

*Original Research Article*

# Weight Status of Adolescents in Preparatory and Secondary Schools in Arar, Northern Saudi Arabia

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## Abstract

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Adolescent weight status is a cumulative effect of health and nutritional problems. Adolescent weight problems often go unnoticed as weight assessment is not considered a priority in adolescents. The objective of this study was to evaluate the weight status of adolescents in a representative sample of preparatory and secondary school male and female students in Arar city, Northern Saudi Arabia, using the BMI and to identify factors influencing it. This cross-sectional study was carried out among adolescent school children of both sexes, aged 11-18 years in Arar, North Saudi Arabia were selected for the study using a stratified multi-staged sampling method. Structured questionnaires were filled by the investigators while weight and height were measured. BMI was calculated using the formula  $\text{weight}/\text{height}^2$  ( $\text{kg}/\text{m}^2$ ). Results: The prevalence of underweight, normal, overweight and obesity were 27.2%, 49.5%, 17.5% and 5.5% respectively. With statistically significant effect of sex, age group, parents education, consanguinity between parents, family history of obesity and father's age group ( $p > 0.05$ ) on the BMI of the studied adolescents. The overall mean BMI for males was significantly higher than that of females and the females were significantly more underweight than males. Adolescents whose mother's had higher education had overweight than the counterparts. So periodic weight assessment of adolescents should be carried out in schools and communities as a part of school health program. This is essential for early detection, planning and implementation of intervention programs to reduce underweight and overweight. Also, health education to promote healthy eating behaviors, regular physical exercise should be inculcated into the school curriculum. This would contribute to controlling underweight and overweight.

**Keywords:** Adolescents, Body mass index, Weight status

## INTRODUCTION

It is becoming increasingly apparent that different forms of childhood malnutrition, from short stature (SS) and underweight to overweight, are growing global health

concerns affecting developed and developing countries alike (Muller and Krawinkel, 2005; Prentice, 2006).

Adolescence refers to the developmental period bet

ween childhood and adulthood and the World health organization (WHO) defines adolescents as individuals between the ages of 10–19 years. Adolescence is the second most critical period of physical growth after the first year (Heald and Gong, 1999; Rees et al., 1999). It is a time of enormous physiological, cognitive and psychosocial changes, largely dependent on hormonal and environmental influences (Nwokocha, 1999; World Health Organization/UNICEF, 1995).

Adolescents make up about 20% of the world's population (World Health Organization/UNICEF, 1995; United Nations Children Education Fund (UNICEF), 2005). There are about 1.2 billion adolescents in the developing nations, making up one fifth to one quarter of the population (Motlomelo and Molapi, 1999).

Twenty five percent of adult height, and up to fifty percent of adult weight are attained during adolescence (Garn and Wagner, 1969). It is also a time of sexual development and increase in fat especially in girls and muscle mass in boys (World Health organization, 2000).

Previous studies have shown that adolescents suffer from a range of health problems especially those associated with substance abuse, sexual behavior and poor eating habits (World Health Organization, 1977). For many of them, inadequacies of the quality and quantity of food they eat, are the prime causes of weight problems which often go unnoticed since assessment of weight status is not considered a priority in adolescence as it is in children (World Health Organization, 1977; WHO working group, 1986).

Under nutrition (stunting and wasting) in adolescents has detrimental effects, as it affects their ability to learn and work at maximal productivity. It affects their sexual maturation, increases the risk of poor obstetric outcomes for females and jeopardizes the healthy development of future children (WHO working group, 1986).

The weight status of children and adolescents is often measured using Body Mass Index (BMI) and compared with reference standards (Barlow and Dietz, 1998).

Few studies in Africa that assess the weight status of adolescents, documented the prevalence of undernutrition (BMI <5<sup>th</sup> percentile) to be between 4–30% (Leenstra et al., 2005; Benefice et al., 2003). In South Asia, a high prevalence of about 50% was found among adolescents (Mukhopadhyay et al., 2005; Kurz and Johnson-Welch, 1994; Cordeiro and Lamstein, 2005).

In a study conducted on Saudi children and adolescents, it was found that, the overall prevalence of moderate and severe short stature in boys was 11.3% and 1.8%, respectively; and in girls, 10.5% and 1.2%, respectively. The prevalence of moderate short stature was 12.1%, 11% and 11.3% in boys and 10.9%, 11.3% and 10.5% in girls (El Mouzan et al., 2011).

A cross-sectional survey was conducted in North India to determine the prevalence of underweight and overweight/obesity among adolescents it was found that,

A total of 298 (41.3%) of the adolescents were suffering from dual burden of malnutrition (Gupta et al., 2014).

In another study conducted in Nigeria to evaluate the weight status of adolescents using BMI, it was reported that, 6.4% of the study population were underweight. Majority (85.3%) had normal weight, while the prevalence of obesity was 1.8%. According to gender, more males (8.9%) were underweight compared to females 3.8%. Females were more overweight and obese than males (Adesuwa et al., 2012).

Another study carried out in Jordan, it was reported that, the overall prevalence of underweight, overweight, and obesity were 5.7 %, 17.3 %, and 15.7 %, respectively. Females were more likely to be overweight, while males were more likely to be obese (Ayman et al., 2016).

In the Eastern province of Saudi Arabia. The overall prevalence of overweight was 19.0% and of obesity was 23.3%. More males than females were obese by ages 14–18 years (35.6% versus 19.2%) (Al-Dossary et al., 2010).

A study conducted to determine the prevalence of obesity and overweight among Saudi adolescents, in Al-Khobar area, Eastern Saudi Arabia. It was found that, the prevalence of obesity was higher in male than female students (19.3% versus 11.8%) while a higher proportion of female students than males were overweight (17.2% versus 10.2%) (Sameeh, 2005). And in students (age 12–15 years) at schools in Riyadh. About half the students (53.3%) were within normal weight, 28.6% were underweight, 12.4% overweight and 5.7% obese (Al-Muammar et al., 2014).

Up to our Knowledge, data to evaluate the weight status of adolescents in Northern Saudi Arabia are limited. The objective of this study was to evaluate the weight status of adolescents in a representative sample of preparatory and secondary school male and female students in Arar city, Northern Saudi Arabia, using the BMI, and to identify factors influencing it.

## Participants and methods

This cross-sectional study was carried out among adolescent schoolchildren of both sexes, aged 11-18 years in Arar, North Saudi Arabia. The study was carried during the academic year 2015–2016. over a period of 6 months (1st January to 30 June 2015). The formula sample size was estimated based on the formula  $n = z^2 p (1 - p) / e^2$ , considering the prevalence of stunted growth in Arar is 50%, target population more than 1000, and study power 95%, absolute error 5%, and a nonresponse rate 20%. The sample size worked out 720 school adolescents. Stratified cluster sampling was used to draw this representative sample of students from classes 1<sup>st</sup> preparatory to 3<sup>rd</sup> secondary in 10 randomly selected schools in the study area. In all, there were 38 clusters (classes) from which 21 clusters (primary sampling unit) were selected through probability proportionate to size

sampling. Finally, 36 students were selected from each class using a lottery method of randomization.

Information was obtained on relevant sociodemographic characteristics such as age, sex, father's age, mother's age, father's educational status, mother's educational status and consanguinity between parents through an interviewer administered semi-structured questionnaire.

Weight was recorded by a trained field investigator using a single electronic weighing machine. Measurement was taken to the nearest 0.1 kg. For the measuring height, each study subject was made to stand against a calibrated vertical bar with a horizontal headboard. Height was recorded to the nearest 0.5 cm. Body mass index (BMI) was calculated as per the formula  $BMI = \text{weight (kg)}/\text{height(m}^2\text{)}$ . Age and sex-specific BMI percentiles were computed based on the Centre for Disease Control (CDC)/National Centre for Health Statistics growth curves. Study subjects were classified as underweight (<5<sup>th</sup> percentile), normal weight ( $\geq 5^{\text{th}}$  percentile and <85<sup>th</sup> percentile), overweight ( $\geq 85^{\text{th}}$  and <95<sup>th</sup> percentile), and obese ( $\geq 95^{\text{th}}$  percentile).

### **Ethical considerations**

Permission to conduct the study was obtained from the Research and Ethics Committee at the College of Medicine, Northern Border University, Arar, Kingdom of Saudi Arabia. Data collector gave a brief introduction to the students by explaining the aims and benefits of the study. Informed written consent was obtained from all participants. Anonymity and confidentiality of data were maintained throughout the study. There was no conflict of interest.

### **Statistical analysis**

We utilized the statistical package for social sciences, version 16 (SPSS Inc., Chicago, Illinois, USA) to analyze the study data. The results were displayed as counts and percentages. The  $\chi^2$  and independent sample t-tests were used as a test of significance, and differences were considered significant at P value less than 0.05.

### **RESULTS**

Table (1): illustrates the BMI, socio-demographic characteristics, family history of obesity and presence of chronic diseases in the studied adolescents, about half (49.5%) of the studied adolescents had normal BMI, 27.2% were Underweight (below the 5<sup>th</sup> percentile), 17.5% overweight and only 5.5% were obese (above 95<sup>th</sup> percentile). In the studied participants male, female ratio was and (50.4%:49.6%). The majority (46.0%) of the

participants were 11-14 years, followed by the age group 14-17 years (45.0%), only (9.0%) were 17-19 years. Mean age of the participants ( $\pm$  SD) was 14.74 ( $\pm 2.07$ ). As regards parents education, more than third (32.2%) of the studied adolescents had mothers who completed their primary education compared to (26.5%) of the fathers, 33.4% of fathers and 25.1% of the mothers had University or more education, illiteracy constitute only 4.4% of the fathers and 7.8% of the mothers. Unfortunately, 21.1% had consanguinity between parents and 15.6% had positive family history of obesity. As regards presence of chronic diseases, 90.6% were free. About half (54.6%) of studied participants had Mothers in the age group 40-50 years and more than third (39.1%) had Fathers in the age group 50-60 years.

Table (2): illustrates the relationship between BMI and socio-demographic, family history of obesity and presence of chronic disease among the studied adolescents. The mean BMI of females in this study was significantly higher than that of males, 23.1( $\pm 4.4$ ) and 20.3( $\pm 4.3$ ) respectively. Underweight adolescents were 74.6% males and 25.4% females, Majority (55.0%) of normal population were males, overweight prevalence was more in males (72.4%) than females (27.6). Obesity (BMI equal or greater than the 95<sup>th</sup> percentile) was more prevalent in males than females (63.3% Vs. 36.7%). With statistically significant effect of Sex, age group, parents education, consanguinity between parents, family history of obesity and Father's age group ( $p < 0.05$ ) and non significant effect of presence of chronic diseases and mother's age group ( $p > 0.05$ ) on the BMI of the studied adolescents.

### **DISCUSSION**

Prevalence data are important for the surveillance of physical growth of school-aged children and adolescents in populations over time. Most cases of malnutrition in this age group are the result of the chronic effect of increasingly reported health hazards, provides further support to the need for monitoring and prevention.

This cross-sectional study was carried out on adolescents of both sexes, aged 11-18 years during the period from 1st January to 30 June 2015 to evaluate the weight status of adolescents in a representative sample of preparatory and secondary school male and female students in Arar city, Northern Saudi Arabia, using the BMI, and to identify factors influencing it.

The mean BMI of adolescent males in this study was significantly higher than that of females; 23.1( $\pm 4.4$ ) and 20.3( $\pm 4.3$ ) respectively. This finding is consistent with findings observed in KSA [19], Jordan [28] and Nigeria (Adesuwa et al., 2012).

This difference in the BMI between sexes may be the result of increased fat free mass in males in addition to increased bone bulk. Also decreased physical activity in females may result in decreased muscles bulk which

**Table 1.** BMI, sociodemographic characteristics, family history of obesity and presence of chronic diseases in the studied adolescents, Arar, 2016 (n=889)

<b>BMI</b>	<b>No. (n=889)</b>	<b>Percent</b>
• Underweight	244	27.4
• Normal	440	49.5
• Overweight	156	17.5
• Obese	49	5.5
Mean BMI ( $\pm$ SD)	21.7 ( $\pm$ 4.6)	
<b>Sex</b>		
• Female	441	49.6
• Male	448	50.4
<b>Age group</b>		
• 11-	409	46.0
• 14-	400	45.0
• 17-19	80	9.0
Mean age ( $\pm$ SD)	14.74 $\pm$ 2.07	
<b>Mother education</b>		
• Illiterate	69	7.8
• Primary education	286	32.2
• Preparatory education	218	24.5
• Secondary education	93	10.5
• University or more	223	25.1
<b>Father education</b>		
• Illiterate	39	4.4
• Primary education	236	26.5
• Preparatory education	207	23.3
• Secondary education	110	12.4
• University or more	297	33.4
<b>Consanguinity between parents</b>		
• Yes	188	21.1
• No	701	78.9
<b>Family history of obesity</b>		
• Yes	139	15.6
• No	750	84.4
<b>Presence of chronic diseases</b>		
• Yes	84	9.4
• No	805	90.6
<b>Mother's age group</b>		
• 35 -	49	5.5
• 40 -	485	54.6
• 50 -	272	30.6
• 55 +	83	9.3
<b>Father's age group</b>		
• 35 -	27	3.0
• 40 -	334	37.6
• 50 -	348	39.1
• 55 +	180	20.2

**Table 2.** The relationship between BMI and sociodemographic, family history of obesity and presence of chronic disease among the studied adolescents, Arar, 2016

	BMI				Total (n=889)	Chi-Square	P value
	Underweight (n=244)	Normal (n=440)	Overweight (n=156)	Obese (n=49)			
Sex	No (%)	No (%)	No (%)	No (%)	No (%)		
• Female	182(74.6)	198(45.0)	43(27.6)	18(36.7)	441(49.6)	98.227	0.000
• Male	62(25.4)	242(55.0)	113(72.4)	31(63.3)	448(50.4)		
Mean BMI (± SD)	20.3(±4.3) in females			23.1(±4.4) in males			
Age group							
• 11-	189(77.5)	185(42.0)	25(16.0)	10(20.4)	409(46.0)	138.22	0.000
• 14-	48(19.7)	210(47.7)	115(73.7)	27(55.1)	400(45.0)		
• 17-19	7(2.9)	45(10.2)	16(10.3)	12(24.5)	80(9.0)		
Mother's education							
• Illiterate	25(10.2)	36(8.2)	5(3.2)	3(6.1)	69(7.8)	27.8	0.006
• Primary	70(28.7)	141(32.0)	53(34.0)	22(44.9)	286(32.2)		
• Preparatory	54(22.1)	107(24.3)	45(28.8)	12(24.5)	218(24.5)		
• Secondary	16(6.6)	51(11.6)	23(14.7)	3(6.1)	93(10.5)		
• University or more	79(32.4)	105(32.9)	30(19.2)	9(18.4)	223(25.1)		
Father's education							
• Illiterate & primary	77(31.5)	143(32.5)	40(25.6)	15(30.6)	275(30.9)	29.77	0.003
• Preparatory	58(23.8)	95(21.6)	40(25.6)	14(28.6)	207(23.3)		
• Secondary	23(9.4)	63(14.3)	19(12.2)	5(10.2)	110(12.4)		
• University or more	86(35.2)	139(31.6)	57(36.5)	15(30.6)	297(33.4)		
Mother's age group							
• 35 -	21(8.6)	20(4.5)	7(4.5)	1(2.0)	49(5.5)	16.95	0.05
• 40 -	135(55.3)	236(53.6)	82(52.6)	32(65.3)	485(54.6)		
• 50-	58(23.8)	147(33.4)	54(34.6)	13(26.5)	272(30.6)		
• 55+	30(12.3)	37(8.4)	13(8.3)	3(6.1)	83(9.3)		
Father's age group							
• 35 -	17(7.0)	8(1.8)	2(1.3)	0(0.0)	27(3.0)	34.02	0.001
• 40 -	104(42.6)	154(35.0)	58(37.2)	18(36.7)	334(37.6)		
• 50-	72(29.5)	179(40.7)	73(46.8)	24(49.0)	348(39.1)		
• 55+	51(20.9)	99(22.5)	23(14.7)	7(14.3)	180(20.2)		
Family history of obesity							
• Yes	18(7.4)	63(14.3)	40(25.6)	18(36.7)	139(15.6)	41.57	0.000
• No	226(92.6)	377(85.7)	116(74.4)	31(63.3)	750(84.8)		
Consanguinity between parents							
• Yes	41(16.8)	95(21.6)	34(21.8)	18(36.7)	188(21.1)	9.992	0.019
• No	203(83.2)	345(78.4)	122(78.2)	31(63.3)	701(78.9)		
Presence of chronic diseases							
• Yes	28(11.5)	40(9.1)	13(8.3)	2(4.1)	83(9.3)	3.134	0.371
• No	216(88.5)	400(90.9)	143(91.7)	47(95.9)	806(90.7)		

contributes to their decreased weight (Wenthe et al., 2009).

Majority (49.5%) of the study population had normal weight and Majority (55.0%) of normal population were males. These findings are consistent with findings of (Al-Muammar et al., 2014) in Riyadh, Saudi Arabia (Al-Muammar et al., 2014) and (Al-Dossary et al., 2010) in Saudi Arabia (Al-Dossary et al., 2010). Findings of Nigeria study (Adesuwa et al., 2012) reported that, 85% of the study population had normal weight which is far higher than our findings.

The prevalence of underweight in this study was 27.4%

is consistent with studies in Riyadh, 28.6% were underweight (Al-Muammar et al., 2014) and in Africa, between 4-30% (Leenstra et al., 2005; Benefice et al., 2003). In South Asia, a high prevalence of about 50% was found among adolescents in Kolkata, West Bengal (Mukhopadhyay et al., 2005). On the other hand, our results are much higher than Jordan study (Ayman et al., 2016) which found that 5.7% only of school adolescents were underweight, which is far less than our findings.

The high prevalence of underweight obtained in our study may be because the study population consisted of

day school students, who are likely to have less access to nutritious and well balanced food.

In the present study, the overall overweight prevalence was 17.9%, more in males than females. This was similar to (Alenazi et al., 2015) in Northern KSA who reported that 17.2% of studied male adolescents were overweight (Alenazi et al., 2015) and (Al-Dossary et al., 2010) who reported overall prevalence of overweight 19%, more males than females (18.0% and 20.3% respectively) (Al-Dossary et al., 2010). (Al-Saheed et al., 2007) in AL-Khobar City reported a higher overweight prevalence of 20% (Al-Saheed et al., 2007) while in Riyadh, Saudi Arabia overweight prevalence was 12.4% (Al-Muammar et al., 2014). This however different from Nigeria study in which the overall overweight prevalence of 6.3% and females were more overweight than their male counterparts (Adesuwa et al., 2012).

In the current study, the overall percent of obesity was 5.5%, more prevalent in males than females (63.3% Vs. 36.7%). This prevalence rate of obesity is consistent with findings of (Al-Muammar et al., 2014); 5.7% of studied adolescents were obese (Al-Muammar et al., 2014). But much lower than results obtained by Alenazi SA et al. who reported that, 34.4% of studied male adolescents were obese (Alenazi et al., 2015) and in Al-Dossary et al. (2010) and Al-Saheed et al. (2007) in KSA. The prevalence of obesity in our study is greater than in China (3.6%) (Sameeh, 2005), Nigeria study (1.8%) and Izuora (2007) in Lagos.

In our study, males showed a higher prevalence of overweight and obesity in all age groups. This could be explained by that females in this age group are more self-conscious about their weight and avoid progressing into the obesity range. This is in accordance with a recent study conducted in Saudi Arabia (Al-Rukban, 2003) which found that obesity and overweight were more common among adolescent boys than girls. This was attributed to the lack of physical activity and to their ability to drive in our country which gives males easy access to unhealthy diets (e.g. fast foods and soda drinks instead of water) and less time to eat at home where meals would be more nutritional.

## CONCLUSION AND RECOMMENDATION

Adolescents whose mother's had higher education had overweight than the counterparts. So periodic weight assessment of adolescents should be carried out in schools and communities as part of school health programme. This is essential for early detection, planning and implementation of intervention programmes to reduce underweight and overweight. Also, health education to promote healthy eating behaviors, regular physical exercise should be inculcated into the school curriculum. This would contribute to controlling underweight and overweight.

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