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## Prevalence of overweight and obesity and their associations with dietary habits among students from a major university in Palestine: A cross-sectional study

### Abstract

Overweight and obesity are major public health problems and the most common nutritional disorders. The prevalence of overweight and obesity is rising at an alarming rate in both developing and developed countries. This study aimed to assess the prevalence of overweight and obesity and their associations with dietary habits among students from a major university in Palestine. A cross-sectional study was conducted on 304 Students (50% males and 50% females). Students were asked to fill in a standard questionnaire. Weight, height, and waist circumference were measured and hemoglobin level was tested. Statistical analysis was conducted using SPSS version 15.0. The prevalence rates of overweight and obesity among students were 20.1% and 4.6%, respectively, ( $P < 0.05$ ). Overweight and obesity were more common among males compared to females (27.0% and 5.9% vs. 13.2% and 3.3%, respectively), ( $P < 0.05$ ). The prevalence of abdominal obesity among students was 17.8% and was more common among females (23.0%) compared to males (12.5%), ( $P < 0.05$ ). The prevalence of anemia was 13.8%. Anemia was more common among females (18.4%) than males (9.2%), ( $P < 0.05$ ). 5.3% of males were underweight compared to 4.6% of female, ( $P < 0.05$ ). 68.4% of students reported that they take meals irregularly and a significant difference was found between males and females in meal patterns, ( $P < 0.05$ ). Also, there were significant differences between males and females in physical activity (69.1% of males and 55.9% of females practiced sports), and smoking (51.3% of males and 91.4% of females never smoked, while 48.7% of males and 8.6% of females were current smokers), ( $P < 0.05$ ). University students would benefit from nutritional and health promotion programs to reduce the tendency of overweight and obesity. Educational programs are needed to encourage the consumption of fruits and vegetables to improve students' eating habits.

### Keywords

Palestine., Anemia, university students, Overweight, Dietary habits, Obesity

## Prevalence of overweight and obesity and their associations with dietary habits among students from a major university in Palestine: A cross-sectional study

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### ABSTRACT

Overweight and obesity are major public health problems and the most common nutritional disorders. The prevalence of overweight and obesity is rising at an alarming rate in both developing and developed countries. This study aimed to assess the prevalence of overweight and obesity and their associations with dietary habits among students from a major university in Palestine. A cross-sectional study was conducted on 304 Students (50% males and 50% females). Students were asked to fill in a standard questionnaire. Weight, height, and waist circumference were measured and hemoglobin level was tested. Statistical analysis was conducted using SPSS version 15.0. The prevalence rates of overweight and obesity among students were 20.1% and 4.6%, respectively, ( $P < 0.05$ ). Overweight and obesity were more common among males compared to females (27.0% and 5.9% vs. 13.2% and 3.3%, respectively), ( $P < 0.05$ ). The prevalence of abdominal obesity among students was 17.8% and was more common among females (23.0%) compared to males (12.5%), ( $P < 0.05$ ). The prevalence of anemia was 13.8%. Anemia was more common among females (18.4%) than males (9.2%), ( $P < 0.05$ ). 5.3% of males were underweight compared to 4.6% of female, ( $P < 0.05$ ). 68.4% of students reported that they take meals irregularly and a significant difference was found between males and females in meal patterns, ( $P < 0.05$ ). Also, there were significant differences between males and females in physical activity (69.1% of males and 55.9% of females practiced sports), and smoking (51.3% of males and 91.4% of females never smoked, while 48.7% of males and 8.6% of females were current smokers), ( $P < 0.05$ ). University students would benefit from nutritional and health promotion programs to reduce the tendency of overweight and obesity. Educational programs are needed to encourage the consumption of fruits and vegetables to improve students' eating habits.

**KEYWORDS:** Overweight, Obesity, Dietary habits, Anemia, University students, Palestine.

### INTRODUCTION

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and /or increased health problems [1]. It is a leading but preventable cause of death worldwide, with increasing prevalence in adults and children, and it is one of the most serious public health problems of the 21<sup>st</sup> century [2]. Some contributing factors are said to include a global shift in diet towards increased calories, fat, salt, and sugar intake, a trend towards decreased physical activity due to the sedentary nature of modern work, transportation, and increasing urbanization [3]. Both overall

and abdominal obesity are associated with non-communicable chronic diseases such as type 2 diabetes, cardiovascular and cerebrovascular diseases, digestive disorders, and cancer [4]. The World Health Organization (WHO) classifies adults as overweight when the Body Mass Index (BMI) is 25 -29.9 kg/m<sup>2</sup>, obese when BMI is >30 kg/m<sup>2</sup> and have abdominal obesity when waist circumference (WC) > 94 cm for men and >80 cm for women, and Waist-to-Hip Ratio (WHR) of > 0.90 in men and > 0.85 in women [5]. On average, obesity reduces life expectancy by six to seven years [6 -7]. In Palestine, an increased prevalence of excessive weight is noted among all age groups in both genders.

It is important to note that there has been a nutritional transition in food choices during the past years from the typical Mediterranean diet into the western fast food pattern. Data from the occupied Palestinian territory, (based on one study that was done in a rural community in Ramallah, are for adults aged 30-65 years and are not necessarily an indication of the national data) indicated that the prevalence of obesity and overweight in men was 58.7% and in women was 71.3% [8]. Recently, few studies have been conducted to assess the associations with overweight among Palestinian schoolchildren [9-10]. Whereas there were no studies conducted to assess the prevalence of overweight and obesity and their associations with dietary habits among university students. Obesity was not considered as an issue of interest in the mid-1980s in the United States, but since then, it has become more common in 2003-2004, approximately 32.2 percent of the US adult populations were obese [11]. Due to obesity; almost one-third of the adult Canadians are at increased risk of disability, disease, and premature death [12]. In the majority of European countries, the trend has increased from 10% to 40% in the last 10 years, whereas in England prevalence has more than doubled [13]. In the Arab countries, some studies are available (Jordan, Kuwait, Saudi Arabia and Lebanon) regarding the determinants of obesity, particularly among university students. These studies plus others from developed countries, draw an alarming picture of prevalent obesity, which in turn could be an indicator for an increase in the occurrence of other chronic diseases in the region. Prevalence of overweight and obesity among Saudis were 27.23% and 13.05% of males and 25.20% and 20.26% of females respectively [14]. Another study showed prevalence of overweight and obesity among Jordan University students were 28.5% and 10.2% respectively [15] Prevalence of overweight and obesity among Kuwaiti college men were 38.5 and 11.1 % respectively [16]. In Lebanon, prevalence of overweight and obesity Among Lebanese American university students were more common among male students compared to females (37.5% and 12.5% vs. 13.6% and 3.2%, respectively [17]. In Bahrain, the prevalence of overweight among males and females Bahrain University

students was 17.6% and 18.5% respectively, while the proportion of obesity was 11.8% in males and 7.6% in females [18]. Prevalence of overweight among Saudis of both gender, between the ages of 30-70 years in rural as well as in urban communities were 36.9%. The age-adjusted prevalence of obesity was 35.5% in KSA, [19]. Several regional and international studies investigated the associations of overweight and obesity with the life-style (meal pattern, physical activity and smoking) and anemia, among university students [16, 20, 21, 22]. In Palestine, there is a lack of data about obesogenic factors (factors tending to cause obesity) which are important in defining and understanding high risk factors which should be targeted for future modifications in public health interventions. Also, there were no studies conducted to assess the prevalence of obesity among university students. Therefore, this study was conducted to assess the prevalence of overweight, obesity and their associations with dietary habits among students from a major university in Palestine. To the best of our knowledge, this is the first study to be conducted in Palestine regarding prevalence of obesity, overweight and their associations with dietary habits among university students.

## MATERIALS AND METHODS

### *Study Design*

A cross-sectional study was conducted on a sample of 304, Bachelor of Arts (BA) and Bachelor of Science (BSC) students admitted to the Faculty of Arts and the Faculty of Science at a major university in Palestine between 2006 and 2010.

### *Study Sample*

A sample of 304 students was chosen by convenient sampling method a long time ago from a major university campus in Palestine, of two faculties having the largest populations (Faculty of Arts and Faculty of science in a ratio of (1:1). The sample size was estimated by using the following equations:

$$n = \frac{z^2 * P(1 - p)}{\delta^2} \quad (1)$$

$$n^* = \frac{n}{1 + \frac{n-1}{N}} \quad (2)$$

Number of participants from each faculty was 152 (76 males + 76 females). Enrollment and recruitment of the study subjects have been done through weekly meetings with the faculty students explaining to them the aim and objective of the study. Banners were hanged on the walls of different areas of the university campus inviting students to participate in the study. Those who agreed to participate and met the study inclusion criteria were asked to fill in and sign a consent form and invited for anthropometric measurements and blood drawings through a fixed appointment.

#### ***Inclusion and Exclusion Criteria***

The study included students who were still studying at both faculties (Faculty of Arts and Faculty of science) at the major university while excluded blind students who couldn't fill in the questionnaire.

#### ***The study Questionnaire***

A questionnaire which was previously used [23] was modified, and contained 29 questions (dietary habits, smoking and physical activity, height, weight, WC, Hb%, etc) was applied to two experts to be revised, in order to improve the validity of the tools. In addition, the questionnaire was tested on ten students by a pilot study to determine its acceptability and ease of use by the study participants. The pilot study was carried out in order to identify potential problems and to revise the methods and logistics of data collection before starting the actual fieldwork. The selected tools were appropriate for the collection of the needed information. Questions were understood and answered correctly. The sequence of the questions was logical, the wording clear, and translations accurate. Accordingly, the questionnaire was valid and reliable for the study purposes

#### ***Data collection procedure***

Data were collected during the period between 5<sup>th</sup> of March to 30<sup>th</sup> of April, 2011. After taking the approval letter from the university IRB (Institutional Review Board)

committee, the researcher had started the research study. Permissions have been taken from the Dean of the Faculty of Arts and the Dean of the Faculty of Science in order to facilitate data collection. Anthropometric measurements and blood withdrawal (3ml EDTA K3 Vacuette) were conducted at two laboratories of the university; the Central Medical Laboratory in the old campus, and the Scientific Medical Laboratory in the new campus. Students were asked to fill in a standard questionnaire. Weight, height and waist circumference of each participant were measured using a weighing scale (SECA-803-Germany), with scale of (0.1- 150kg) and measuring tape and rod. Measurements for each parameter were taken in three occasions at the same time, the closest two measurements were averaged and recorded in the individual's questionnaire while the third measurement was excluded. The weighing scale was calibrated at the beginning of every session of measurement. Participants were weighed in their light clothing without shoes (after the removal of their coats, handbags, mobile phones and other personal accessories). Weight was measured to the nearest 100g. Height and waist circumferences were measured to the nearest 0.5 cm. With the footwear removed, standing straight and looking forward, the participant's height was recorded at the point when the arm of the measuring rod rested on the head. The BMI was calculated as the weight in kilograms divided by the height in square meters (kg/m<sup>2</sup>). BMI was based on the World Health Organization (WHO) BMI cut-offs; (BMI < 18.5 kg/m<sup>2</sup> is classified as underweight, 18.5– 24.9 kg/m<sup>2</sup> is classified as normal weight, 25.0–29.9 kg/m<sup>2</sup> is classified as pre-obese (overweight), and > 30 is classified as obese. In addition, hemoglobin level in blood was tested by auto-analysis device (CBC method) for each participant by a well qualified laboratory technician to assess the prevalence of anemia. The result considered normal when hemoglobin level for males ranged between 13.8 to 17.2 gm/dL and for females between 12.1 to 15.1 gm/dL [24].

#### ***Data Analysis***

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) version 15. Quantitative variables

(continuous) were analyzed using students't-test, while chi-square and Fisher's exact tests were conducted for qualitative variables (categorical). All reported P-values were made and compared to a significance level of 5%; differences were considered statistically significant at  $P < 0.05$ .

### **Ethical considerations**

Approval letter from the university IRB committee was taken before starting this study. All participants in this study were asked to sign a consent form. In addition, students were given a note that the participants can withdraw from the study without giving reasons. All data were recorded and stored in a locked cabinet. Questionnaires were anonymous (no name was written) and only identified by codes. Permissions to collect data from the faculties have been taken from each faculty Dean.

### **RESULTS**

**Table (1):** Mean and standard deviation of the anthropometric measurements of the participants by gender.

Variable	Mean $\pm$ SD		*P- Value
	Male	Female	
Weight in kg	73.1 $\pm$ 13.1	59.9 $\pm$ 8.7	0.001
Height in cm	176.2 $\pm$ 6.7	162.4 $\pm$ 5.6	0.001
BMI in kg/m <sup>2</sup>	23.5 $\pm$ 0.7	21.5 $\pm$ 0.5	0.009
WC in cm	81.4 $\pm$ 9.3	74.6 $\pm$ 8.1	0.001

\*t-Test

### **Meal pattern of university students by gender**

The meal pattern of university students by gender are presented in Table (2). About two thirds (68.4%) of the participants take meals irregularly, while 31.6% take meals always regularly. In addition, more than half (50.7%) of the participants were consuming two main meals per day, while 6.9% were taking one main meal per day, 37.8% of them were taking three main meals /day and 4.6% were taking more than three main meals per day. Furthermore, 22.4% declared that they do not consume snacks between meals, while about half (47.0%) of the participants were consuming one snack between meals, 23.0%

### **Anthropometric measurements of the participants**

The mean and standard deviation of the anthropometric measurements of the participants in this study are presented in Table (1). The mean and standard deviation of weight for male students was 73.1  $\pm$ 13.1 kg compared to 59.9  $\pm$  8.7kg for females. The mean and standard deviation of height was 176.2 $\pm$ 6.7cm for male students and 162.4 $\pm$ 5.6 cm for females. However, the BMI mean and standard deviation was 23.5 $\pm$  0.7 (kg/m<sup>2</sup>) for male students and 21.5 $\pm$  0.5 (kg/m<sup>2</sup>) for females. The mean and standard deviation of waist circumference for male students was 81.4 $\pm$ 9.3cm and 74.6 $\pm$ 8.1cm for females. Findings showed significant differences ( $P < 0.01$ ) between males and females in the means and standard deviation of all variables, Table (1)

were consuming two snacks between meals, whereas 4.9% were consuming three snacks between meals, and 2.6% were consuming more than three snacks between meals. There were significant differences between males and females in meal patterns, ( $P < 0.05$ ). Higher proportion of female students had their meals irregularly compared to male students (76.3% vs 60.5%). Male students had more meals than female students, but consumed less snacks (50.7% of males consumed three or more meals compared to 34.2% of females; 84.9% of females consumed one or more snacks compared to 70.4% of males), Table (2).

**Table (2):** Meal pattern of university students by gender.

Meal pattern		Sex				Total		X <sup>2</sup> Value	*P-Value
		Male		Female		N	%		
		N	%	N	%				
Taking meals regularly	Always regular	60	39.5	36	23.7	96	31.6	5.911	0.003
	Irregularly	92	60.5	116	76.3	208	68.4		
Total		152	100	152	100	304	100		
Main meal /day	One	9	5.9	12	7.9	21	6.9	3.784	0.026
	Two	66	43.4	88	57.9	154	50.7		
	Three	67	44.1	48	31.6	115	37.8		
	>Three	10	6.6	4	2.6	14	4.6		
Total		152	100	152	100	304	100		
Snack/ day	Nothing	45	29.6	23	15.1	68	22.4	20.290	0.008
	One	68	44.7	75	49.3	143	47.0		
	Two	27	17.8	43	28.3	70	23.1		
	Three	6	3.9	9	5.9	15	4.9		
	>Three	6	3.9	2	1.3	8	2.6		
Total		152	100	152	100	304	100		

\*X<sup>2</sup> test**Percentages of physical activity and smoking among university students by gender**

The outcome of this study indicated that about two thirds (62.5%) of the participants were practicing different kinds of sports while 37.5 % of them were not. Furthermore, 71.4% of the participants never smoked; in contrast 28.6% of them were active smokers. There were significant differences between

males and females in physical activity and smoking, ( $P < 0.05$ ). Higher proportion of males practiced sports, but higher proportions were current smokers. Male students practiced sports more than female students (69.1% of males practiced sports compared to 55.9% of females; 48.7% of males currently smoked compared to 8.6% of females), Table (3)

**Table (3):** Percentages of physical activity and smoking among university students by gender.

Physical activity & smoking		Sex				Total		X <sup>2</sup> Value	*P-Value
		Male		Female		N	%		
		N	%	N	%				
Do you practice any kind of sports	Yes	105	69.1	85	55.9	190	62.5	3.069	0.018
	No	47	30.9	67	44.1	114	37.5		
Total		152	100	152	100	304	100		
Smoking	Never smoke	78	51.3	139	91.4	217	71.4	46.304	0.000
	Smoking Currently	74	48.7	13	8.6	87	28.6		
Total		152	100	152	100	304	100		

\*X<sup>2</sup> test

**Prevalence of overweight and obesity among university students by gender**

Findings indicated that the overall prevalence of overweight and obesity among university students were 20.1% and 4.6%, respectively (Table (4)). Prevalence of overweight and obesity were higher among male

**Table (4):** Prevalence of overweight and obesity among university students by gender.

BMI status	Sex				Total N %	X <sup>2</sup> Value	*P- value
	Male		Female				
	N	%	N	%			
<b>Underweight</b> (BMI<18.5)	8	5.3	7	4.6	15 4.9	11.598	0.009
<b>Normal</b> (BMI: 18.5-24.9)	94	61.8	120	78.9	214 70.4		
<b>Overweight</b> (BMI: 25-29.9)	41	27.0	20	13.2	61 <b>20.1</b>		
<b>Obese</b> (BMI > 30)	9	5.9	5	3.3	14 <b>4.6</b>		
<b>Total</b>	152	100	152	100	304 100		

\*X<sup>2</sup> test**Prevalence of abdominal obesity among university students by gender**

Table (5) shows the prevalence of abdominal obesity among university students by gender. About 18% of the participants had abdominal obesity (central obesity) based on

**Table (5):** Prevalence of abdominal obesity among university students by gender.

Waist Circumference	Sex				Total N %	X <sup>2</sup> Value	*P- value
	Male		Female				
	N	%	N	%			
<b>Normal</b>	133	87.5	117	77.0	250 82.2	77.975	0.016
<b>Abdominal Obesity</b>	19	12.5	35	23.0	54 <b>17.8</b>		
<b>Total</b>	152	100	152	100	304 100		

\*X<sup>2</sup> test. Male abdominal Obesity; WC (>94cm), Normal; WC (≤94cm). Female abdominal Obesity; WC (>80cm), Normal; WC(≤80cm).

**Prevalence of anemia among university students by gender**

The prevalence of anaemia among university students by gender is presented in Table (6). The prevalence of anaemia was

**Table (6):** Prevalence of anaemia among university students by gender.

Hemoglobin status	Sex				Total N %	X <sup>2</sup> Val- ue	*P- value
	Male		Female				
	N	%	N	%			
Anemia	14	9.2	28	18.4	42 13.8	5.15	0.020
<b>Normal</b>	138	90.8	124	81.6	262 86.2		
<b>Total</b>	152	100	152	100	304 100		

\*X<sup>2</sup> test

students (27.0% and 5.9%) compared to females (13.2% and 3.3%). There was a significant relationship between gender and BMI status (chi-square test,  $p < 0.05$ ). (BMI classifications were not homogenous among males and females), Table (4).

WC classification. The prevalence of abdominal obesity was higher ( $P < 0.05$ ) among females than males in the studied sample of university students (23.0% vs 12.5%), (Table (5)).

13.8%; (18.4% among female students and 9.2% among males). There were significant differences in anaemia between male and female university students, ( $P < 0.05$ ), Table (6)



## DISCUSSIONS

Nowadays, increased prevalence of overweight and obesity is noted among all age groups in both genders. Study results indicated that the prevalence of overweight and obesity among the sample (n=304) of students from a major university were 20.1% and 4.6% respectively. In this study, it is clear that the prevalence of overweight and obesity was higher among males than female students, and these results are in agreement with other studies where similar findings of prevalence of obesity among males of university students were reported, [25-26]. Furthermore, the results of this study are in agreement with several studies conducted among university students in Arab countries [17-18]. Prevalence of overweight and obesity among Lebanese American university students was more common among male students compared to females (37.5% and 12.5% vs. 13.6% and 3.2%, respectively [17]. Prevalence of overweight among males and females of Bahrain university students was 17.6% and 18.5% respectively and the proportion of obesity was 11.8% in males and 7.6% in females [18]. Regarding food habits, university students often select fast food due to its palatability, availability and convenience. They usually do not follow healthy eating habits, as diet is high in fat and low in fruits and vegetables [27-28]. In this study, the data on students' meal pattern indicated that 68.4% of the participants were taking their meals irregularly, while 31.6% were taking their meals always regularly. However, there were significant gender differences in the meal pattern among university students, (females eating more snacks and males eating more main meals), ( $P < 0.05$ ). Frequent snacking and eating fast food can adversely affect students' health status, given the abundance of energy-dense and high-fat ingredients they contain. Improving students'

knowledge about nutrition and healthy eating habits may promote healthy body weight management among students and reduce the prevalence of overweight and obesity [29]. Regarding physical activity and smoking, the findings indicated that 37.5 % of the university students were not practicing physical activity, and 71.4% of the subjects never smoked. Therefore, smoking was not common in the studied sample of university students, in agreement with findings of other studies in the region [30]. Prevalence of smoking cigarettes only, Nargileh only, and both among school students in Beirut, Lebanon, was 2.5%, 25.6%, and 6.3%, respectively. However, results of this study indicated a significant gender difference in physical activity and smoking among university students ( $P < 0.05$ ). Several studies had shown inverse relationship between level of physical activity and overweight and obesity [15]. The prevalence of anaemia among the studied sample of university students was 13.8%. Anaemia was more common in females (18.4%) compared to male students (9.2%). These findings are in agreement with other studies in the region [31- 32]. A significant association was found between anemia and BMI status (overweight and obesity) among females, ( $P < 0.05$ ). These results are in agreement with a study which confirmed that overweight children and adolescents exhibited lower iron levels [33]. Such results suggest that iron supplement and food iron fortification are required in order to overcome the prevalence of anemia particularly among females, as well as the educational programs are needed to encourage consumption of fruits and vegetables to improve students' eating habits. Further researches are needed to investigate the prevalence of factors associated with overweight and obesity among larger samples representing all Palestinian university students.

## LIMITATION OF THE STUDY

The results of this study are limited by the use of a sample of students from just one university which may not be a representative of all university students in Palestine. The sampling methodology of this study was done by convenient sampling method, in addition to the long time since data has been collected.

### CONCLUSIONS

Overweight and obesity were more common among male students compared to females. Prevalence of anaemia was more common among females than male students. The prevalence of abdominal obesity measured as waist circumference (17.8%) was significantly higher than overall obesity measured as BMI (4.6%) among university students and it was more common among female students compared to males. University students would benefit from nutritional and health promotion programs to reduce the tendency of overweight and obesity. Educational programs are needed to encourage consumption of fruits and vegetables to improve students' eating habits.

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### CONFLICT OF INTERESTS

The authors declare that no conflicts of interest in this manuscript.

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