



Assessment of Nutritional Status and its Related Factors among Female Adolescent Girls: A School based Study in Arar city, Kingdom of Saudi Arabia

Waseem Fatima*, Nasser Alqhatani and Leena mohammad Ahmad

Department of Clinical Nutrition, Northern Border University, Arar, Saudi Arabia

*Corresponding e-mail: fatimawaseem1512@gmail.com

ABSTRACT

Objective: The objective of the present study was to assess the nutritional status of adolescent girls and to investigate its association with socio-economic status, eating and physical activity pattern. **Methods:** A cross-sectional survey was conducted among adolescent girls (15 and 19 years) and stratified random sampling technique was done in 4 schools of Arar city, KSA. Subjects were asked to fill pre-tested questionnaire about socio-economic status, dietary and physical activity pattern and their height and weight were measured and BMI (kg/m^2) was calculated. SPSS version 22 (2017) was used in entering, managing survey data and to analyze the obtained data. A p -value < 0.05 was considered statistically significant for individual variables. **Results:** The final study sample consisted of 322 adolescent girls (response rate of 90.96%), with a mean age of 17.14 ± 1.15 years. More than one-fifth of the study population was overweight and obese, moreover, about three-fifth of the study population were of normal weight, while 19.2% were underweight. A significant relationship was observed between nutritional status with the mother's occupation and education, family size, and a number of meals taken per day. **Conclusion:** Adolescent's populations face two contrasting nutrition situations, under and over nutrition. This study will help in generating imperative data and recommendations for managing nutrition-related problems in adolescent girls in Saudi Arabia.

Keywords: Nutritional status, Basal metabolic index (BMI), Adolescent girls, Socio-economic status, Physical activity pattern, Dietary pattern

INTRODUCTION

Adolescent constitutes about one-fifth of the world's population. The World Health Organization (WHO) has defined adolescence as the age group of 10-19 years [1]. The population of Kingdom of Saudi Arabia (KSA) exceeds 27 million, and 20% of its population are adolescents and 55.51% of Saudi Arabia's female population is younger than 20 years of age [2,3].

Adolescence is considered as a nutritionally vulnerable stage and distinguished from other stages of the life cycle with features of rapid growth and development [4]. This period has also been identified as a period of potential interest in correcting nutritional imbalance and insufficient growth from childhood. During this stage, 25% of adult height and up to 50% of adult weight is attained. The combined stresses of puberty and social expectation place great nutritional demands. Although eating habit and attitudes towards the health that are cemented during adolescence also affect their future nutritional health status [5].

Several studies throughout the world indicated a high prevalence of malnutrition in this stage, either as a form of overweight or underweight [6-10]. It is now well documented that being overweight and obese during childhood and adolescence is a risk factor in long-term health problems such as diabetes, cardiovascular disease and premature death whereas, inadequate diet during adolescent years can result in many nutrition related disorders, delayed sexual maturation and can arrest or slow linear growth [5,11]. However, recent studies have shown that these nutritional problems in adolescence are attributed to their lifestyle and eating habits [8,12].

The rapid development in the economy that took place in Arab countries specially Saudi Arabia during the preceding

decades, resulted in the adoption of a sedentary lifestyle and faulty foods habits that significantly affect the nutritional status of adolescents [13]. Therefore, it is very crucial to understand the potential factors which are associated with their nutritional status. But, there is a limited number of studies on nutrition status and associated factors that have been conducted on an adolescent population of the Kingdom of Saudi Arabia. Hence, keeping in view the seriousness of problem on one hand and lack of knowledge on the other, the present cross-sectional study aimed at assessing the nutritional status of adolescent girls and identifying the factors such as socio-economic status, dietary habits and physical activity pattern associated with nutritional status.

PATIENTS AND METHODS

A cross-sectional survey design was used to conduct the present study. Arar city, Kingdom Saudi Arabia was selected for the purpose of the study which is located to the north-east of Saudi Arabia on the Iraqi border. Adolescents school girls (15-19 years) were selected from 4 schools by stratified random sampling method by dividing the city into specific zones, to ensure that the study was representative of the whole city. After identifying schools from each zone, school authorities were approached personally with the recommendation letter from the deanship of research, Northern Border University, Arar. The purpose and nature of the study were explained to them. Based on the consent and active cooperation of the school authorities one school from each region was selected. Time table of all the classes, section-wise, were obtained from the authority for easy approachability and to avoid any academic interruption.

Before the actual study, initial versions of the questionnaire and all the techniques for anthropometric measurement were piloted on a set of 30 adolescent girls in international school to test the efficiency of the questionnaire. Consequently, the content of the questionnaire was modified and minor changes were made in the method of gathering information about various variables of the study. Students who have chronic diseases and obesity other than exogenous dietetic and pregnant females were excluded from the study.

At the time of data collection, researchers introduced themselves and briefly explained the study objectives to participants. Then, the participants were asked to proceed to fill in the questionnaires under the supervision of the researchers.

Tools of Data Collection

Two types of data collection tools were used in the present study:

1. Questionnaire
2. Anthropometric measurements (height and weight)

Questionnaire: Questionnaire was divided into 3 sections and translated in Arabic language and two Arabic professors double checked it.

- Section A: Contains socio-demographic characteristics such as education level, nationality, their family size, parent's educational and employment status, nationality, birth order, and health status were collected
- Section B: Eating pattern and food frequency questionnaire were designed which contained 12 items
- Section C: Physical activity pattern questionnaire containing 10 items

Anthropometric measurements: The weight of student was recorded with the help of platform spring balance, 0 error was checked and removed if present every day before starting the data collection. The students remain in school uniform without heavy woolen clothes and shoes. The weight was measured up to the accuracy of 500 gram and the nearest reading was recorded. The same weighing machine was used in the whole study.

Height was measured by using standard stadiometer. The student was asked to stand erect without shoes with the support to the wall with erect head, eyes straight and head, buttocks, heels, shoulder, and back touching the stadiometer scale. The height was recorded up to nearest of 1 cm when the metallic scale was brought down on the head, pressing the hair and touching the head. BMI was calculated as $\text{weight}/\text{height}^2$, with weight being in kilograms and height being in meters.

The nutritional status was determined by comparing BMI values with the BMI index for age and sex percentiles set by the US Centers for Disease Control and Prevention in 2000 [14], in which $\text{BMI} \geq 95^{\text{th}}$ percentile was considered as

obese, BMI between 85th and 95th percentile was regarded as overweight and BMI value between 5th and 85th percentile was considered as normal weight and BMI ≤ 5th percentile were categorized as underweight.

Data Analysis

The data were analyzed using the SPSS windows software version 22 (2017). Analysis of variance (ANOVA), was used to compare different parameters which were studied. Chi-square test was used to determine the independence of attributes within and between the groups. We used multinomial logistic regression to investigate the factors associated with overweight and obesity. The p-value of less than 0.05 was considered statistically significant.

RESULTS

For the purpose of this study, subjects with incomplete questionnaire were excluded (out of 354 subjects, 32 were excluded). Accordingly, the final study sample consisted of 322 adolescent girls (response rate of 90.96%), with a mean age of 17.14 ± 1.15 years.

Findings of the present study showed that the prevalence of underweight in the total study population was 19.2%. The prevalence of overweight and obesity was 13.97% and 7.76%, respectively whereas 59% of the study population was a normal weight (Table 1). The highest prevalence of overweight and obesity was in the age of 17 years however underweight was seen in the age of 16 years, however, a non-significant difference was observed in the percentage of the adolescent girls who were obese in all age group of the study population ($\chi^2=12.19, p=0.43$)

Table 1 Distribution of BMI categories of adolescent girls by age

Indicator	Cut off value	15 Years		16 Years		17 Years		18 Years		19 Years		Total	
		n	%	n	%	n	%	n	%	n	%	n	%
Under weight	<5 th percentile	3	0.93%	19	5.90%	16	4.96%	16	4.96%	8	2.48%	62	19.20%
Normal weight	5 th to 85 th percentile	10	3.10%	57	17.70%	48	14.90%	48	14.90%	27	8.38%	190	59.00%
Over weight	85 th to 95 th percentile	16	4.96%	11	3.41%	15	4.65%	7	2.17%	11	3.41%	45	13.97%
Obesity	>95 th percentile	1	0.31%	6	1.86%	7	2.17%	5	1.55%	3	0.93%	25	7.76%

Nutritional Status and Socio-economic Factors

The mean and standard deviation (SD) of BMI of participants and proportion of nutritional status according to socio-economic data of participants such as parent’s education level, parents’ occupation, nationality, family size, and birth order is given in Table 2.

Table 2 Socio-economic status of the study population and its association with nutritional status

Socio Economic Status	BMI (Kg/m ²) Mean (SD)	Indicators										p-value	
		Underweight		Normal weight		Overweight		Obese		Total			
		n	%	n	%	n	%	n	%	N	%		
Mother education													
Illiterate	21.80 (4.91)	16	4.96%	36	11.18%	11	3.41%	6	1.86%	69	21.41%	0.19	
Primary	21.91 (5.48)	20	6.21%	51	15.83%	11	3.41%	11	3.41%	93	28.88%		
Secondary	20.24 (4.49)	15	4.65%	63	19.56%	9	2.79%	4	1.24%	81	25.15%		
Graduate	21.98 (4.17)	11	3.41%	38	11.80%	10	3.10%	2	0.62%	61	18.94%		
Post graduate	27.77 (7.21)	0	0.00%	2	0.62%	2	0.62%	2	0.62%	6	1.86%		
Professional	22.64 (2.45)	0	0.00%	4	1.24%	2	0.62%	0	0.00%	6	1.86%		
p-value	0.06												
Mother occupation													
House wife	21.56 (4.75)	57	17.17%	170	52.79%	38	11.80%	18	5.59%	283	87.88%	0.01*	
Self employed	19.67 (3.01)	3	0.93%	4	1.24%	1	0.32%	0	0.00%	8	2.48%		
Public/civil servant	24.98 (5.32)	2	0.62%	16	4.96%	6	1.86%	7	2.17%	31	9.62%		
p-value	0.00*												

Father education												
Illiterate	22.89 (6.22)	7	2.17%	11	3.41%	5	1.55%	5	1.55%	28	8.69%	0.29
Primary	22.29 (4.52)	12	3.72%	38	11.8%	15	0.00%	3	0.93%	68	21.11%	
Secondary	21.71 (4.86)	23	7.14%	88	27.32%	14	4.34%	12	3.72%	137	42.54%	
Graduate	20.97 (4.24)	14	4.34%	35	10.86%	6	1.86%	2	0.62%	57	17.7%	
Post graduate	22.15 (6.69)	4	1.24%	9	2.79%	2	0.62%	2	0.62%	17	5.27%	
Professional	22.20 (3.90)	2	0.62%	8	2.48%	3	0.93%	1	0.32%	14	4.34%	
p-value	0.58											
Father occupation												
Unemployed	21.49 (4.75)	28	8.69%	66	20.49%	20	6.21%	7	0.19%	121	37.57%	0.122
Self Employed	21.74 (4.14)	9	2.79%	29	9.00%	9	2.79%	1	0.32%	48	14.9%	
Public or civil servant	21.20 (5.20)	24	7.45%	94	29.19%	16	4.96%	17	5.27%	151	46.69%	
p-value	0.48											
Nationality												
Saudi	21.85 (4.93)	61	18.94%	177	54.96%	43	13.35%	24	7.45%	305	94.72%	0.43
Non-Saudi	21.64 (3.91)	1	0.32%	13	4.03%	2	0.62%	1	0.32%	17	5.27%	
p-value	0.86											
Family size												
<3	27.30 (4.55)	0	0.00%	2	0.62%	1	0.32%	2	0.62%	5	1.55%	0.07
4-6	22.43 (5.34)	13	4.03%	52	16.14%	16	4.96%	9	2.79%	90	27.97%	
>7	21.63 (4.7)	49	15.21%	136	42.23%	28	8.69%	14	4.34%	227	70.47%	
p-value	0.01*											
Birth order												
1 st	21.05 (3.81)	13	0.42%	29	9.00%	6	1.86%	1	0.32%	49	15.21%	0.23
2 nd	22.40 (5.96)	2	0.62%	17	5.27%	1	0.32%	22	6.83%	22	6.83%	
>3	21.95 (4.96)	47	14.59%	144	44.72%	38	11.8%	22	6.83%	251	77.95%	
p-value	0.43											

*p<0.05 considered statistically significant

Over half of the study population’s mothers were either illiterate and had studied up to primary school (21.41% and 28.88% respectively). University level education was observed in 22.67% of the mothers and the corresponding values for father’s education levels were 27.32%. Majority of mothers in the study population were house wives (87.88%), only 2.48% of mothers in the study population were self-employed, whereas 14.90% of fathers were self-employed. Families of most adolescent girls had more than 7 family members (70.47%), whereas 22.04% of the adolescents were first or second in birth order.

However, the proportions of nutrition status according to the parent’s education levels, father occupation, nationality, and birth order did not differ significantly. Similarly, there was no significant difference in BMI values. The significant difference was only observed in nutritional status by mothers occupation (p<0.01) and family size (p<0.05) (Table 2). Study outcomes exposed that BMI value was high in children of working women (p<0.01).

Study results also revealed that BMI value was high in adolescents who live in small families than those who live in large families (>7) and there was a significant association between BMI and household size.

The highest percentage of obesity in Saudi adolescent girls was observed (7.45%), compared to non-Saudi girls (0.32%) but the difference was not statistically significant in the mentioned groups.

Nutritional Status and Dietary Factors

The analysis of the relation between students’ BMI and their dietary habits is given in Table 3. Majority of the study population reported that they were non-vegetarian (93.16%). Furthermore, most of the students had 2-3 meals in a day (44.73%) however 13.04% study population who consume more than 4 meals a day were overweight and obese. Mean of BMI value were also high among those who eat 4-5 times in a day (23.05 ± 5.93) compared to students who consume 1 meal only in a day and 2-3 times in a day (21.09 ± 4.85 and 21.25 ± 4.13 respectively) and this difference

was highly significant ($p < 0.01$). Moreover, students reported the consumption of fast food, soft drinks, and lunch in the form of snacking usually 2-3 times in a week (43.78%, 48.13%, and 42.85% respectively).

Table 3 Dietary pattern of the study population and its association with nutritional status

	BMI	Indicators										p-value
	(Kg/m ²)	Underweight		Normal weight		Overweight		Obese		Total		
	Mean (SD)	n	%	N	%	n	%	n	%	N	%	
Dietary habit												
Vegetarian	23.36 (6.28)	4	1.24%	11	3.41%	3	0.93%	4	1.24%	22	6.83%	0.3
Non vegetarian	21.73 (4.75)	58	18.12%	179	55.59%	42	13.04%	21	6.52%	300	93.16%	
p-value	0.13											
Number of meal per day												
Once	21.09 (4.85)	15	4.65%	31	9.62%	3	0.93%	4	1.24%	53	16.45%	0.00**
2-3	21.25 (4.13)	24	7.45%	99	30.74%	18	5.59%	3	0.93%	144	44.73%	
4-5	23.05 (5.93)	15	4.65%	34	10.55%	13	4.03%	14	4.34%	76	23.60%	
>6	22.52 (4.84)	8	2.48%	26	8.74%	11	3.41%	4	1.24%	49	15.21%	
p-value	0.00**											
Fast food intake/week												
Once	21.33 (4.71)	14	4.34%	37	1.49%	7	2.17%	4	1.24%	62	19.25%	0.41
2-3	21.68 (4.80)	25	7.79%	87	27.01%	21	6.52%	8	2.48%	141	43.78%	
4-5	22.35 (4.52)	9	2.79%	36	11.18%	12	3.72%	5	1.55%	62	19.25%	
>6	22.24 (5.63)	14	4.34%	30	9.31%	5	1.55%	8	2.48%	57	17.70%	
p-value	0.59											
Soft drink/week												
Once	21.14 (4.60)	13	4.03%	37	11.49%	11	3.41%	5	1.55%	66	22.49%	0.85
2-3	21.58 (4.69)	30	9.31%	95	29.50%	21	6.52%	9	2.79%	155	48.13%	
4-5	22.15 (5.61)	13	4.03%	30	9.31%	7	2.17%	7	2.17%	57	17.70%	
>6	21.92 (5.05)	6	1.86%	28	8.69%	6	1.86%	4	1.24%	44	13.60%	
p-value												
Lunch in the form of snacking/ week												
Once	21.64 (4.84)	14	4.34%	53	16.45%	7	2.17%	6	1.86%	80	24.84%	0.45
2-3	22.17 (5.28)	30	9.31%	71	22.04%	23	9.93%	14	4.34%	138	42.85%	
4-5	22.05 (4.67)	9	2.79%	35	10.86%	10	3.10%	3	0.93%	57	17.70%	
>6	20.98 (4.88)	9	2.79%	31	9.62%	5	1.55%	2	0.62%	47	14.59%	
p-value	0.5											
Generally Skipped meal												
Breakfast	22.19 (4.59)	15	4.65%	81	25.15%	18	5.59	8	2.48%	122	37.88%	0.11
Lunch	21.47 (4.75)	13	4.03%	44	13.66%	9	2.79	5	1.55%	71	22.04%	
Dinner	21.71 (4.88)	34	10.55%	65	20.18%	18	5.59	12	3.72%	129	40.06%	
p-value	0.56											

* $p < 0.05$: considered statistically significant; ** $p < 0.01$: considered highly statistically significant

Present study population state that they generally skipped meals such as dinner (40.06%) whereas 37.88% stated that they skip breakfast and 22.04% skipped lunch but the BMI value was found high among those who skip breakfast (22.19 ± 4.59) than those who skip lunch and dinner (21.47 ± 4.75 and 21.71 ± 4.88 respectively). Figure 1 summarized the frequency of consuming fruits and green leafy vegetables, revealed that normal weight adolescents consume more fruits and vegetables whereas underweight and obese did not consume green leafy vegetables 4-5 times in a week.

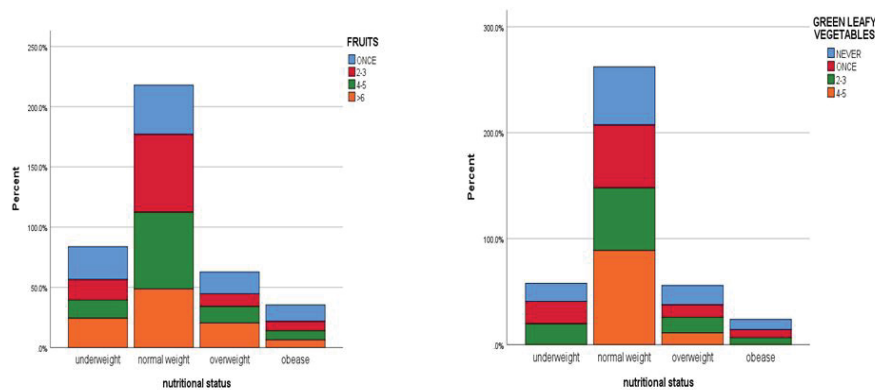


Figure 1 Frequency of consuming for fruits and green leafy vegetables according to different BMI categories in female adolescents

Nutritional Status and Physical Activities

Study participant’s responses to physical activity revealed that most of the study participant did not exercise regularly (92.2%). Of the 25 adolescent girls who exercise, most of them preferred aerobics (walking, running etc.). However, 82.29% study population reported that they spend more than 3 hours in a day in watching television and mean BMI was also higher in the study population who spend more time in watching television (>5 hours) and this result was statistically significant ($p>0.05$) (Table 4). However, 44.09% and 57.45% of adolescent’s girls reported that they spend more than 3 hours in a day for computer and mobile surfing respectively. Most of the respondents did not participate in any outdoor physical activity and sports activity (86.33%) and have higher BMI than those who spend some time in outdoor games and take part in sports activity but no significant difference was found.

Table 4 Physical activity pattern of the study population and its association with nutritional status

Physical activity pattern	BMI (Kg/m ²)	Indicators										p-value
		Underweight		Normal weight		Overweight		Obese		Total		
		Mean (SD)	n	%	n	%	n	%	n	%	N	
Exercise Regularly												
Yes	21.80 (4.74)	4	1.24%	16	4.96%	4	1.24%	1	0.32%	25	7.76%	0.84
No	21.84 (4.90)	58	18.01%	174	54.03%	41	12.73%	24	7.45%	297	92.23%	
p-value	0.96											
Type of Exercise												
Aerobic	20.92 (2.83)	1	0.32%	6	1.86%	1	0.32%	0	0.00%	8	2.48%	0.19
Dance	22.22 (6.35)	1	0.32%	6	1.86%	1	0.32%	1	0.32%	9	2.79%	
Strength training	19.43 (2.06)	0	0.00%	3	0.93%	0	0.00%	0	0.00%	3	0.93%	
Other	22.47 (5.34)	2	0.62%	1	0.32%	2	62.00%	0	0.00%	5	1.55%	
p-value	0.77											
Hours spent watching TV												
0-2	22.35 (5.04)	14	4.34%	50	15.52%	16	4.96%	7	2.17%	87	27.01%	0.33
4-Mar	21.51 (4.80)	48	14.9%	133	41.30%	28	8.69%	16	4.96%	225	79.19%	
>5	24.86 (6.66)	0	0.00%	7	2.17%	1	0.32%	2	0.62%	10	3.10%	
p-value	0.05*											
Hours spent computer and lap top												
0-2	21.95 (4.74)	34	10.55%	103	31.98%	30	9.31%	13	4.02%	182	56.52%	0.42
4-Mar	21.70 (5.06)	28	8.69%	87	27.01%	15	4.65%	12	3.72%	142	44.09%	
p-value	0.47											
Hours spent mobile and tablets												

0-2	21.48 (4.92)	26	8.074%	86	26.70%	16	4.96%	9	2.79%	137	42.54%	0.89
4-Mar	21.17 (4.91)	33	10.24%	94	29.19%	26	8.07%	15	4.65%	168	52.17%	
>5	21.48 (4.17)	3	0.93%	10	3.10%	3	0.93%	1	0.32%	17	5.27%	
p-value	0.45											
Hours spent sports and outdoor game												
Never	21.78 (4.86)	54	16.77%	164	50.93%	40	12.42%	20	6.21%	278	86.33%	0.9
o-1	21.09 (4.99)	7	2.17%	23	7.14%	5	1.55%	4	1.24%	39	12.11%	
>2	20.1 (5.78)	1	0.31%	3	0.93%	0	0.00%	1	0.31%	5	1.55%	
p-value	0.77											

*p<0.05: considered statistically significant

Table 5 shows the distribution of some demographic and lifestyle factors and corresponding odds ratios at 95% confidence intervals for overweight/obesity female adolescents. The odds of overweight/obesity tended to be higher adolescents those belong to large families compared with a small family (OR=0.14, 95% CI: 0.02-0.87). The odds of overweight/obesity tended to be higher in 3rd birth order compared with 1st born girls (OR=1.87, 95% CI: 0.75-4.6). Higher levels of education in mothers (post graduate and professional degree) was associated with greater risk of overweight/obesity in children but significant association was found with mother's education level as post graduate mothers (OR=6.6, 95% CI: 1.1-3.56, p=0.03) when compared with children of illiterate mothers.

Table 5 The distribution of socio economic factor, dietary factors and physical activity, and corresponding odds ratios at 95% confidence intervals for overweight/obesity female adolescents

Variables	Characteristic	OR	95% confidence interval	p-value
Family size	>3	1.00	ref	
	4-6	0.20	0.03-1.2	0.09
	>7	0.14	0.02-.87	0.03*
Birth order	First	1.00	ref	
	Second	1.13	0.25-5.008	0.87
	>3	1.87	0.75-4.6	0.17
Nationality	Saudi	1.00	ref	
	Non-Saudi	0.55	0.12-2.4	0.44
Mother education	Illiterate	1.00	ref	
	Primary	0.79	0.32-1.69	0.55
	Secondary	0.57	0.25-1.3	0.19
	Graduate	0.57	0.23-1.4	0.22
	Post graduate	6.60	1.10-3.56	0.03*
	Professional	1.60	0.277-9.8	0.58
Mother occupation	Housewife	1.00	ref	
	Self employed	0.68	0.08-5.6	0.72
	Public/civil servant	2.60	1.18-5.8	0.01**
Father occupation	Unemployed	1.00	ref	
	Self employed	0.95	0.39-2.3	0.91
	Public or civil servant	1.20	0.69-2.3	0.42
Eating habits	Vegetarian	1.00	ref	
	Non vegetarian	0.59	0.22-1.5	0.36
Number of fast food per weak	0-1	1.00	ref	
	2-3	1.01	0.45-2.2	0.97
	4-5	1.80	0.74-4.3	0.18
	>6	1.38	0.54-3.5	0.49
Lunch in form of snacking per week	0-1	1.00	ref	
	2-3	1.90	0.93-4.1	0.075
	4-5	1.50	0.60-3.7	0.38
	>6	0.91	0.31-2.6	0.87

Number of meal per day	Once	1.00	ref	
	2-3	0.93	0.36-2.3	0.89
	4-5	2.80	1.12-7.2	0.02*
	>6	2.30	0.85-6.5	0.096
Exercise	No	1.00	ref	
	Yes	1.00	0.38-2.99	0.88
Hours spend on mobile and on tablets per day	0-2	1.00	ref	
	3-4	1.15	0.64-2.06	0.16
	>5	1.44	0.43-4.8	0.54
Hours spend on television per day	0-2	1.00	ref	
	3-4	0.61	0.33-1.13	0.11
	>5	1.30	0.31-5.6	0.68
Hours spend exercises and outdoor games	Never	1.00	ref	
	0-1	0.92	0.38	2.2
	>2	1.06	0.11-9.69	0.95

Ref: Referent category; p<0.05 considered statistically significant

Surprisingly, mothers occupation as public and civil servant was significantly associated with increased risk of overweight/obesity when compared with housewives (OR=2.6, 95% CI: 1.18-5.8), whereas children of self employed mothers did not significantly increase the risk of overweight/obesity (OR=0.68, 95% CI: 0.08-5.67). Similarly, self-employed fathers were also not significantly associated with increased risk of overweight/obesity compared to unemployed (OR=0.95, 95% CI: 0.39-2.3).

The odds of overweight/obesity tended to be higher with 4-5 meals per day compared with 1 meal per day (OR=2.8, 95% CI: 1.12-7.2, p=0.02). Adolescent girls who spend more time in mobile and watching television (>5 hours in a day) were associated with overweight and obesity compared to the girls who spend less time in mobile and watching television (OR=1.44, 95% CI: 0.43-4.8 and OR=1.3 95% CI: 0.31-5.6 respectively) but the difference was non-significant.

DISCUSSION

The present study made an assessment of the adolescent girls' nutritional status in Arar city, KSA and provide evidence linking with specific factors to increased risk of malnutrition in the study population. Our findings revealed that adolescent girls in Saudi Arabia face 2 contrasting nutrition situations, underweight and overweight. It was found that 19.2% of girls were underweight and 21.73% were overweight or obese. Similar findings were reported in other regions of Saudi Arabia and other Gulf countries [8,12,15-20]. While in some studies the prevalence rates of overweight and obesity were higher than our study while in other studies the rates were lower than present study in Saudi Arabia and in neighboring countries [8-10,12,13,15-17,19,21].

A similar study of the eastern region of Saudi Arabia observed obesity in 11.8% girls and 17.2% of girls were overweight [17]. Another study found a prevalence of overweight and obesity as 20% and 11%, respectively among urban Saudi female students [18]. Al-Malki also found a significant increase in the prevalence of both overweight and obesity (30% and 19%, respectively) occurred with age in girls [22]. Another epidemiological household survey has also shown a high prevalence of overweight and obesity (27% and 24%) among Saudi female [23]. Whereas, the overall prevalence of overweight and obesity was 12.2% and 27.0% respectively found in the capital city Riyadh [8].

These results on prevalence of overweight and obesity in female adolescents are also in agreement with several others studies conducted among different Arab countries such as in Kuwait (32% and 8.9%, respectively) [24]; in Lebanon (13.6% and 3.2%, respectively) and in United Arab Emirates where 35.7% of students were either overweight or obese, 1.5% in Jordan and 34.8% in another study from Lebanon [25-28].

Moreover, the percentages of overweight and obese students in Nigerian (6.3% and 1.8%) adolescents were less than the corresponding values obtained in the current study for female Saudi students. Whereas, 24% of adolescents in Brazil were reported as overweight [29].

In the study conducted on the students of Turkey, the percentages of underweight, overweight, and obese female

students were reported to be 3.8%, 13.5%, and 8% respectively [30]. These show that, as compared with their Turkey counterparts, female Saudi students exhibited a greater prevalence of underweight as well as for overweight and obesity. However, the prevalence of overweight in the present study was lower than that estimated in the US (30%) population [31].

The present study result revealed that the percentage of underweight students was more than obtained for Nigerian adolescents (6.4%) [7]. However, 49% underweight were reported in Indian students, 20.2% in the Iranian students, whereas 26.27% was underweight girls reported in Nepal and only 6.4% in Lebanon [9,32-34].

The reason for this discrepancy can be attributed to their faulty eating habits and female students were more motivated to lose weight and acquire ideal weight, and this trend has been on the increase particularly in the past few years [35-37]. Overweight and obesity have a complex etiology, and numerous variables may be associated with this phenomenon and may vary in different populations across various geographical areas.

Several studies were done to describe risk factors related to nutritional status of adolescent's population such as socio-economic status such as family size, monthly income, and parental education and occupation dietary and physical activity pattern [7-10,12,13,16,19,28,30,32,34,38,39]. However, few studies indicate the progression from overweight to obesity with increasing age [8]. This discrepancy may be attributed to puberty which results in different body composition, including regional distribution of fat and bone mineralization in adolescence.

Our finding that malnutrition was highly prevalent among children of highly educated mothers were similar to results of other studies [7]. Another study from Saudi Arabia from Khobar city revealed that the prevalence of overweight was higher among school children with father in private work ($p < 0.01$) and with highly educated mothers ($p = 0.008$) but statistically no significant differences were observed in the study between nutritional status and parent education and income [18]. An Iranian study showed that the mean BMI among adolescents was associated with families size [10]. However, it is worth noting that comparing nationalities in this study should be viewed with some caution due to the difference in sample size between the Saudi and Non-Saudi populations.

Eating behaviors of adolescent girls have come into the spotlight in recent years and several studies claim that many adolescent girls in Arab countries have a poor dietary habit. Insufficient consumption of fruits and vegetables and high intake of snacks and fast food have been considered as associated factors of obesity in adolescents [16,40]. In the current study, 44.73% of the studied adolescents consumed only 2 meals per day; however, more than one-third had no first meal at all, moreover similar eating pattern data have been obtained in other studies [10,13,16,30,41]. Breakfast as a part of a healthful diet and lifestyle can positively impact children's health and well-being [30]. Several studies revealed that skipping breakfast had actually led to obesity and it was claimed that skipping breakfast might increase a person's craving for the next meal which could contain high energy foods with little nutritional value. Long breaks between meals usually favor eating between meals [18,30].

Snacking is a well-established eating pattern amongst adolescents all over the world. More than one-third of our study population ate snacks more than 4 times in a week. The intake of carbonated drink in the present study was also very high and the fact that adolescents snack frequently, were more likely to skip lunch was also proven in the present study population. These results were consistent with another study of Riyadh where nutritional status was positively correlated with sugar-sweetened carbonated beverage intake in fast food meal intake, savory snacks [8].

The presence of sedentary behavior among adolescent students in this study was found to be very high. However, the American Academy of Pediatrics recommends that screen time does not exceed 2 hours per day for this age group [41]. Only 27.01% of the study population met these recommendations.

The prevalence rate of screen time appears to be higher than what has been reported in many other studies [10,12]. This may be due to cultural differences because in Saudi Arabia adolescent girls have less opportunity to go out and as a result, they spend more time watching television. The result of another Saudi Arabian study revealed that weight status was negatively correlated with only night time sleep in girls [8]. In United Arab Emirate the risk of obesity was found to be greater among those who watched television for more than 4 hours a day ($RR = 1.31$), and not practicing sport ($RR = 1.77$) [26].

The findings of many studies suggest that intensity rather than the amount of physical activity may be more important in relation to the prevention of obesity in children. Although we did not provide data with the intensity of physical activity this issue can be considered important in explaining the prevalence rates of overweight/obesity.

CONCLUSION

Our findings revealed that adolescent girls face two contrasting nutrition situations, underweight and overweight. Early and prompt recognition of mild forms of nutritional problems can prevent severe ones. It is very important to develop a database on the diet and nutritional status of the adolescents from different parts of Saudi Arabia, to enable the governments and other non-governmental agencies to formulate policies and initiate strategies for the well-being of adolescent children.

Limitations

There were several limitations to this study. First, the study was a cross-sectional design and provided only a snapshot of the current nutritional status of the study population; secondly, this sample is representative of one city of Kingdom of Saudi Arabia and might not be representative of other regions. Another limitation was that the outcome of the present study relied on self-report, thus honest responses was an expectation of the study.

DECLARATIONS

Acknowledgment

The authors gratefully acknowledge the approval and the support of this research study by the grant number AMS-2017-1-8-F-7439 from the Deanship of Scientific Research at Northern Border University, Arar, KSA.

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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