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Examination of Eating Patterns, Sleep Quality, and Anxiety among Normal-Weight and Overweight Female Students in Shiraz, Iran

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ABSTRACT

Background: Obesity has become a common health problem, and its prevalence has been increasing worldwide. The present study aimed to determine whether factors such as sleep quality, mental health status, and eating patterns are different between normal-weight and overweight/obese students in Shiraz University of Medical Sciences, Shiraz, Iran.

Methods: In a case-control study, 33 overweight/obese and 101 normal-weight students were enrolld that served as case and control groups, respectively. Anthropometric measurements, eating patterns, sleep quality, and psychological mood disorders were evaluated and compared to the control group.

Results: There were no significant differences between groups regarding sleep quality scores. Although students with a body mass index (BMI)>25 showed higher depression, anxiety, and stress scores, but these differences were not statistically significant between the groups. There was no significant difference in relation to physical activity between the two groups. Besides, dietary habits were almost similar in both groups, and there was no significant difference between normal-weight and overweight/obese females regarding dietary habits and meal patterns.

Conclusion: There was no significant difference in sleep quality, depression, anxiety, and stress scores among normal-weight and overweight female students. Moreover, physical activity level and dietary habits, including meal patterns, were comparably similar between the two groups. This indicates a lack of correlation between weight status and the psychological and behavioral variables examined in this population.

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Introduction

Globally, overweight and obesity are major public health concern, and it was shown that approximately one-third of the world's population is currently overweight or obese and that more than 60% of those with obesity live in developing countries (1). It has been proven that obesity increases the risk of type 2 diabetes, coronary heart disease, hyperlipidemia, high blood pressure, and breast cancer (2). There are many factors involved in the etiology of obesity, including genetic, hormonal, social, and environmental influences such as a sedentary lifestyle and poor diet (3). Diet plays a crucial role in preventing obesity. Currently, food-based dietary recommendations emphasize a healthy diet, defined by increased consumption of fruits and vegetables and reduced intake of high-fat foods to promote better health (4). It was documented that worldwide dietary patterns have changed significantly that can influence the obesity prevalence (3). It was found that a prudent dietary pattern (healthy diet) is associated with a lower risk of overweight or obesity, as well as a reduced risk of central obesity and metabolic syndrome (4). Patterns of physical activity, including sedentary behavior, are also related to weight change and have an important influence on the physiological regulation of body weight (5).

Sleep patterns and quality are among the lifestyle factors influencing obesity in both children and adults. Previous studies have identified a substantial relationship between sleep disorders and higher body mass index (BMI) (6). A review study revealed a U-shaped correlation between sleep duration and BMI, suggesting that both excessive and insufficient sleep can be harmful (7). A recent cross-sectional study illustrated that overweight and obese individuals are 12.6% and 15.2% more likely, respectively, to have a short sleep duration than normal-weight individuals (8). Poor sleep can negatively impact glucose regulation, inflammatory markers, and appetite-regulating hormones and lead to an increase in food intake. Short sleep duration is also associated with increased appetite, irregular eating habits, reduced physical activity, and lower intake of fruits and vegetables (9). Additionally, obesity is reported to be associated with mental health issues including anxiety, stress, depression, sleep behavior, dietary intake, and mental health (10). A cross-sectional study has focused mainly on depression; while many researchers have found a positive relationship, and some have observed either an inverse or null association. Other mental health conditions also appear to be linked to obesity, including anxiety and mood disorders (11). Based on this background, although some studies have examined the relationship between sleep quality, anxiety, and obesity, the results are not entirely consistent. Therefore, the present study aimed to determine whether factors such as sleep quality, mental health status, and eating patterns differ between normal-weight and overweight/obese individuals.

Materials and Methods

This case-control study was conducted on 134 female students (aged 18 to 30 years) residing in dormitories at Shiraz University of Medical Sciences, Shiraz, Iran. The sample size was determined based on the results of a study by Matuska *et al.* (12), assuming a mean difference of 3.6 in sleep quality scores between normal weight and overweight individuals. Inclusion criteria were absence of any severe diseases or symptoms of severe diseases, no history of metabolic or psychological diseases, not being on a special diet, not being pregnant, and not taking any medications. The subjects were divided into case (n=33) and control (n=101) groups. The case group consisted of students with a BMI in the overweight or obese range (BMI≥25), while the control group included students with a normal weight (BMI=18.5-24.9). A random cluster sampling method was used to recruit participants from various university dormitories. A written informed consent was obtained from all participants after explaining the study's purpose and the confidentiality of the data. The Ethics Committee of Shiraz University of Medical Sciences approved the study protocol (Code: 98-01-21-19955).

Demographic information, such as age and major, was recorded for each participant. Participants' weight was measured using a digital scale (Seca, Hamburg, Germany) with light clothing and no shoes, to a precision of 0.1 kg. Height was also measured using a Seca stadiometer to the nearest 0.1 cm. BMI was calculated as weight (kg)/height^2 (m). Waist circumference (WC) was measured at the midpoint between the lowest rib and iliac crest to the nearest 0.1 cm, using a non-stretchable tape measure. The waist-to-height ratio was also calculated. The Pittsburgh Sleep Quality Index (PSQI) questionnaire was used to measure students' sleep patterns. The PSQI as a standardized self-rated questionnaire consisted 19 questions that generated seven component scores over the last 30 days including subjective sleep quality, sleep latency, sleep duration, use of sleeping medication, habitual sleep efficiency, sleep disturbances, and daytime dysfunction. The sum of the component scores produced a global score ranging from 0 to 21. Individuals with total PSQI scores of ≥5 were classified as having severe sleep problems (13). The reliability and validity of the PSIQ questionnaire were examined as described by Farrahi *et al.* (14). Based on results obtained in 2012, the Persian version of this questionnaire had appropriate psychometric properties for assessing sleep quality in both clinical and research settings (14).

The DASS (Depression, Anxiety, and Stress Scale) as a commonly test to detect mental health issues was used in this study. The DASS-21 as a short form of the DASS questionnaire was utilized as a standard tool to assess the severity of distress. The reliability and validity of both the DASS and DASS-21 have been confirmed in clinical and non-clinical adult samples (15). This self-report tool included 21 items (7 per scale) that evaluated three constructs including depression, anxiety, and stress. Students scored each item on a Likert scale from 0 to 3 (0=never a problem, 1=sometimes a problem, 2=often a problem, and 3=almost always a problem). The total score was calculated by summing the scores of each subscale. Furthermore, the DASS scoring manual provided cut-off scores for identifying normal scores (0-4 for depression, 0-3 for anxiety, and 0-7 for stress), mild (5-6 for depression, 4-5 for anxiety, and 8-9 for stress), moderate (7-10 for depression, 6-7 for anxiety, and 10-12 for stress), severe (11-13 for depression, 8-9 for anxiety, and 13-14 for stress), and extremely severe scores (>14 for depression, >10 for anxiety, and >17 for stress) (16).

Physical activity (PA) was measured using the International Physical Activity Questionnaire based on metabolic equivalents (METs), which included nine levels, ranging from sleep and rest (MET=0.9) to intensive physical activity (greater than MET=6). The MET was defined as the energy cost of sitting quietly and is equal to 1 kcal/kg/hour of caloric consumption (17). A previous study in Europe has used this questionnaire, and its validity has been confirmed through comparisons with self-reported daily physical activity and the CSA (Computer Science Application) accelerometer. The validity and reliability of this questionnaire in Iran have also been confirmed by Klishadi *et al.* in a study involving adolescents (18).

The number of meals and snacks per day and consumption of different food groups and fast food or restaurant foods were assessed as described before (19). Participants were asked how many servings they consumed in a typical day, week, or month for each of the food items of fruits, vegetables, dairy products, red meat, poultry, fish, fast food, dining out, canned foods, fried foods, and salt. Additionally, the frequency of meal intake was evaluated by asking how many times per week, the participants consumed breakfast, lunch, dinner, and snacks, with possible responses such as 'never,' '1-2 times/week,' '3-4 times/week,' '5-6 times/week,' or 'every day.'

Data were analyzed using SPSS software (Version 22, Chicago, IL, USA). Descriptive statistics, along with central and dispersion indicators were used for both quantitative and qualitative variables. Continuous variables were presented as means and standard deviations (SDs), while categorical variables were presented as absolute frequencies and percentages. The Kolmogorov-Smirnov test was applied to determine the normality of the distribution of the variables. The Chi-Square test was utilized to assess differences between categorical variables. An independent t-test was employed to compare sleep quality scores, anxiety, stress, and depression between the two groups. A significance level of α=0.05 was used for hypothesis testing.

Results

In this case-control study, 33 overweight/obese students and 101 normal-weight students constituted the case and control groups, respectively. The mean age of the case and control groups was 22.04±4.10 years and 20.68±1.65 years, respectively. As shown in Table 1, significant differences were observed in weight, BMI, WC, and waist-to-height ratio between the two groups. The average scores for sleep quality and its subscales were presented in Table 2. The total sleep quality scores for the case and control groups were 6.27±2.81 and 6.69±2.86, respectively. There were no significant differences between the groups forn total scores (p=0.338). Also there were not any difference regarding the subscale scores. Although the percentage of participants in the case group that were identified with poor sleep quality was higher than that in the control group (66.7% versus 53.5%), and the difference did not reach a statistically significant level.

Depression, anxiety, and stress scores for the case group were 13.39±12.03, 8.96±7.98 and 17.09±9.69, respectively (Table 2). Although students with a BMI>25 had higher depression, anxiety, and stress scores, these differences were not statistically significant between the groups. The physical activity scores were 40.12±8.51 and 39.57±8.26 MET.H in normal-weight and overweight/obese participants, respectively. Physical activity level did not differ significantly between the two groups (p=0.560, Table 2). Dietary habits of the participants for BMI were presented in Table 3; while dietary habits were similar in both groups, and there was no significant difference between normal-weight and overweight/obese females regarding dietary habits. The scores for dining out and fried foods were higher among individuals with a BMI<25, but the differences were not statistically significant between the groups. Regarding meal patterns, no significant differences were found between the two groups (Table 4). Normal-weight participants consumed more morning and evening snacks per day than overweight/obese participants, but this difference did not reach statistical significance.

Table 1: Baseline characteristics of the study participants.

Variable		BMI=18.5-24.9 (n=101)	BMI≥25 (n=33)	*P* value
Age (year)		20.68±1.65	22.04±4.10	0.163[a]
Weight (kg)		56.87±5.77	73.96±11.05	<0.001[a]
Height (cm)		162.87±4.78	160.98±4.46	0.048[b]
BMI (kg/m2)		21.43±1.78	28.54±4.96	<0.001[a]
Waist circumference (cm)		77.52±7.61	95.10±10. 42	<0.001[a]
Waist to height ratio		0.47±0.04	0.59±0.07	<0.001[a]
Major	Nutrition	11 (13.9)	4 (17.4)	0.740[c]
	Other majors	68 (86.1)	19 (82.6)	

Data were presented as number (%) or mean±standard deviation. BMI: Body mass index. [a]Mann-Whitney test. [b]Independent samples test. [c]Fisher's exact test. P values less than 0.05 were considered to indicate statistical significance.

Table 2: Sleep quality and DASS by BMI category.

Variable		BMI=18.5-24.9 (n=101)	BMI≥25 (n=33)	*P* value
Subjective sleep quality		1.12±0.71	0.96±0.63	0.335[a]
Sleep latency		1.37±0.78	1.24±0.75	0.510[a]
Sleep duration		1.46±0.79	1.45±1.00	0.862[a]
Sleep efficiency		13 (12.9)	7 (21.2)	0.266[b]
Sleep disturbances		1.04±0.46	1.18±0.46	0.169[a]
Use of sleep medications		9 (8.9)	5 (15.2)	0.332[b]
Day time dysfunction		0.95±1.08	1.18±1.33	0.481[a]
Total sleep quality score		6.27±2.81	6.69±2.86	0.338[a]
Sleep quality status	Good	47 (46.5)	11 (33.3)	0.184[c]
	Poor	54 (53.5)	22 (66.7)	
Depression score		9.96±8.37	13.39±12.03	0.372[a]
Anxiety score		7.92±6.98	8.96±7.98	0.490[a]
Stress score		15.79±9.07	17.09±9.69	0.605[a]
Physical activity (MET.H)		40.12±8.51	39.57±8.26	0.560[a]

Data are presented as number (%) or mean±standard deviation. [a]Mann-Whitney U test. [b]Fisher's exact test. [c]Chi-squared test. P values less than 0.05 were considered to indicate statistical significance.

Table 3: Dietary habits of the participants by BMI group.

Variable	BMI=18.5-24.9 (n=101)	BMI≥25 (n=33)	*P* value
Fruits (serving/day)	1.81±1.49	1.72±0.91	0.860[a]
Vegetables (serving/day)	0.37±0.98	0.42±0.93	0.804[a]
Dairy products (serving/week)	6.09±3.34	6.15±2.69	0.598[a]
Red meat (serving/week)	2.95±1.65	3.21±1.63	0.510[a]
Poultry (serving/week)	4.28±2.36	4.72±2.58	0.275[a]
Fish (serving/week)	1.24±1.34	1.60±1.53	0.256[a]
Fast food (n/month)	3.32±2.78	4.67±6.13	0.432[a]
Eating out (n/month)	4.50±8.28	2.91±2.82	0.958[a]
Canned foods (n/month)	1.87±1.75	1.36±1.47	0.171[a]
Fried foods (n/month)	12.43±8.96	10.33±7.51	0.286[a]
Do you usually salt your food at the table? (yes)	31 (30.7)	13 (39.4)	0.355[b]

Data are presented as number (%) or mean±standard deviation, n=number. [a]Mann-Whitney test. [b]Chi-squared test. *P* values less than 0.05 were considered to indicate statistical significance.

Table 4: Meal patterns and night eating habits by BMI group.

Variable	BMI=18.5-24.9 (n=101)	BMI≥25 (n=33)	*P* value
Breakfast consumption (n/week)	4.54±1.77	4.88±1.76	0.435[a]
Lunch consumption (n/week)	6.87±0.71	6.88±0.69	0.820[a]
Dinner consumption (n/week)	6.63±0.88	6.42±1.48	0.709[a]
Morning snack consumption (n/week)	4.14±2.57	3.12±2.69	0.064[a]
Evening snack consumption (n/week)	4.39±2.64	3.36±2.72	0.061[a]
After dinner snack (n/week)	4.56±2.43	3.81±2.59	0.157[a]

Data are presented as number (%) or mean±standard deviation, n=number. [a]Mann-Whitney test. *P* values less than 0.05 were considered to indicate statistical significance.

Discussion

Given that obesity has become a common health problem and that its prevalence as a global epidemic is increasing in many developed and developing countries, understanding its causes is crucial (20). The present study aimed to determine whether factors such as sleep quality, mental health status, and eating patterns differred between normal-weight and overweight/obese individuals. There were no significant differences in sleep quality, depression, anxiety, and stress scores between the groups based on the results. Besides, physical activity levels did not differ significantly between the two groups. The two groups were also similar in their dietary habits and meal patterns.

PSQI has been utilized to assess sleep quality and indicated a link between sleep quality and obesity (21). A study conducted by Bidulescu *et al.* demonstrated that the global PSQI score was correlated with obesity in female African Americans but not in males (22). Additionally, a meta-analysis suggested that poor sleep quality was associated with overweight or obesity, and this association may be independent of sleep duration (23). However, the current study found no statistically significant difference between the PSQI scores of normal-weight and overweight/obese participants. The mechanisms explaining the association between sleep quality and BMI or obesity are unclear. In a study, Spiegel and colleagues found that in participants who experienced two nights of sleep restriction (four hours in bed per night) with controlled energy consumption via an intravenous glucose infusion, ghrelin (a hormone that increases appetite) levels increased (24). In contrast, leptin (a hormone that suppresses appetite) level decreased. Considerable increases in self-reported ratings of hunger and appetite were associated with these neuroendocrine changes, particularly for carbohydrate-rich foods. Moreover, it was shown that sleep restriction affected macronutrient consumption and meal frequency. Sleep restriction in adults was demonstrated to be associated with increased cravings for carbohydrate-rich foods and a higher caloric intake from carbohydrates, fats, or snacks (25).

A previous research revealed that the prevalence of psychological disorders (anxiety/depression/stress) increased with an increase in BMI (26). Also, some studies illustrated that obesity was associated with mental disorders in women, but not in men (27, 28). Several factors have been implicated in the comorbidity of obesity and depression, including severe obesity, female gender, and high socioeconomic status (SES). These factors may not cause obesity or depression, but their presence may increase the likelihood of depression in some obese individuals (29). In the present study, although students with a BMI>25 had higher depression, anxiety and stress scores, these differences were not statistically significant between groups. Some previous studies also confirmed our findings of anxiety and stress scores (30, 31). In the same vein, Pothos *et al.* conducted a cross-sectional study on 151 male and female undergraduate students using the DASS-21 questionnaire and concluded that there was no significant correlation between BMI and stress or anxiety (32). This study was similar to our findings but in a limited sample size. Maybe in larger populations, these associations can be more detectable.

A noticeable shift was shown in the dietary pattern worldwide that can play an important role in obesity epidemiology. Significant dietary changes include a high-energy-density diet with an increased role for fat and added sugars in foods, greater saturated fat intake (mostly from animal sources), major increases in animal food intake, a reduction in complex carbohydrates and dietary fiber, and a decrease in fruit and vegetable consumption (3). Though dietary factors can influence obesity development, and this association is complicated and is poorly understood (33). According to some studies, dietary patterns like western eating patterns with increased intake of soft drinks, sweets, snacks, and meat may be positively associated with obesity, while healthier dietary patterns rich in whole grains, legumes, and vegetables have favorable effects on BMI. However, the results have been contradictory (33, 34).

In a cross-sectional study, Ma *et al.* found that eating patterns were independently related to obesity, even after controlling for total energy intake and physical activity (35). Also, reports suggest that individuals who do not eat breakfast, they consume more overall daily energy intake and are more likely to be obese (35, 36). Additionally, in a systematic review study, Vilela *et al.* concluded that adherence to healthy eating patterns might prevent the transition from metabolically healthy obesity to metabolically unhealthy obesity by improving metabolic health and reducing cardiovascular disease risk and mortality from all causes (37).

No significant differences were found between the two groups for dietary habits or eating patterns in the present study. This may be due to dormitory students following the same meal plan and routine. Furthermore, no significant differences were observed for physical activity between BMI categories of the present study. This finding is consistent with other researches indicating that physical activity level and obesity prevalence are not significantly associated (17, 38). Despite this, some studies have indicated a positive correlation between BMI and physical activity (39, 40). There was a limitation in the present study regarding its limited sample size, which may have prevented the detection of differences. However, the present study used validated questionnaires to assess sleep quality and mental health, which can be considered as strengths of the study.

Conclusion

Our study revealed no significant differences in measures of sleep quality, depression, anxiety, and stress scores among normal-weight and overweight female students. Furthermore, physical activity level and dietary habits, including meal patterns, were similar between the two groups. These findings indicate a lack of correlation between weight status and the psychological and behavioral variables examined in this population.

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Authors' Contribution

MA: Conceptualization, review and editing the manuscript, methodology, investigation, consulting for data analyses and interpretation. LA: Writing the original draft, consulting for data analyses and interpretation, review and editing the manuscript, and investigation. DK: Data collection, data analyses and interpretation. AA: Data collection, data analyses and interpretation.

Conflict of Interest

None declared.

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