	16.7	9.5	5.373	> 0.05
Lunch	83.3	72.2	76.9	66.7	76.2		
Dinner	6.7	16.7	23.1	16.7	14.3		
Eating breakfast							
Yes	60.0	48.2	46.2	83.3	53.2	6.976	> 0.05
No	0.0	10.7	15.4	0.0	7.5		
Sometimes	40.0	41.1	38.5	16.7	39.3		
Daily water intake							
Less than 6 cups /day	56.7	34.0	7.0	4.0	58.9	1.473	> 0.05
6 to 8 cups /day	33.3	15.0	4.0	2.0	29.9		
More than 8 cups /day	10.0	7.0	2.0	0.0	11.2		
Daily fruit and vegetables consumption							
Yes	16.7	16.1	7.7	16.7	15.0	8.378	> 0.05
No	6.7	23.2	30.8	50.0	21.2		
Sometimes	76.7	60.7	61.5	33.3	63.8		
Daily milk consumption							
Yes	36.7	17.9	33.3	33.3	26.4	4.367	> 0.05
No	26.7	48.2	33.3	50.0	39.6		
Sometimes	36.7	33.9	33.3	16.7	34.0		
Daily consumption of snacks							
Yes	93.3	85.7	92.3	100	89.5	3.468	> 0.05
No	6.7	8.9	7.7	0.0	7.6		
>3 times	0.0	5.4	0.0	0.0	2.9		

Table 3 Distribution of the studied adolescent females in some intermediate schools in Riyadh according to their preferred food

Preferred food	Underweight (%)	Normal weight (%)	Overweight (%)	Morbidly obese (%)	Total (%)	Chi-squared	P-value
Food at school							
Cheese sandwich	60.0	37.7	41.7	50.0	45.54		
Burger	6.7	0.0	8.3	0.0	2.97		
Chocolate	26.7	41.5	41.7	33.3	36.63		
Biscuits	16.7	7.5	16.7	16.7	11.88		
Ice cream	6.7	1.9	8.3	0.0	3.96		
Fizzy drinks	10.0	11.3	25.0	0.0	11.88	0.629	> 0.05
Milk	0.0	1.9	0.0	0.0	0.99		
Juice	30.0	32.1	58.3	50.0	35.64		
Fruits or vegetables	3.3	0.0	0.0	0.0	0.99		
Nothing	0.0	5.7	8.3	0.0	3.96		
Chips and snacks	36.7	43.4	33.3	33.3	39.6		
Favourite drink							
Tea	13.3	5.7	.0	16.7	7.92		
Power drinks	10.0	17.0	7.7	0.0	12.87		
Fresh juice	13.3	28.3	23.1	0.0	21.78	0.228	> 0.05
Coffee	13.3	7.5	15.4	0.0	9.90		
Fizzy drinks	86.7	71.7	69.2	100.0	78.22		
Packet juice	10.0	30.2	30.8	33.3	24.75		
Low-calorie fizzy drinks	76.7	50.9	53.8	50.0	59.41		
Food preferred while watching television							
Fast foods	89.7	85.5	84.6	80.0	86.28		
Main meal	3.4	9.1	0.0	20.0	6.86	0.531	> 0.05
Coffee	0.0	0.0	7.7	0.0	0.98		
Desserts and fizzy drinks	31.0	20.0	23.1	0.0	22.55		
Fruits and vegetables	0.0	3.6	15.4	0.0	3.92		

to the community [8]. During this time, changes in adolescents' lifestyle may also affect eating habits and food choices. It has been shown that dietary quality decreases throughout childhood and adolescents have a poorer quality diet compared to younger children [9]. This study also indicated that there are no significant differences between the sociodemographic data and BMI. However, Nilsen et al. reported that the education of mothers of adolescents affected adolescents' health-related dietary habits [10]. Another study reported an association between socioeconomic factors and obesity among female school-aged children and adolescents in primary and intermediate schools [11].

Our finding about skipping meals concurs with other studies that found that adolescents tend to skip regular meals and instead of enjoying a balanced meal, consume fast foods during the day resulting in weight gain [12]. Many adolescents skip breakfast in particular or eat the wrong kind of breakfast [12]. Samuel points out that adolescents who skip breakfast are missing an opportunity to boost their nutrient intake, which has a negative effect on their learning performance and academic achievement [13].

As well as skipping meals, national survey data in the United States show that 88% of adolescents consume at least one snack per day, with a range of

1 to 7 [14,15] and snacks account for 25%–33% of daily energy intake among adolescents. Furthermore, food choices made by adolescents while snacking tend to be high in sugar, sodium, and fat, while relatively low in vitamins and minerals, which increase the risk for developing obesity, heart disease, osteoporosis, dental cavities and various types of cancer [16].

It is reported that watching television during family meals is associated with poorer dietary quality among adolescents and increased television viewing is associated with increased caloric intake, consumption of higher-fat food and lower intake of fruits and vegetables [17–19], which is in line with our

Table 4 Distribution of the studied adolescent females in some intermediate schools in Riyadh according to their attitude to their body weight

Attitude to weight	% (*n* = 107)
Affected by the media	
Yes	61.0
No	38.1
Some times	1.0
χ^2	5.323
Daily exercise	
Yes	15.0
No	31.8
Some times	53.3
χ^2	1.423
Satisfied with weight	
Yes	30.2
No	69.8
χ^2	15.688
Would like to lose weight	
Yes	71.7
No	28.3
χ^2	27.184
Would like to gain weight	
Yes	11.4
No	88.6
χ^2	19.521

obese students inversely increased by age and schooling grade ($P < 0.001$). Ninety-five percent of the students living in villas or big houses were obese, clearly showing that the existence of obesity-promoting factors [22]. Thus obesity and physical inactivity among Saudi children and youth represent a growing public health challenge [23].

Almost 70% of our sample were not satisfied with their weight. Heilman reported that during adolescence many teenagers desire an ideal weight which relates to their image [7]. The media and advertisers reinforce unrealistic body weights as they convey to women and young girls that 10% body fat is the ideal when 22% body fat is in fact considered healthier [7]. At the same time, many adolescents who are overweight do not participate in sport and prefer to diet in order to maintain a slim figure instead of doing exercise to burn calories [8].

Conclusion

Our results show that there was no significant variation between BMI category and dietary pattern, but the dietary pattern of the adolescent females was unhealthy and most of them tended to skip meals. Increasing educational programmes which introduce healthy dietary concepts to improve the dietary pattern of female adolescents is recommended.

results. Eating a diet rich in fruits and vegetables may be particularly important during adolescence due to the high nutrient needs in this rapid period of growth and development. Furthermore, the development of healthy eating patterns during adolescence, including an adequate fruit and vegetable intake, may lead to continued healthy eating patterns in adulthood [20].

A recent study in Saudi Arabia reported a predominance of unhealthy behaviours [21]. A similar study in Riyadh observed that the proportion of

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