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Sociodemographic Characteristics, Dietary Intake, and Body Image Dissatisfaction Among Saudi Adolescent Girls

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ABSTRACT

This study assesses sociodemographic characteristics, dietary intake and body image dissatisfaction (BID) among Saudi adolescent girls. A total of 399 girls ages 13-14 were randomly selected from intermediate schools in Arar, Saudi Arabia. Data on anthropometric measurements, sociodemographic characteristics, dietary intake and body image (BI) were collected. Multiple linear regression was used to predict the association between variables. Most adolescents had a normal weight based on their body mass index (BMI), normal waist circumference (WC), and normal waist-to-height ratio (WHtR). Fried chicken and Kabsa rice were the most frequently consumed foods; most girls consumed excessive fat. Most girls had BID (81.5%), and 51.4% desired to lose weight. BMI was positively correlated with age and current BI ($p<0.001$) and negatively associated with dairy product intake ($p=0.004$) and desired BI ($p<0.001$). WC had a positive association with age ($p=0.001$) and current BI ($p<0.001$) and a negative association with dairy product intake, cereal and grain intake ($p=0.001$) and ideal BI ($p<0.001$). WHtR was positively associated with current BI ($p<0.001$) and negatively associated with cereal and grain intake ($p=0.005$), dairy product intake and desired BI ($p<0.001$). Although most participants had a normal weight, they

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consumed excessive fat and were dissatisfied with their BI, which are significant predictors of obesity. Saudi adolescent girls require nutritional interventions to help them transition to a healthy diet, positive BI and healthy lifestyle.

Keywords: Body image dissatisfaction, dietary intake, obesity, Saudi female, unhealthy food, waist-to-height ratio

INTRODUCTION

Obesity and overweight exacerbate health problems and the risk of noncommunicable diseases (NCDs), such as musculoskeletal disorders, some cancers, cardiovascular diseases, breathing difficulties and diabetes (WHO, 2021a). They pose a significant public health challenge among children and adolescents in countries with high, middle and low incomes (WHO, 2021a) (El Kabbaoui et al., 2018). In the United States, 14.4 million children and adolescents are obese (CDC, 2021). In Europe, one in three children is overweight or obese (Bell et al., 2019). A recent study on Saudi adolescent nutritional profiles reported that 15.8% and 14.2% of participants were obese and overweight, respectively (Musharrafieh et al., 2020).

The rapid economic growth of Saudi Arabia has coincided with negative changes in lifestyle, such as a shift toward high-caloric-density food consumption, which has been accompanied by an increase in NCDs (Al-Hazzaa, 2018). One study found that 19.4% of Saudi females consumed a large amount of unhealthy food, while 21.1% and 60.4% consumed less healthy foods, such as French fries and chocolate, respectively, for ≥ 3 days (Alzamil et al., 2019). Saudi adolescents consume large quantities of fat, carbohydrates and proteins, especially among obese subjects (Al-Kutbe et al., 2017). A systematic review revealed that Middle Eastern children, including Saudis, engaged in several unhealthy dietary behaviours. These included consuming excessive amounts of refined carbohydrates and fat and having a low intake of vegetables, fruits and dairy products, increasing their risk of obesity (Albataineh et al., 2019). An unhealthy diet is an NCD risk factor (WHO, 2021b). It must be addressed in the adolescent period to prevent NCDs from becoming more prevalent in adults (Draper et al., 2015). Consequently, nutritionists recommend that adolescents consume healthy foods, including whole grains, vegetables and fruits, and limit their junk food consumption to promote a healthy lifestyle and avoid risky behaviours (Tabbakh & Freeland-Graves, 2016; WHO, 2021a). It would support their growth and development (Hijji et al., 2021).

Adolescence involves physical, intellectual, psychological, cognitive and social changes between childhood and adulthood (WHO, 2021c); it affects adolescent bodies' weight, shape and appearance (Voelker et al., 2015). Family members, friends, gender and age, play a role in shaping one's body image (BI) (Cafri et al., 2005). However, adolescents with negative BI are more likely to adhere to an unhealthy lifestyle involving behaviours

such as disordered eating (Cruz-Sáez et al., 2020). Obesity and body image dissatisfaction (BID) are linked to depression and low self-esteem. However, those who are obese are not all equally prone to BID, and this association may also exist among those with normal body weight (Weinberger et al., 2016). A previous study indicated that body mass index (BMI) was significantly associated with the proportion of BID (p<0.001) among Saudi females (Albawardi et al., 2021). Therefore, a key to weight management and health is body satisfaction and a healthy self-perception (Lynch et al., 2009; Radwan et al., 2019). The results indicated that the percentage of underweight Saudi adolescent girls who wanted to lose weight between the ages of 10 and 14 years was 16%, and it was 5% for boys (Hijji et al., 2021). Khalaf et al. (2015) found that only 23.3% of Saudi female adolescents were satisfied with their ideal, visible and current BI, while most desired a thinner body shape. Children and adolescents with BID are generally at risk of being inactive, eating uncontrollably, smoking or exhibiting depression (Baceviciene et al., 2020; Bray et al., 2018).

To our knowledge, many Saudi adolescent studies focus on the connections between dietary intake, BI and anthropometric measurements. The current study aims to assess sociodemographic characteristics, dietary intake and BID and to predict their association with anthropometric measurements among Saudi adolescent girls between 13 and 14 in Arar.

METHODOLOGY

Design and Location of the Study

This cross-sectional study was carried out in September-October 2019 in Arar City, located in the northern border region of Saudi Arabia. Saudi female adolescent students were recruited from government schools randomly. Among Arar's 22 all-girl public intermediate schools, one school from each identified region was randomly selected (Figure 1).

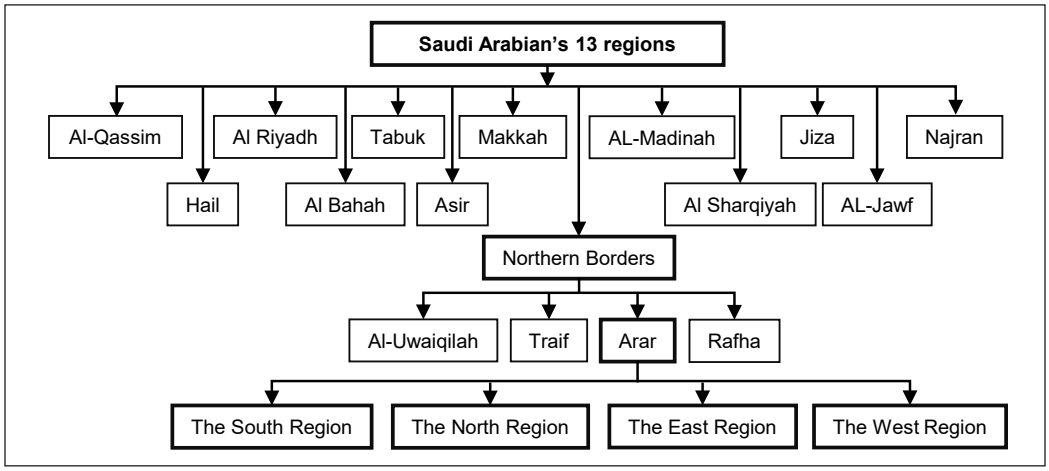

Figure 1. Recruitment of participants in Arar, Saudi Arabia

Ethical Considerations

Ethical approval was obtained from the Ministry of Education, the Local Committee of Bio-Ethics HAP-09-A-043 at Northern Border University, Arar, Saudi Arabia (reference no. 13/40/H) and the research ethics committee of Universiti Putra Malaysia involving human subjects (reference no. UPM/TNCPI/RMC/JKEUPM/1.4.18.2 (JKEUPM)) to conduct this study. Participation was voluntary. The participants and their parents signed an informed consent form to participate. The purpose of the study was explained to them before the study commenced. The identities of the participants were kept confidential.

Participants and Sample Size

The researchers recruited only Saudi girls (13–14 years old) who enrolled in an intermediate public school in Arar during the 2019–2020 academic year. The sample size was calculated using the commonly used formula of Lemeshow et al. (1990). A total of 399 participants were obtained, indicating a 93.2% response rate. The inclusion and exclusion criteria details and sample size determination were previously published elsewhere (Bahathig et al., 2021).

Data Collection

The researcher provided face-to-face guidance to the students who were asked to complete the questionnaire, which consisted of sociodemographic characteristics, food habits and BID. Anthropometric indicator data were measured for all students.

Sociodemographic Characteristics. In addition to specifying their age and date of birth, the participants indicated their number of siblings and household members, the education levels of their mothers and fathers and monthly income in the sociodemographic data.

Participants' Anthropometries. All measurements were repeated twice for accuracy, and further analysis was conducted using the mean value. The participants were initially asked to remove their shoes, wear light clothes, stand up straight, hold their heads upright and relax their shoulders and arms at their sides. The girls' body weight and height were measured using a special digital body weight scale (Detecto solo Digital Clinical Scale; Webb City, MO, USA) to the nearest 0.1 kg and 0.1 cm, respectively. According to a growth reference for girls aged 5–19, body mass index-for-age (BMI z-score) was measured. BMI was categorised as follows: (thinness: < -2 standard deviation SD; normal weight: ≤ 2 SD and ≥ 1 SD; overweight: $> +1$ SD; and obesity: $> +2$ SD) (WHO, 2021d). A non-stretchable tape marked in centimetres was used to measure the waist circumference (WC) in the area between the iliac crest and the last rib of the ribcage to the nearest 0.1 cm. The cut-off points were 77 cm (obesity) and 72.3 cm (overweight) (Motlagh et al., 2018). Waist-to-height

ratio (WHtR) was calculated in centimetres by dividing WC by height. WHtR ≥ 0.5 was considered abdominal obesity (Maffeis et al., 2008).

Assessment of Food Habits. The Arabic version (original) of a semi-quantitative food frequency questionnaire (SFFQ) developed by Almajwal et al. (2018) was used to assess the dietary intake of the participants. The SFFQ involves 74 food items categorised into once, 2–3, 4–5 and 6–7 times/day; 1–2, 3–4 and 5–6 times/week; once and 2–3 times/monthly; and never. The nutrient and food groups had an average percentage agreement of 70.1% and 70.9%, respectively (Almajwal et al., 2018). The participants were asked to determine the food they consumed and its size. The mean score of calories for each type of food, the 10 most and least frequently consumed food and the frequency of consumption of food groups were determined using Nutritionist Pro™ Diet version 6 (Axxya Systems, USA; Axxya Systems, 2014). According to the guidelines provided by Hackshaw (2014), food items with a frequency of ≥ 0.5 were referred to as the most frequently consumed food.

Assessment of Body Image Dissatisfaction (BID). Figure drawings or questionnaires are usually used to assess BI (Moehlecke et al., 2020). BID in this study was determined by adopting the Stunkard Figure Rating Scale (Stunkard, 1983). The test–retest of this scale was 0.8 (Cardinal et al., 2006). The scale is reliable in a wide range of populations, including the Middle East; it consisted of nine figures coded from (one) thinnest to (nine) heaviest (McElhone et al., 1999; Shaban et al., 2016). Each participant was required to choose a figure representing her present image, the desired BI and the perfect BI figure based on her perception. BID was calculated as follows: desired BI minus current BI. A score is other than zero means that the participants were unsatisfied with their BI (Sánchez et al., 2018). The pre-test was conducted among 30 students to ensure the scale was appropriate and understandable.

Statistical Analysis

SPSS Statistics for Windows (version 25; Chicago, USA) was used for data analysis, with a 95% confidence interval (CI). The mean, standard deviation, percentage and frequency were used to present the data. The chi-square test was used to determine the correlation between the actual BMI and the perceived BMI. A multiple linear regression model was used to determine the association between the anthropometric measurements and the variables. A p-value < 0.05 was considered statistically significant.

RESULTS

Study Sample and Anthropometric Measurements

Table 1 shows the sociodemographic characteristics of the 399 girls aged 13–14 years who were satisfied (N = 74; 18.5%) and dissatisfied with their BI (N = 325; 81.5%).

Approximately 52.9% of the girls with BID reported having 5–10 siblings, and 76.9% had 5–10 family members. Among the participants, 48.3% and 54.8% of the girls' mothers and fathers had at least some college education, respectively. Among the girls who were satisfied with their BI, 54% and 78.3% had 5–10 siblings and lived with 5–10 household members, respectively. Among them, 47.3% and 54.1% of the girl's mothers and fathers obtained a university education or higher, indicating that most participants had educated parents.

Table 1
Participants' sociodemographic data and anthropometric indicators

Items	Body image satisfaction (BIS), (N=74)		Body image dissatisfaction (BID), (N=325)		
	Mean (SD)	N (%)	Mean (SD)	N (%)	*p*-value
Age group (years)	13.39±.49		13.32±0.47		0.258
School(s)					0.795
The Northern Region		22(29.7)		88(27.1)	
The South Region		20(27.0)		91(28.0)	
The East Region		11(14.9)		63(19.4)	
The West Region		21(28.4)		83(25.5)	
Number of Siblings					0.500
< 5		29(39.2)		140(43.1)	
5 - 10		40(54.0)		172(52.9)	
> 10		5(6.8)		13(4.0)	
Number of households					0.750
< 5		3(4.1)		14(4.3)	
5 - 10		58(78.3)		250(76.9)	
> 10		13(17.6)		61(18.8)	
Mother's education					0.923
Intermediate school or lower		15(20.3)		70(21.5)	
High school		24(32.4)		98(30.2)	
Undergraduate or higher		35(47.3)		157(48.3)	
Father's education					0.347
Intermediate school or lower		6(8.1)		44(13.5)	
High school		28(37.8)		103(31.7)	
Undergraduate or higher		40(54.1)		178(54.8)	
Family monthly income (SAR) *					0.462
< 5000		8(10.8)		49(15.1)	
5000 - 14999		38(51.4)		160(49.2)	
≥ 15 000		28(37.8)		116(35.7)	

Table 1 *(continue)*

Items	Body image satisfaction (BIS), (N=74)		Body image dissatisfaction (BID), (N=325)		
	Mean (SD)	**N (%)**	**Mean (SD)**	**N (%)**	***p*-value**
Person in charge of preparing cook food					0.340
Mother		64(86.5)		295(90.8)	
Father		1(1.4)		1(0.3)	
Housekeeper		5(6.8)		21(6.5)	
Others		4(5.4)		8(2.5)	
Person spent most time on weekdays					0898
Mother		54(73.0)		235(72.3)	
Father		5(6.8)		16(4.9)	
Friends		7(9.5)		32(9.8)	
Others		8(10.8)		42(12.9)	
Person spent most time on weekends					0.102
Mother		51(68.9)		198(60.9)	
Father		6(8.1)		25(7.7)	
Friends		12(16.2)		42(12.9)	
Others		5(6.8)		60(18.5)	
Anthropometric measurements					
Height (cm)	151±0.06		152±0.07		0.190
Weight (kg)	46.63±8.42		52.07±14.36		<0.001
BMI (kg/m^2)	20.45±3.32		22.36±5.35		<0.001
BMI z-score	0.29±1.07		0.63±1.46		<0.022
WC (cm)	67.89±7.25		71.35±10.59		0.001
WHtR (cm)	1.51±0.06		1.52±0.07		0.003
BMI status					0.013
Thinness <−2 SD		1(1.4)		19(5.8)	
Normal ≤ −2 SD and ≥1		69(93.2)		248(76.3)	
Overweight > +1 SD		4(5.4)		48(14.8)	
Obese > +2 SD		0(0)		10(3.1)	
WC					0.001
Normal		56(75.7)		193(59.4)	
Overweight 72.3 cm		12(16.2)		40(12.3)	
Abdominal Obesity 77 cm		6(8.1)		92(28.3)	
WHtR					0.001
WHtR < 0.5		67(90.5)		231(71.1)	
WHtR ≥ 0.5		7(9.5)		94(28.9)	

* 1 USD = 3.75 SAR (Saudi Arabia Riyal). Abbreviations: BMI—body mass index; WHtR—waist to height ratio; WC—Waist circumference.

Among the participants, 49.2% and 54.1% with BID and BIS came from middle-income families earning 5,000–14,999 Saudi riyals, respectively. Most students reported that their mothers usually prepared their food. Among the girls with BID, 72.3% and 60.9% spent most of their time with their mothers on weekdays and weekends, respectively; among girls with BIS, 73% and 68.9% spent most of their time with their mothers on weekdays and weekends, respectively. The results indicated no significant differences between the two groups for sociodemographic variables ($p > 0.05$).

The anthropometric indicators of the participants are presented in Table 1. The mean value was 152.00 ± 0.07 cm for height, 52.07 ± 14.36 kg for weight, 0.63 ± 1.46 for the BMI z-scores, 71.35 ± 10.59 cm for WC and 1.52 ± 0.07 cm for WHtR for the girls with BID. The mean value was 151 ± 0.06 cm for height, 46.63 ± 8.42 kg for weight, 0.29 ± 1.07 for the BMI z-scores, 67.89 ± 7.25 cm for WC and 1.51 ± 0.06 kg for WHtR for the girls with BIS. Thus, most respondents in both groups had normal average BMI, WC and WHtR. In the BID group, 14.8% were overweight, and 3.1% were obese based on BMI; 12.3% were overweight, 28.3% were obese based on WC, and 28.9% did not have normal weight based on WHtR. In the BIS group, only 5.4% were overweight, and none were obese based on BMI; 16.2% were overweight, 8.1% were obese based on WC, and 9.5% did not have normal weight based on WHtR. The results showed significant differences between the two groups for all anthropometric variables except height ($p = 0.190$). Thus, girls with BID were more likely to gain weight, whereas those with BIS were more likely to have normal weight.

Distribution of Respondents Based on Dietary Intake

Table 2 shows the percentage contribution of each nutrient intake to the girls' energy assessed by the SFFQ at least once a week. In this study, the top ten most frequently consumed and least frequently consumed food items were selected. Most of the girls who had BIS consumed fried chicken and Kabsa rice (100.0%), both of which are high in energy and fat content, followed by potato chips (97.3%), ice cream milk and sugar (94.6%), with mean scores of 69.14 ± 51.49, 764 ± 342.73, 222.27 ± 100.33 and 209.89 ± 103.99 calories, respectively. The least frequently consumed food items were canned unsweetened (1.4%), liver sandwich (2.7%) and low-fat cow's milk, with mean scores of 1.42 ± 10.67, 2.9 ± 6.96 and 28.6 ± 105.71 calories, respectively. Most of the participants with BID consumed fried chicken and rice Kabsa (100%), sugar (95.1) and aerated cola drinks (93.8), with mean scores of 65.21 ± 47.4, 758.39 ± 305.88, 200.19 ± 101.98 and 118 ± 59.14 calories, respectively. The least consumed foods were fresh tomatoes (11.4%), cream desserts (11.5%), low-fat cow's milk (9.2%), coconut (8.9%) and liver sandwiches (0.9%), with mean scores of 32.49 ± 47.94, 27.63 ± 42.29, 243.39 ± 595.14, 81.63 ± 65.13 and 7.75 ± 13.69 calories, respectively.

Table 2
Top 10 contributors and less according to per cent contribution to total energy intake (at least once a week), frequency of consumption for the seven food groups, and the adequate, inadequate and excess intake of macronutrients per day among girls BIS and those who had BID

Body image satisfaction (BIS), (N=74)			Body image dissatisfaction (BID), (N=325)			*p*-value
	Mean (SD) of calorie	N (%)		Mean (SD) of calorie	N (%)	
Top 10 most frequently consumed food (at least once a week)			**Top 10 most frequently consumed food (at least once a week)**			
Fried chicken	69.14±51.49	74(100)	Fried chicken	65.21±47.4	325(100)	
Rice kabsa	764±342.73	74(100)	Rice kabsa	758.39±305.88	325(100)	
Potato chips	222.27±100.33	72(97.3)	Sugar	200.19±101.98	309(95.1)	
Ice cream milk	469.57±184.33	70(94.6)	Aerated cola drink	118±59.14	305(93.8)	
Sugar	209.89±103.99	70(94.6)	Ice cream milk	448.01±200.43	300(92.3)	
Bread	105.05±54.99	69(93.2)	Potato chips	241.25±233.99	300(92.3)	
Aerated cola drink	115.08±63.55	68(91.9)	Bread	129.72±142.06	298(91.7)	
Poached chicken	66.87±86.11	64(86.5)	Biscuits	20.47±25.73	279(85.8)	
Biscuits	224.76±323.12	63(85.1)	Poached chicken	54.52±58	270(83.1)	
Cappuccino	1.29±0.86	63(85.1)	Cake	5.94±7.74	264(81.2)	
Top 10 less frequently consumed food (at least once a week)			**Top 10 less frequently consumed food (at least once a week)**			
Kofta kebab meat	6.67±15.88	9(12.2)	Fresh tomatoes	32.49±47.94	37(11.4)	
Cream desserts	10.59±9.42	9(12.2)	Cream desserts	27.63±42.29	34(10.5)	
Coconut	9.01±25.18	8(10.8)	Low-fat cow's milk	243.39±595.14	30(9.2)	
Sandwich mixed	6.21±18.37	6(8.1)	Sandwiches meat	0.3±0.38	29(8.9)	
Konafa cream	77.37±345.3	6(8.1)	Coconut	81.63±65.13	29(8.9)	
Sandwiches meat	2.98±8.81	4(5.4)	Samosas meat	241.25±233.99	23(7.1)	
Samosas meat	11.28±36.77	3(4.1)	Sandwich mixed	4.15±4.03	16(4.9)	
Low-fat cow's milk	28.6±105.71	3(4.1)	Konafa cream	190.11±262.43	16(4.9)	
Liver sandwiches	2.9±6.96	2(2.7)	Canned unsweetened	65.21±47.4	6(1.8)	

Table 2 *(continue)*

Body image satisfaction (BIS), (N=74)			Body image dissatisfaction (BID), (N=325)			*p*-value
	Mean (SD) of calorie	N (%)		Mean (SD) of calorie	N (%)	
Canned unsweetened	1.42±10.67	1(1.4)	Liver sandwiches	7.75±13.69	3(0.9)	
Frequently consumed food groups						
Cereal and grain	0.63±0.23			0.64±0.23		0.507
Dairy products	0.54±0.18			0.54±0.17		0.275
Fish, poultry, and meat products	0.4±0.15			0.4±0.15		0.949
Sweeten beverage	0.54±0.14			0.56±0.15		0.696
Fruit and vegetables	0.5±0.15			0.5±0.13		0.873
Sweet baked goods	0.45±0.14			0.44±0.14		0.504
Mixed dishes	0.40±0.14			0.40±0.15		0.892
Intake of macronutrients per day						
Carbohydrate						0.851
Inadequate < 45 %		17(23)			78(24)	
Adequate (45-65) %		57(77)			247(76)	
Excess > 65 %		0(0)			0(0)	
Fat						0.798
Inadequate < 25 %		0(0)			0(0)	
Adequate (25-35) %		7(9.5)			34(10.5)	
Excess > 35 %		67(90.5)			291(89.5)	
Protein						0.086
Inadequate < 10 %		0(0)			0(0)	
Adequate (10-30) %		71(95.9)			291(89.5)	
Excess > 30 %		3(4.1)			34(10.5)	

As shown in Table 2, cereals and grains, dairy products and sweet beverages were the most frequently consumed food groups by all BIS and BID respondents. By contrast, fish, poultry, meat products, and sweet baked goods were less frequently consumed in both groups.

The average daily dietary intakes of the respondents of both groups were 777.3 ± 238.4 g of carbohydrates, 292.6 ± 132.8 g of fat and 275.7 ± 172.8 g of protein. Among the girls with BIS and BID, the majority had an adequate intake of carbohydrates (77% and 76%) and protein (95.9% and 89.5%), respectively. As shown in Table 2, 23% and 24% of the girls with BIS and BID consumed insufficient amounts of carbohydrates, and 90.5% and 89.5% consumed excessive amounts of fat due to a high intake of unhealthy food, respectively. The intake of carbohydrates, fat and protein of the two groups did not show a significant difference ($p > 0.05$).

Body Image Dissatisfaction (BID) Among the Respondents

According to the Stunkard Figure Rating Scale (FRS), Table 3 shows that more than 81.5% of the participants were dissatisfied with their BI, whereas only 18.5% expressed satisfaction with their BI. Among the participants, 51.4% desired a smaller body size, and 30.1% preferred a larger body type.

Table 3
BI discrepancy score (BIDS) and girl distribution based on image discrepancy score categories among participants

Variable	Body image satisfaction (BIS), (N=74)		Body image dissatisfaction (BID), (N=325)	
	N	%	N	%
Total numbers and percentage	74	18.5	325	81.5
Perceptions of participants				
Underweight	1	1.4	19	5.8
Normal	69	93.2	248	76.3
Overweight	4	5.4	48	14.8
Obese	0	0	10	3.1
BIDS status				
Desired to reduce			205	51.4
Desire to increase			120	30.1

Table 4 presents the significant relationship between the perceived BMI and the actual BMI ($X^2 = 215.636$, $p < 0.001$). The participants who identified their BMI as normal had a normal BMI (39.3%), but those who perceived their BMI as underweight (38.3%) had a normal BMI. Moreover, 7% of overweight girls considered themselves normal, and 5% considered themselves overweight. Only two obese girls correctly identified themselves as obese.

Table 4
Actual BMI and perceived BMI among participants

Actual BMI	Perception BMI				$\chi 2$	*P*-value
	Thinness N (%)	Normal N (%)	Overweight N (%)	Obese N (%)		
Thinness	19(4.8)	1(0.3)	0(0)	0(0)	215.636	<0.001
Normal	153(38.3)	157(39.3)	7(1.8)	0(0)		
Overweight	1(0.3)	28(7)	22(5.5)	1(0.3)		
Obese	0(0)	2(0.5)	6(1.5)	2(0.5)		

Association Between Body Weight Indicator, Sociodemographic, Dietary Intake and Body Image Perception

Table 5 presents the strong association among BMI, WC, WHtR, sociodemographic data, dietary intake, and BI explored using simple and multiple regression analyses. A simple regression was conducted, and all significant ($p < 0.05$) factors were selected and used in the multiple regression analysis. The results of the multiple regression analysis using a backward stepwise approach showed a significant and positive association between BMI and the participants' age ($\beta = 1.252$, $p < 0.001$) and current body size ($\beta = 2.826$, $p < 0.001$) and a negative association between dairy products ($\beta = -0.080$, $p = 0.004$) and desired body size ($\beta = -0.734$, $p < 0.001$). The results indicated that the respondents with a perception of their (current and desired) body size as different from their actual body size tended to have a higher BMI. In terms of BMI, these four variables were observed to affect the final model ($p < 0.05$) and significantly predicted the body weight indicator of the study subjects [$F(4,394) = 151.737$, $p = 0.00$]. A moderate relationship was observed between the four predictor variables ($R^2 = 0.602$). In the final model, 62% of the body weight indicators (BMI) could be explained by this model. The body weight indicator is the equation of the backward stepwise multiple regression model: BMI = 1.716 + [1.252 age] + [− 0.080 dairy products] + [2.826 current body size] **-** [0.734 desired body size].

The WC results of the stepwise regression model showed a significant and positive association with age ($B = 2.324$, $p = 0.001$) and current body size ($B = 5.369$, $p = 0.001$), as well as a significant and negative relationship with dairy products ($B = -0.189$, $p = 0.001$), cereal and grain ($B = -0.171$, $p = 0.001$) and ideal body size ($B = -1.537$, $p < 0.001$). The current and ideal body sizes perceived differently from the actual BI were associated with a higher BMI among the girls. In terms of WC, these five variables predicted the body weight indicators [$F(5,393) = 96.741$, $p < 0.001$]. A moderate relationship was found among these predictor variables ($R^2 = 0.546$). A 54.6 % change in body weight indicators for WC could be explained as 29.120 + [2.342 age] + [-0.171 cereal and grain] + [-0.189 dairy products] + [5.369 current body size] + [-1.537 ideal body size].

Table 5
Relationship between sociodemographic characteristics, dietary intake, and BI with BMI, WC, and WHtR explored using multiple regression analyses

Variable(s)	BMI			WC			WHtR		
	Adjusted (Multiple regression)			Adjusted (Multiple regression)			Adjusted (Multiple regression)		
	B (β) (95% CI)	*p*-Value	VIF	B (β) (95% CI)	*p*-Value	VIF	B(β) (95% CI)	*p*-Value	VIF
Sociodemographic characteristics									
Age (years)	1.252(0.583 -1.921)	<0.001	1.059	2.342(0.889 - 3.749)	0.001	1.059			
Number of siblings									
Number of household members									
Mother's education									
Father's education									
Family's monthly income									
Dietary intake									
Cereal and grain				-0.171(-0.307-- 0.036)	0.001	1.039	-0.125(-0.212-- 0.038)	0.005	1.014
Dairy products	-0.08(-0.135 -- 0.026)	0.004	1.028	-0.189(-0.305 -- 0.073)	0.001	1.039	-0.134(-0.208 -- 0.06)	<0.001	1.025
Fish, poultry, and meat products									
Sweeten beverage									
Fruit and vegetables									
Sweet baked goods									
Mixed dishes									
Body image discrepancy									
Current body size (BI)	2.826(2.584 -3.068)	<0.001	1.121	5.369(4.853 - 5.886)	<0.001	1.123	3.21(2.885 - 3.534)	<0.001	1.071
Desired body size (BI)	-0.734(-1.045 -- 0.423)	<0.001	1.064				-0.931(-1.359 -- 0.504)	<0.001	1.065
Ideal body size (BI)				-1.537(-2.200 -- 0.874)	<0.001	1.064			
F value	151.737			96.741			95.944		
p-value	0			0			0		
Adj R^2	0.602			0.546			0.488		

Abbreviations: BI —body image; BMI—body mass index; WC — waist circumference; WHtR—waist to height ratio; β —regression coefficient; CI—confidence interval; VIF—variance inflation factor

The WHtR results showed a significant and negative association with cereal and grain ($\beta = -0.125$, $p = 0.005$), dairy products ($\beta = -0.134$, $p < 0.001$) and desired body size ($\beta = -0.931$, $p < 0.001$), and a positive and significant association with current body size ($\beta = 3.21$, $p < 0.001$). The multiple regression analysis used all significant factors ($p < 0.05$) selected in the simple regression. These factors were WHtR-based variables ($F(4,394) = 95.944$, $p \leq 0.001$), and a moderately significant relationship was observed ($R^2 = 0.488$). A 48.8% change in body weight indicators for WHtR could be explained as 40.880 + [−0.125 cereal and grain] + [−0.134 dairy products] + [3.21 current body size] + [−0.931 desired body size].

In summary, the body weight indicator was positively associated with age and current body size and negatively associated with cereal, grain, dairy products, desired body size, and ideal body size. The results of the multiple linear regression models revealed that fish, poultry and meat products, sweetened beverages, fruit and vegetables, sweet baked goods and mixed dishes did not significantly predict body weight indicators ($p > 0.05$).

DISCUSSION

According to a previous study, sociodemographic characteristics such as age, sex and socioeconomic status are associated with overweight or obesity (Bel-Serrat et al., 2018). Conversely, the present study showed a significant association between anthropometric measurements (BMI and WC) and age only, and it did not find a significant relationship with the other sociodemographic characteristics analysed ($p > 0.05$). It is possible that the homogeneity of the sample influenced our results. Moreover, all the participants were Saudi girls aged 13 and 14, and all other nationalities were excluded. We found a significant positive association between body weight indicators with age and current body size and a negative association with cereal and grain, dairy products, and desired and ideal body size at ($p < 0.05$). The participants' BMI was [$F(4,394) = 151.737$, $p = 0.00$], the WC was [$F(5,393) = 96.741$, $p < 0.001$], and the WHtR was ($F(4,394) = 95.944$, $p \leq 0.001$). A significant moderate relationship was found among the following predictor variables: ($R^2 = 0.602$ (BMI), 0.546 (WC), and 0.488 (WHtR)).

Adolescence marks a period of rapid growth; thus, the results were unsurprising. Al-Kutbe et al. (2017) reported that excessive energy intake predicted body weight as positive ($p = 0.001$) among Saudi children based on BMI and WC, consistent with our results. A significant difference was found in the mean daily energy intake, with higher consumption among obese participants than those with normal body weight (2677 ± 804 vs 1806 ± 403 kcal/d at $p < 0.001$). Conversely, 30% were found to be overweight or obese, with a mean WC of 72.1 ± 5.3 and 79.8 ± 7.9 and BMI of 90 ± 3.6 and 97.9 ± 0.9, respectively. Thus, higher consumption of unhealthy foods was significantly inversely correlated with a lower risk of abdominal obesity. Our findings are consistent with those of Gosadi et al. (2017),

who found a statistically significant association between BMI and consumption of meat and dairy products ($p = 0.03$) among Saudi adolescents. Moreover, a study among Qatari female adolescents indicated that the frequency/week of an unhealthy diet, i.e., fast food, fries, sweets and cake intake, were significantly associated with high WHtR/ WC ($p < 0.05$) (Kerkadi et al., 2019).

The association between body weight indicators and (current, desired and ideal) BI was significant. The (current, desired and ideal) body size of the participants contributed to and predicted the body weight indicators of BMI, WC and WHtR, whether positively or negatively. According to previous studies, 60.1% of students had BID. BID was significantly associated with BMI ($p < 0.001$), and it was 4.06 times greater among overweight/obese participants ($p < 0.001$) than among those with normal BMI (Latiff et al., 2018). However, in accordance with our findings, Albawardi et al. (2021) reported that 87% of Saudi university students were unhappy with their physical shape and that 68% had normal body weight. Gaddad et al. (2018) revealed that most subjects (90.05%) had no concerns about BI, 75% had a normal BMI, only one was overweight, and none were obese. Our results are not consistent with a study that showed the prevalence of overweight (28.2%), obesity (19.5%) and BID (13.2%) among children from Chile. A significant association was found between BID and the anthropometric parameters of obesity/overweight ($p < 0.001$) and WHtR ($p < 0.001$) (Delgado-Floody et al., 2018). The different work environments could have contributed to the different results.

Our results revealed that most of the adolescents had poor nutritional habits. Fried chicken and rice Kabsa (100.0%) were consumed the most. Many adolescents with BIS and BID also consumed potato chips (97.3% and 92.3%), sugar (94.6% and 95.1%) and cola drinks (91.9% and 93.8%), respectively, which are known to be high in fat and energy content. Around 90.5% of girls with BIS and 89.5% of those with BID consumed excessive fat daily. Our results support the Moradi-Lakeh et al. (2017) study of Saudi adolescents and adults, which showed that only a small proportion met the dietary recommendations. Only 5.2%, 7.5% and 44.7% of the participants consumed fruits, vegetables and fish, respectively, and most young adults consumed large amounts of sweetened beverages (115.5 ± 2.6 ml/ day). Although the survey included only 42 items in the diet history questionnaires, this shows a larger picture of adolescents' dietary habits. In line with other studies, Saudi females consumed chicken Kabsa (77.5%) the most, followed by rice and chicken burgers (60%). At the same time, fruit syrup (12%) and cabbage (11.5%) were consumed less frequently (Gosadi et al., 2017). Consistent with our results, Song and Shim (2019), who analysed data from 2007 to 2017, found that 11-year-old Korean children increased their fat intake from 21.7% kcal (54.3 g) to 25.2% kcal (61.8 g). The percentage of children with fat intake above the recommended values increased from 3.7% to 27.5%. In accordance with our results, Al Bahhawi et al. (2018) found that 90%, 81%, 71% and 75% of Saudi girls

consumed sugary desserts, fast food, canned food and caffeine, respectively, and that 97%, 86% and 90% consumed meat, fish and fruits, respectively. Thus, previous studies revealed that people still have unhealthy eating habits and that Saudi girls are no exception. For instance, our participants with BIS and BID consumed more sweetened beverages than fruits and vegetables, possibly due to a lack of nutrition knowledge.

The current findings reported that 81.5% of the participants were dissatisfied with their BI and that 51.4% desired to reduce their body size. Among the participants with an actual normal BMI, only 39.3% believed they had a normal BMI, while the rest were mistaken. Most overweight or obese students consider themselves to have a lower BMI than their actual BMI. These results are close to those of Farias et al. (2018), who found that most Brazilian participants were unsatisfied with their BI and that 71% were female. As the participants were adults, their BID continued into adulthood. Similarly, Hijji et al. (2021) reported that underweight Saudi girls (44.8% and 39.4%) and boys (49.4% and 45.2%) 10–14 and 15–19 years of age were satisfied with their BI, respectively. This work is consistent with a study conducted among Turkish adolescents with a normal BMI, which reported that only 22.8% were satisfied with their BI (Düzçeker et al., 2021).

The present study shows a significant association between the perceived BMI and actual BMI ($p < 0.001$). Around half of our adolescents did not misinterpret their BMI status. Radwan et al. (2019) showed that 80.9% of Emirati university students had BID and that 57.5% wanted to lose weight. The perceived BMI significantly influenced the actual BMI ($X^2 = 546$, $p < 0.001$). Most participants considered their BMI normal indeed had a normal BMI, and 19.8% of the overweight participants reported a normal BMI. Cid et al. (2018) reported that among Spanish participants with a mean age of 12.46 ± 2.14, 47 had a mean BMI of 20.18 ± 3.58, and 41.14% were overweight or obese. Among the overweight participants, the majority (69.23%) misperceived their weight, mainly believing they had normal weight (62.82%). Among the obese, the majority (88.63%) misperceived their weight, and (84.09%) considered themselves slightly overweight or normal. A significant correlation was found between BMI and BID/restricted eating ($p < 0.0001$).

The present study aimed to assess the sociodemographic characteristics, dietary intake and BID and predict their association with anthropometric measurements among Saudi adolescent girls aged 13–14. The findings showed that most study population consumed fat in excessive amounts and that the prevalence of BID was high among them. Moreover, age, dairy products, cereal and grain, and (current, desired and ideal) body size predicted the body weight of the girls based on regression analyses. A previous study found that BID with a desire to reduce weight among adolescents was associated with being female ($p = 0.007$) and that a desire to gain weight was associated with eating between meals ($p = 0.01$) and frequent fast food consumption ($p = 0.038$) (Ayed et al., 2019). Ribeiro-Silva et al. (2018) reported that among overweight and obese Brazilian adolescents, a pattern

of a Western diet of fast food, sweets and sugars, soft drinks, milk and dairy products was negatively associated with a slight BID (OR: 0.240, 95% CI: 0.100–0.576). However, no association between normal weight or underweight between the BID and any dietary pattern was found. Note that most of the participants were of normal weight (77.3%) and were satisfied with their BI (80.5%) (Ribeiro-Silva et al., 2018). Cereal and grain, and dairy products were the most frequently consumed food groups by our participants with BIS and BID. Conversely, they consumed insufficient fish, poultry and meat products. However, no significant differences were found between the two participant groups in terms of food groups. This study's multiple linear regression models showed that the self-assessment of fish, poultry and meat products, sweetened beverages, fruit and vegetables, sweet baked goods and mixed dishes did not significantly predict anthropometric measurements (BMI, WC and WC WHtR; $p > 0.05$). Previous studies used different methods to assess dietary intake and reported a correlation with BMI. For example, Al-Kutbe et al. (2017) and Gosadi et al. (2017) found that dietary intake predicted obesity using a 24-h record for four days and the SFFQ including 120 food items, respectively. The Drawing Scale (Latif et al., 2018) and the Stunkard Scale (Kops et al., 2019) were also used, and a significant association between BMI and BID was found to determine BID.

To our knowledge, this study is the first to focus on measuring the relationships among the sociodemographic characteristics, dietary intake, BID, and anthropometric measurements (BMI, WC and WHtR) of young Saudi adolescent girls in Arar. The results are important for those interested in future nutrition education and obesity prevention programmes, as the results can provide them with methodological support. This study is a source of information on anthropometric status, nutrition and BID status among children and adolescents. The use of validated questionnaires is another advantage of this study.

This study has several limitations. First, it was conducted in only one Saudi Arabian city (Arar). Time constraints restricted the expansion to other cities. Second, boys were not included in this study because of the nature of Saudi society, which separates the genders in schools. We recommend that males be included in future research of similar populations to study nutritional intake and male image dissatisfaction with female outcomes. Third, biological maturation variables were not evaluated. Future research should include this variable in similar population groups. Finally, the FFQ was used to determine the nutritional intake of female students. The FFQ may not give many details because it depends on the girls' memories, which could lead to errors. Including a 24-h dietary recall to assess the participants' dietary intake and food habits would be more accurate.

CONCLUSION

The percentage of Saudi girls aged 13–14 with normal weight was higher in BIS than in BID in terms of BMI, WC and WHtR. Fried chicken, Kabsa rice and sugar were the most

frequently consumed foods of most respondents, and fish, poultry and meat products were the least frequently consumed. Adolescent girls consume an excess intake of fat per day. The prevalence of BID was high, and half of the girls desired to reduce their body weight. The percentage of BID adolescents found to be overweight/obese based on WHtR was higher than that of BIS girls; this is not considered healthy. Only age, cereal and grain, dairy products and (current, desired and ideal) body size were significantly associated with body weight indicators. Therefore, school-based intervention programmes for Saudi girls are required to address unhealthy behaviours, such as eating unhealthy food and having a negative BI. Increasing knowledge, attitudes and practices through nutritional education and creating awareness about nutrition and positive BI can positively change eating behaviour and encourage BI satisfaction.

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