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Research Article

Evaluation of Anthropometric Risk Parameters and Meal Habits in University Students According to Gender

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Abstract

Purpose*: The aim of the study is to evaluate anthropometric risk parameters and meal habits regarding nutrition-related chronic diseases in university students according to gender.* ***Methods****: This study was conducted on a total of 898 university students. A questionnaire was used to determine the demographic characteristics and meal habits of university students. Body weight, height, waist circumference (WC), hip circumference (HC) was measured and, body mass index (BMI), waist-to-hip ratio (WHR), waist-to-height ratio (WHtR) were calculated.* ***Results:*** *The mean age of the participants was 20.9 ± 2.0, 76.5% were female, 82.5% skipped meals. Mean values of all anthropometric parameters respectively body weight, height, BMI, WC, HC, WHR and WHtR; 61.0±11.7 kg, 166.7±8.4 cm, 21.8±3.0 kg/m2 ,75.3±9.3 cm, 96.3±7.8 cm, 0.78±0.07 and 0.45±0.05. Mean values of all parameters were found to be significantly different according to gender (p <0.05). According to BMI group 11.7% of females and 26.5% of males were pre-obese or obese. The prevalence of the participants at risk (above the cut-points) was 4.7% in men and 3.2% in women for abdominal obesity according to WC. 14.8% of the females and 32.7% of the males have the risk according to WHR. Abdominal obesity was found in 13.1% of the participants according to WHtR cut-off degree (WHtR> 0.5)* ***Conclusion:*** *There was statistically significant relationship between the meal skipping status and the mean WC (cm) of the participants. It was observed that WC was higher in male students and those who frequently skipped meals.*

Key words: *Anthropometric risk parameters, Meal habits, University students*

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Introduction

It is a common idea that the daily diet should be divided into three meals: breakfast, lunch and dinner. Meal skipping is the skipping or non-consumption of one or more of the traditional main meals during the day. Regularly skipping meals, especially breakfast, has been associated with lower diet quality, lower total energy, vitamin and mineral intake, increased risk of central obesity, insulin resistance markers and cardio metabolic risk factors (1).

Diet is a risk factor for the development of many chronic conditions (2). Diet-related chronic diseases such as obesity, coronary heart disease, diabetes and hypertension are common and increasing worldwide (3). Obesity is associated with various cardiovascular risk factors including hypertension, type 2 diabetes, and dyslipidemia (4).

Skipping breakfast increases the risk of diet-related chronic diseases and all-cause mortality. Also, those who tend to consume more refined and sweet products at night skip breakfast, which increases the risk of cardiovascular disease and type 2 diabetes (5).

According to World Health Organization (WHO), globally, 43% of adults were overweight and 16% were obese in 2022 (6). The prevalence of central obesity in TURDEP-I was 34% (49% female, 17% male) in the general population. In TURDEP-II, it increased to 53% (female 64%, male 35%) (7).

WHO recommends measuring body mass index (BMI) universally to determine overweight and obesity. Measurements such as waist circumference (WC) or waist-hip ratio (WHR) are also used, which measure the distribution of abdominal fat. As a more sensitive measure of visceral obesity, WC has been suggested as an indicator of cardiovascular risk (8). WHR and waist-to-height ratio (WHtR) are alternative methods to WC that can be applied to determine anthropometric risk factors (4). WHtR has been suggested as a better predictor of cardiovascular risk, mortality, and intra-abdominal fat than WC (8). WHtR and other anthropometric measurements (BMI, WC and WHR) are considered risk determinants of chronic diseases such as cardiovascular diseases and Type 2 diabetes mellitus (9). The relationship between WC or WHR with chronic diseases in adults has been shown by epidemiological studies (10). The type of obesity in which the WC or WHR is increased is called central (visceral or abdominal) obesity.

Central obesity is an important risk factor for cardiovascular health. According to WHO, WC is ≥88 cm in females and ≥102 cm in males, indicating the presence of central obesity. According to the data of Turkey Endocrinology and Metabolism Society (TEMD) obesity-lipid metabolism-hypertension study group, abdominal obesity criterion was recommended as ≥100 cm in men and ≥90 cm in women (11).

Research indicates that inadequate dietary habits are prevalent among university students, predisposing them to health risks such as obesity, cardiovascular diseases, and eating disorders (12). These dietary habits are influenced by multiple factors, including gender, with varying implications for health and well-being. Moreover, the university setting often exacerbates the vulnerability to poor nutritional choices due to factors like food insecurity, limited access to healthy food options, and the temptation of convenient but unhealthy fast food. Young adulthood, a pivotal developmental phase, necessitates a deeper investigation into the dietary habits, anthropometric risk factors, and their implications for chronic disease risk among university students (13, 14).

Evidence points to widespread inadequate dietary habits within this demographic, increasing susceptibility to various health risks such as obesity, cardiovascular diseases, and eating disorders (14). Through a comprehensive understanding of the interplay between anthropometric measures, meal habits, and gender differences, health promotion interventions can be more precisely tailored to address the specific needs and vulnerabilities of university students, thus contributing to the prevention of nutrition-related chronic diseases in this population. Evaluating these parameters not only furnishes crucial insights into the efficacy of health-promoting interventions aiming at enhancing dietary habits and nutritional cognizance within the university milieu but also aspires to shape future initiatives and programs to offset the risks of nutrition-related chronic diseases, fostering healthier lifestyle choices among university students. By integrating a holistic analysis of meal habits and anthropometric indices with a focus on gender disparities, our study augments the ongoing discourse on public health enhancement, disease deterrence, and the welfare of young adults as they navigate the pivotal transition into university life, thereby making a significant contribution to the corpus of nutritional health research.

The aim of the research was to evaluate the meal habits and anthropometric risk parameters of regarding nutrition-related chronic diseases as diabetes and

cardiovascular diseases of university students according to gender. Additionally, in this study, the relationship between anthropometric risk parameters and meal habits in university students was evaluated.

Material and Methods

Participants

This cross-sectional study population consisted of university students in the eastern part of Turkey. The universe of the study consists of 27151 undergraduate students. The sample size was calculated as 1027 using the sample size calculation formula $n=Nt^2(pq)/d^2(N-1)+t^2(pq)$ in groups with known population numbers ($t=1.96$, $d=0.03$, $p=0.5$). Recruitment consisted of an informative talk, explaining details to the students inside the college about the research. Those who volunteered to participate were included. The exclusion criteria consisted of the students with chronic diseases. And any responses from outside the college were excluded.

Study plan

The data were collected between February-May 2019. The datas of socio-demographic characteristics and meal habits were obtained by a questionnaire consisted of 32 questions applied by the researchers using face to face interview technique.

Anthropometric measurements

Trained dieticians obtained the body weight, height, waist circumference (WC) and hip circumference (HC) in the study. Height, WC and HC was measured using a stadiometer. Weight was measured with a portable scale. BMI was calculated as weight (kg)/height (m^2). The participants were classified in four groups according to their BMIs: underweight (BMI <18.5), normal weight (BMI 18.5 to 24.9), preobese (BMI 25 to 29.9) and obese (BMI above 30 kg /m2). According to the data of Turkey Endocrinology and Metabolism Society (TEMD) obesity-lipid metabolism-hypertension study group, abdominal obesity criterion was recommended as ≥100 cm in men and ≥90 cm in women according to WC. WC ≥90 and ≥80 cm for male and female, respectively was defined as overweight (11). WHR was determined by dividing WC to HC. WHR <0.90 and <0.85 for male and female, respectively is defined as a normal healthy fat level (15). WHtR was calculated by dividing WC by height length. WHtR >0.5 for male and female are defined as markers of increased risk of chronic disease (16). WHtR≥0.5 was defined as a measure of central obesity (11).

Statistical analyses

SPSS Statistics was used for analysis. Meal habits and anthropometric risk parameters were analyzed using frequency tables.

Counts (n), percentage (%), and mean± standard deviation (SD) values were taken to evaluate of the data. Pearson chi-squared test and Student's t-test was used. Statistical tests were regarded as statistically significant if *p* value <0.05.

Results

The results of the study indicated that the mean age of 898 university students aged between 18-30 was determined as 20.9±2.0. 76.5% of them were female, 23.5% were male. 59.5% of them stay in dormitories. 2.3% of the students dieting.

Mean values of all anthropometric parameters respectively body weight, height, WC and HC; 61.0±11.7 kg, 166.7±8.4 cm, 75.3±9.3cm, 96.3±7.8cm. BMI, WHR and WHtR were assessed. Distribution of anthropometric parameters according to gender are shown in Table 1.

Table 1. Distribution of anthropometric parameters according to gender among university students.

	Female (n=687)	**Male (n=211)**	**Total (n=898)**		
Parameters	Mean ± SD	Mean ± SD	Mean ± SD	t	p-value
Body weight (kg)	57.0±8.6	73.9±11.1	61.0±11.7	23.296	<0.001
Height (cm)	163.2±5.6	177.8±5.9	166.7±8.4	32.816	<0.001
Body mass index (kg/m2)	23.3±3.2	21.4±2.8	21.8±3.0	8.636	<0.001
Waist circumference (cm)	72.4±7.4	84.8±8.6	75.3±9.3	20.548	<0.001
Hip circumference (cm)	95.9±7.4	97.7±8.8	96.3±7.8	2.857	0.004
Waist/hip ratio	0.76±0.05	0.87±0.07	0.78±0.07	26.674	<0.001
Waist/height ratio	0.44±0.05	0.48±0.05	0.45±0.05	9.309	<0.001

Student's t-test, significance at p<0.05

Body weight, height, WC, HC, WHR and WHtR were significantly higher (p<0.05) in males than females. BMI was significantly higher (p<0.05) in females than males (Table 1).

Table 2 shows the distribution of anthropometric risk parameters according to gender among university students.

Table 2. Distribution of anthropometric risk parameters according to gender among university students.

Anthropometric risk parameters	Female n(%)	Male n(%)	Total n(%)
Body mass index (BMI) (kg/m2)			
Underweight (<18.5)	86(12.6)	5(2.4)	91(10.1)
Normal (18.5-24.9)	520(75.7)	150(71.1)	670(74.6)
Pre-obese (25.0-29.9)	69(10.0)	46(21.8)	115(12.9)
Obese (≥30.0)	12(1.7)	10(4.7)	22(2.4)
Waist circumference (WC) (cm)			
Normal	590(85.9)	147(69.7)	737(82.1)
Overweight	75(10.9)	54(25.6)	129(14.3)
Obese	22(3.2)	10(4.7)	32(3.6)
Waist/hip ratio (WHR)			
Normal	585(85.2)	142(67.3)	727(81.0)
Risk	102(14.8)	69(32.7)	171(19.0)
Waist/height ratio (WHtR)			
<0.4 (No increased risk)	72(10.5)	5(2.4)	77(8.6)
0.4-0.5 (Increased risk)	554(80.6)	149(70.6)	703(78.3)
>0.5 (Very high risk)	61(8.9)	57(27.0)	118(13.1)

Measure of Body mass index: underweight <18.50; 18.50-24.99 overweight, > 25–29.99 kg/m2; obesity, > 30 kg/m2
Waist circumference (WC: overweight: > 94 cm(M); > 80 cm(F), obesity: > 102 cm(M); > 88 cm(F)
Waist-to-hip ratio (WHR): obesity ≥ 0.90 cm(M); ≥ 0.85 cm(F)
** Pearson Chi-square test is for a difference in frequency of obesity between males and females as measured by each method

According to BMI group 11.7% of females and 26.5% of males were overweight or obese. 75.7% of females and 71.1% of males had normal weight. We found that the prevalence of obesity was 2.4% of participants according to BMI. In this study WC<90 cm in men and <80 cm in women was accepted as normal. W≥90 and ≥80 cm for male and female, respectively was defined as overweight. WC ≥100 and ≥90 cm for male and female, respectively was defined as obese according to the data of Turkey Endocrinology and Metabolism Society (TEMD, 2018). The prevalence of the participants at risk according to WC was 4.7% in men and 3.2% in women for abdominal obesity (Table 2). WHR<0.90 and <0.85 for male and female, respectively was defined as a normal healthy fat level. 14.8% of the females and 32.7% of the males have the "risk" WHR. WHtR≥0.5 was defined as a measure of central obesity. Abdominal (central) obesity was found in 13.1% of the participants according to WHtR cut-off degree (WHtR>0.5) (Table 2). Meal habits of the study participants according to gender are given in Table 3.

Table 3. Distribution of meal habits according to gender among university students.

	Female n(%)	Male n(%)	Total n(%)	χ2	*p*-value
Number of Main meal					
1	12(1.7)	9(4.3)	21(2.3)	5.116	**0.036**
2	271(39.4)	93(44.1)	364(40.5)		
3	404(58.9)	109(51.6)	513(57.2)		
Number of snacks					
None	137(19.9)	49(23.2)	186(20.7)	0.119	0.140
1	233(33.9)	83(39.3)	316(35.2)		
2	223(32.5)	59(28.0)	282(31.4)		
3 and more	94(13.7)	20(9.5)	114(12.7)		
Meal Skipping					
Yes	556(80.9)	185(87.7)	741(82.5)	5.092	**0.024**
No	131(19.1)	26(12.3)	157(17.5)		
Skipped meal (n=741)					
Breakfast	234(42.1)	82(44.3)	316(42.7)	0.291	0.864
Lunch	270(48.6)	86(46.5)	356(48.0)		
Dinner	52(9.3)	17(9.2)	69(9.3)		
Meal Skipping Reason (n=741)					
Don't want to eat	253(45.5)	90(48.6)	343(46.3)	2.482	0.478
Lack of time	238(42.8)	68(36.8)	306(41.3)		
To lose weight	20(3.6)	8(4.3)	28(3.8)		
Other reasons	45(8.1)	19(10.3)	64(8.6)		

** Pearson Chi-square test, significance at p<0.05

Participants consumed the average of 3.9± 1.1 meals a day (min-max: 1-6) and 82.5% (n=741) of them (80.9% female and 87.7% male) skipped meals. There was statistically significant relationship between the number of main meals consumed by the participants and meal skipping status according to gender (p<0.05). Table 4 shows the comparison of anthropometric parameters with skipping meals among university students.

Table 4. Comparison of anthropometric parameters with skipping meals among university students.

	Skipping meal				
Parameters	**Yes (n=741)**	**No (n=157)**	**Total (n=898)**		
	Mean ± SD	Mean ± SD	Mean ± SD	t	p-value
Body weight (kg)	61.2±11.9	59.6±10.4	61.0±11.7	-1.553	0.121
Height (cm)	166.8±8.4	166.0±8.2	166.7±8.4	-1.044	0,297
Body mass index (kg/m2)	21.9±3.1	21.5±2.6	21.8±3.0	-1.309	0.191
Waist circumference (cm)	75.6±9.4	74.0±8.7	75.3±9.3	-2.027	**0.043**
Hip circumference (cm)	96.5±8.1	95.7±6.5	96.3±7.8	-1.234	0.218
Waist/hip ratio	0.78±0.07	0.77±0.07	0.78±0.07	-1.667	0.096
Waist/height ratio	0.45±0.05	0.44±0.04	0.45±0.05	-1.833	0.067

*Student's t-test, significance at p<0.05.

There was no statistically significant difference between body weight, height, BMI, HC, WHR and WHtR according to meal skipping status ($p>0.05$). There was statistically significant relationship between the meal skipping status and the mean WC (cm) of the participants ($p=0.043$).

Discussion

This study was planned and conducted in order to evaluate anthropometric risk parameters regarding nutrition-related chronic diseases and meal habits in university students according to gender. In this study, BMI, WHR and WHtR were assessed among 898 university students. Anthropometric measurements are important in determining nutritional status because they are indicators of protein and fat storage. In practice, BMI is frequently used in the assessment of body weight and it is a useful and simple method for determining obesity. A study conducted on 382 university students showed that 24.87% of women and 33.53% of men had body weights above normal, according to their BMI values (17). In another study conducted on 424 university students, 78.6% of the students were normal and 18.0% were above normal, according to their BMI values (18). Also in another study conducted on 1271 university students, it was observed that 86.5% of the students had a normal BMI (19). In a study conducted on medical faculty students, 19.7% were above normal, according to their BMI values (20). A crosssectional study among undergraduate students at the University of Barcelona, Spain showed that 83.3% of the students were normal weight, 9.4% were underweight and 7.3% were overweight or obese (21).

In our study, 74% of the students (75.7% of females and 71.1% of males) had a normal BMI. According to BMI group 11.7% of females and 26.5% of males were overweight or obese. According to the results of the "Turkey Chronic Diseases and Risk Factors" study conducted by the Ministry of Health, 22.1% of males and 19.9% of the females were found to be overweight and obese between the ages of 15-24 in our country (22).

Body fat distribution is an important indicator of health risk associated with obesity. WC and WHR are important indicators of abdominal obesity. Abdominal obesity is a high risk factor for hypertension, type II diabetes, hyperlipidemia and coronary artery disease. In this study, the prevalence of the participants at risk according to WC was 4.7% in men and 3.2% in women for abdominal obesity. In a study conducted among medical faculty students, obesity rates according to WC were found to be 5.8% in girls and 8.0% in boys (20).

In another study conducted on 506 university students; the prevalence of abdominal (central) obesity was 5.0% (1.3% in men and 8.4% in women) based on WC and 20% (12.3% in men and 26.5% in women) based on WHR (23). In this study, the prevalence of abdominal obesity was found 19.0 % (14.8% in men and 32.7% in women) of the participants based on WHR. The results were similar to those obtained in our study.

According to Turkey Nutrition and Health Research data, normal WHtR ratio (0.4-0.5) show a distribution between 20.0-39.2% in men and 19.0-29.1% in women. WHtR increases with age. In addition, as WHtR increases, the risk of chronic disease increases. It is lowest in the 19-30 age group and highest in the 65 and over age group (10). WHtR is more sensitive than BMI as an early warning of health risks. It is significantly associated with all risk factors for obesity and metabolic syndrome. It is stated that it can predict morbidity and mortality, often better than BMI (24). In this study, abdominal obesity was found in 13.1% of the participants according to WHtR cut-off degree (WHtR >0.5).

The start of college is characterized by a variety of life changes, such as moving away from the family home and having more responsibilities. This change can affect lifestyle and eating habits. Accordingly, this population tends to have certain eating habits that increase their tendency to gain weight, including: skipping meals, snacking, and eating larger portions (21).

The number of meals is important in adequate and balanced nutrition. In this study, 57.2% of the students have 3 main meals, 17.2% of them have 3 snacks. 82.5% of students skipped meals. Skipping meals is quite common among university students. A study of 503 university students conducted in Lagos State, Nigeria showed that less than one third (31.0%) of university students' ate three daily meals (23). In another study, the rate of skipping breakfast among those who skipped meals was 42.7% (5).

In various studies conducted among university students in Turkey, show that carbohydrate-based food consumption is common, and skipping meals is very high. The frequency of meal skipping varies between 48-96% (18, 19, 25-28).

A systematic review reported that meal skipping rates among youth aged 18–30 ranged from 5% to 83%. Breakfast skipping rates ranged from 14-89%, lunch skipping rates ranged from 8-57%, and dinner skipping rates ranged from 5-47% (1).

The transition to university life represents a critical period marked by significant

changes in lifestyle and behavior, including those related to nutrition and health. University students, often living independently for the first time, are confronted with new challenges in managing their diet and nutrition, potentially impacting their health and academic performance (29, 30).

Research shows that young adults have poor eating behaviors, frequently skipping meals and not eating regular meals. Gender was the most frequently assessed correlate of skipping meals. Studies have found that men are more likely to skip breakfast, while women are more likely to skip lunch or dinner (1).

In a study investigating the effect of skipping meals on BMI in university students, it was determined that students' skipping meals was related to BMI classification (24). One study showed that the number of meals was positively associated with obesity and overweight. Another study showed that higher main meal and snack frequency increased the likelihood of overweight/obese and central obesity among US adults (5).

Different anthropometric indices have been developed in defining obesity. In similar studies investigating some anthropometric indicators of university students, BMI, WC, WHR are emphasized as health risk predictors (31, 32). A lower WHR is associated with a lower risk of cardiovascular disease and other obesity-related health problems, indicating a healthier body fat distribution. A study of Southern Nigerian University Undergraduate students suggests that there are notable gender differences in health risk distribution. This highlights the importance of gender-specific health interventions (31).

In our study, there was statistically significant relationship between the number of main meals consumed by the participants and meal skipping status according to gender. Although there was not statistically significant relationship between BMI and skipping meal status. There was statistically significant relationship between the meal skipping status and the mean WC (cm) of university students. This result is important because waist circumference is an indicator of central obesity. Healthy body weight can be maintained when adequate and regular meal habits are provided.

Conclusion

In conclusion, the findings of our study showed that the prevalence of abdominal obesity according to WC was higher than general obesity according to BMI among university students. Our study additional delineates an elevated WC among male students and those who frequently omitted meals, underscoring the influence of irregular meal patterns on students'

anthropometric parameters. Poor eating habits emerge as an important factor contributing to nutrition-related chronic diseases among university students. By identifying the critical relationship between meal habits, gender disparities, and obesity indices among university students, this study provides a clear direction for health promotion strategies. Developing healthy meal habits in university students may increase the likelihood of individuals maintaining this behavior later in their lives. Emphasizing the cultivation of healthy eating behaviors among university students is crucial, as it not only addresses immediate health concerns but also sets the stage for sustained beneficial practices throughout adulthood. Future studies might explore the efficacy of tailored nutritional education programs, digital health initiatives, or campus-wide policy changes aimed at improving the availability of healthy food options. Moreover, investigating the long-term outcomes of early dietary interventions on adult health behaviors will be crucial in understanding the best approaches to instigating lasting change.

Ethical considerations

Necessary permissions and "Ethical Commission Approval" were obtained from the Firat University (Elazig, Turkey) before conducting the study (decision dated and numbered 13/06/2018-04-04). Participating students were informed about the study and their verbal consent was obtained.

Limitations

The present study has a number of limitations. Firstly, we could only assign the relations not the causal connection between variables. Secondly, the results should not be generalized to the entire country. It is only carried out on university students from central Elazig, Turkey. The participation of students from every department in the university could not be ensured. Thirdly, since it is predicted that the nutritional habits of students living in dormitories will differ from those living at home with their families, the effect of this situation could not be eliminated.

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Conflict of Interest Statement

The authors declare no conflict of interest.

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