

Depressive Symptoms, Dietary Behaviors, and Lifestyle Factors among Female Undergraduate Students: A Cross-Sectional Study

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ABSTRACT

Background: Female university students may experience depressive symptoms due to academic, social, financial, and lifestyle pressures.

Objective: To assess depressive symptoms alongside anthropometric status, dietary behaviors, nutrient intake, and lifestyle factors among Pakistani undergraduates.

Methods: A cross-sectional study was conducted among 150 female undergraduate students aged 18–27 years. Anthropometric measurements, sociodemographic and lifestyle information, dietary habits, a 24-hour dietary recall, and Beck Depression Inventory (BDI) scores were collected. Nutrient intake was estimated using Windiet® 2005. Descriptive statistics were calculated, and Spearman rank correlations were used for ordinal/continuous associations. A multivariable linear regression model examined independent associations with BDI score. Statistical significance was set at $p < 0.05$.

Results: Mean age was 20.68 ± 1.32 years, BMI was 21.81 ± 4.41 kg/m², and BDI score was 15.83 ± 8.25 . Normal BMI was observed in 54.7% of participants, while 22.7% were underweight, 18.7% overweight and 4.0% obese. BDI score was positively correlated with meal-skipping frequency ($p = 0.248$, $p = 0.002$), stress frequency ($p = 0.308$, $p < 0.001$), and poorer self-rated mental health ($p = 0.359$, $p < 0.001$). BMI was not associated with BDI score ($p = -0.019$, $p = 0.817$). Selenium intake showed a weak inverse unadjusted correlation with BDI score ($p = -0.171$, $p = 0.037$), but this association was not retained after adjustment. The regression model explained 16.6% of the variance in BDI scores; stress and meal-skipping frequency remained significant independent correlates.

Conclusion: Depressive symptoms were associated more consistently with stress and meal-skipping behavior than with BMI or most measured dietary variables. These findings support a broader student health approach incorporating psychological well-being and regular eating patterns. Longitudinal studies with repeated dietary assessment are needed to clarify directionality and causality.

Keywords: Depression, Body Mass Index (BMI), Beck Depression Inventory (BDI), Undergraduate Students

INTRODUCTION

Depression is a major mental health disorder characterized by persistent low mood, loss of interest or pleasure, and a range of associated cognitive, behavioral, and physical symptoms. It can affect daily functioning, academic performance, interpersonal relationships, and overall quality of life. The World Health Organization estimates that hundreds of millions of people worldwide live with depression, making it an important public-health concern and a significant contributor to disability.¹ Depression is particularly relevant during young adulthood, a developmental period in which individuals experience substantial educational, social, financial, and personal transitions. These changes may create additional psychological demands and may influence emotional well-being, health behaviors, and coping patterns.^{2,3,4}

University students may be particularly vulnerable to depressive symptoms because of academic workload, examination pressure, competitive educational environments, financial constraints, changing social relationships, uncertainty about future careers, and disruption of established lifestyle routines. Students may also

experience irregular eating patterns, inadequate sleep, reduced physical activity, and prolonged screen exposure as a consequence of academic and social demands. These factors can interact with one another and may contribute to psychological distress during university life. Evidence from Pakistan indicates a substantial burden of depressive symptoms among university students, highlighting the importance of understanding potentially associated behavioral and lifestyle factors in this population.⁵⁻⁷ A systematic review and meta-analysis of Pakistani university students reported a pooled prevalence of approximately 42.7%, although estimates varied considerably according to study setting, participant characteristics, and assessment instrument.⁸⁻¹⁰

Nutritional status and dietary behavior have also received increasing attention in relation to mental health. Food choices influence the intake of essential nutrients and may form part of broader lifestyle patterns associated with psychological well-being. Dietary patterns characterized by greater consumption of nutrient-dense foods, including fruits and vegetables, have been associated in observational research with lower depression risk,



while evidence from dietary-intervention studies suggests that improving overall diet quality may benefit depressive symptoms. Such findings have contributed to growing interest in the relationship between nutrition and mental health among young adults. However, dietary behavior is multidimensional, and associations may differ according to the specific dietary variable examined, including food-group consumption, nutrient intake, meal patterns, and overall dietary quality.¹¹⁻¹⁴

Body mass index (BMI) provides a simple and widely used measure of weight status, but BMI alone may not capture dietary adequacy, food quality, or overall nutritional behavior. Similarly, a single dietary recall provides information about reported intake on a particular day rather than long-term usual intake and may be influenced by day-to-day variation and reporting practices. Lifestyle characteristics such as physical activity, sleep duration, stress, and screen time may also be relevant when interpreting depressive symptoms and dietary behaviors. Therefore, examining dietary behaviors together with anthropometry, lifestyle factors, and depressive symptoms may provide a more useful description of the overall health profile of university students.¹⁵⁻¹⁷

Data on these relationships among female undergraduate students in Pakistan remain limited. The present study therefore examined depressive symptoms in relation to BMI, dietary behaviors, nutrient intake, stress, sleep, physical activity, and screen time among female undergraduate students at Women University Swabi, Khyber Pakhtunkhwa, Pakistan. Based on the available participant-level data, the study was framed as an observational cross-sectional analysis, with emphasis on identifying associations between depressive symptoms and selected nutritional and lifestyle characteristics rather than establishing causal relationships.

METHODOLOGY

This cross-sectional observational study was conducted among female undergraduate students at Women University Swabi, District Swabi, Khyber Pakhtunkhwa, Pakistan. The data collection was performed from May 2024 to November 2024.

A total of 150 female undergraduate students were included having age range of 18–27 years (Mean±SD; 20.68±1.32 years). Participants with known medical conditions like kidney dysfunction, diabetes, coronary heart diseases, head injury, and diagnosed psychiatric disorders were excluded from the study.

A structured questionnaire was used to record age, educational information, socioeconomic characteristics, family and living arrangements, financial difficulties, physical activity, sleep duration, screen time, meal frequency, meal skipping, fast-food intake, fruit and vegetable intake, dietary supplement use, beverage consumption, perceived stress, self-rated mental health,

and social support.

Height was measured using a Magicmad stadiometer (Model HS-210) with participants positioned according to the Frankfort horizontal plane. Weight was measured using a Camry Jumbo Digital Scale (Model BR-9707), with participants wearing light clothing and no shoes. Two consecutive readings were reportedly obtained and averaged. BMI was calculated as weight in kilograms divided by height in meters squared. BMI categories in the source dataset were underweight (<18.5 kg/m²), normal (18.5–24.9 kg/m²), overweight (25.0–30.0 kg/m²), and obese (>30 kg/m²).

Dietary intake was assessed using a 24-hour dietary recall. Participants reported foods and beverages consumed during the preceding 24 hours, including snacks and drinks, with portion sizes and preparation methods recorded. Nutrient and energy intake were analyzed using Windiet® 2005 software.

Depressive symptoms were assessed using the Beck Depression Inventory (BDI).

Statistical Package for the Social Sciences (SPSS) version 20.0 (IBM Corp., Armonk, NY, USA) was used for data entry and statistical analysis. Continuous variables are presented as mean ± standard deviation (SD), while categorical variables are presented as frequencies and percentages.

Because several behavioral variables were ordinal, Spearman rank correlation was used to examine associations between BDI score and BMI, meal-skipping frequency, stress, self-rated mental health, physical activity, sleep duration, screen time, fast-food intake, fruit and vegetable intake, and nutrient variables. A multivariable ordinary least-squares linear regression model was fitted with BDI score as the dependent variable and stress, meal skipping, sleep duration, physical activity, screen time, BMI, and selenium intake as predictors. Two-sided $p < 0.05$ was considered statistically significant.

RESULTS

Among 150 female undergraduate students, the mean age was 20.68 ± 1.32 years, mean BMI was 21.81 ± 4.41 kg/m², and mean BDI score was 15.83 ± 8.25. Normal BMI was observed in 54.7% of participants, while 22.7% were underweight and 22.7% were overweight/obese. BDI scores were significantly correlated with meal-skipping frequency ($\rho = 0.248$, $p = 0.002$), stress ($\rho = 0.308$, $p < 0.001$), self-rated mental health ($\rho = 0.359$, $p < 0.001$), and selenium intake ($\rho = -0.171$, $p = 0.037$). In multivariable regression, stress ($B = 2.264$, $p < 0.001$) and meal-skipping frequency ($B = 1.387$, $p = 0.014$) were significant independent predictors of BDI score. The model explained 16.6% of the variance (adjusted $R^2 = 0.125$).

Table 1. Participant Characteristics and Anthropometry

Parameters	Mean±SD	Range
Age, years	20.68±1.32	18–27
Height, m	1.567±0.089	1.244–1.780
Weight, kg	53.05±9.17	32–85
BMI, kg/m ²	21.81±4.41	12.27–38.46
BDI score	15.83±8.25	1–37

Table 2. Anthropometric and depressive-symptom characteristics of the study participants (n=150).

BMI category	N	%
Underweight (<18.5)	34	22.7%
Normal (18.5–24.9)	82	54.7%
Overweight (25.0–30.0)	28	18.7%
Obese (>30)	6	4.0%

Table 3. Sociodemographic Characteristics of the Study Participants (n=150)

Parameters	N	%
Age		
18-20	70	46.7
21-27	80	53.3
Marital Status		
Single	139	92.7
Married	10	6.7
Divorced	1	0.7
Ethnicity		
Pashtun	139	92.7
Punjabi and others	11	7.3
Family System		
Nuclear Family	78	52.0
Joint Family	72	48.0
Mother Education		
No formal education	44	29.3
Primary	36	24.0
Secondary	46	30.7
Graduate	20	13.3
Postgraduate	4	2.7
Father Education		
No formal education	9	6.0
Primary	32	21.3
Secondary	59	39.3
Graduate	32	21.3
Postgraduate	17	11.3
Null	1	0.7
Husband Education (if married)		
Educated	8	5.3
Uneducated	2	1.3
Null	140	93.3
Father Occupation		
Employed	109	72.7
Unemployed	40	26.7
Null	1	0.7
Mother Occupation		
Employed	12	8.0
Home maker	138	92.0
Husband Occupation		
Employed	8	5.3
Unemployed	2	1.3
Null	140	93.3
Family income		
≤ 50k	86	57.3
>50k	64	42.7

Table 4. Academic and Financial Characteristics of the Study Participants (n=150)

Parameters	N	%
Field of Study		
Sciences	101	67.3
Arts	22	14.7
Allied Sciences	27	18.0
Year of Study		
1st Year	0	0.0
2nd Year	37	24.7
3rd Year	48	32.0
4th Year	65	43.3
Are you doing any job (home tutor etc.)		
Yes	25	16.7
No	125	83.3
GPA (Grade Point Average)		
<3	29	19.3

≥3	121	80.7
Primary Source of Financial Support for Education		
Family	128	85.3
Self-financed	6	4.0
Scholarship	7	4.7
Loan	9	6.0
Do you face financial difficulties that affect your academic performance or health?		
Yes	48	32.0
No	102	68.0

Table 5. Lifestyle Characteristics of the Study Participants (n=150)

Parameter	N	%
Physical Activity		
Sedentary (little to no exercise)	85	56.7
Moderately active (exercise 1-2 times a week)	48	32.0
Active (exercise 3-4 times a week)	14	9.3
Very active (exercise 5 or more times a week)	3	2.0
Sleep Duration (on average)		
Less than 5 hours	16	10.7
5-6 hours	57	38.0
7-8 hours	65	43.3
More than 8 hours	12	8.0
Do you feel that your sleep pattern affects your mental health?		
Yes	88	58.7
No	62	41.3
Living Arrangement		
Living with family	147	98.0
Living in a hostel	3	2.0
Mode of Transportation to University		
Walking	8	5.3
University Transport	36	24.0
Public Transport	90	60.0
Own Vehicle	16	10.7
Daily Screen Time (phone/computer)		
Less than 2 hours	23	15.3
2-4 hours	61	40.7
5-7 hours	45	30.0
More than 7 hours	21	14.0

Table 6. Distribution of Participants According to BDI Severity Categories (n=150)

Depression	N	%
Up and down	41	27.3
Mild mood	46	30.7
Borderline	18	12.0
Moderate	38	25.3
Severe	7	4.7

Table 7. Mental Health and Psychosocial Characteristics of the Study Participants (n=150)

Parameters	N	%
Do you have any chronic health conditions?		
Yes	14	9.3
No	136	90.7
Do you take any regular medications?		
Yes	13	8.7
No	137	91.3
Do you have any diagnosed mental health conditions?		
Yes	7	4.7
No	143	95.3
How often do you experience stress?		
Rarely	62	41.3
Occasionally	47	31.3
Frequently	21	14.0

Almost every day	20	13.3
How would you rate your overall mental health?		
Excellent	24	16.0
Good	81	54.0
Fair	36	24.0
Poor	9	6.0
Do you feel you have sufficient social support (family, friends)?		
Yes	128	85.3
No	22	14.7

Table 8. Dietary Behaviors of the Study Participants (n=150)

Parameters	N	%
How many meals do you eat in a day?		
1	10	6.7
2	63	42.0
3	74	49.3
More than 3	2	1.3
How often do you skip meals?		
Rarely	56	37.3
Once a week	21	14.0
Few times a week	45	30.0
Almost every day	28	18.7
How often do you consume fast food?		
Rarely	66	44.0
Once a week	40	26.7
2-3 times a week	32	21.3
More than 3 times a week	9	6.0
How often do you eat fruits and vegetables?		
Rarely	28	18.7
Once a week	14	9.3
2-3 times a week	52	34.7
Almost every day	56	37.3
Do you take any dietary supplements (e.g., vitamins, minerals)?		
Yes	42	28.0
No	108	72.0
Are you on a special diet (e.g., vegetarian, vegan, keto)?		
Yes	13	8.7
No	137	91.3
How often do you consume caffeinated beverages (coffee, tea, energy drinks)?		
Rarely	45	30.0
Once a day	59	39.3
2-3 times a day	29	19.3
More than 3 times a day	17	11.3

Table 9. Energy, Macronutrient, and Micronutrient Intakes Estimated from the 24-Hour Dietary Recall

Parameters	Mean $\pm$ SD	Median (IQR)
Energy (KJ)	7495.32 $\pm$ 5634.34	6702.50 (3969.5)
Energy (Kcal)	1987.76 $\pm$ 2808.26	1597.50 (924.5)
Fat (g)	91.49 $\pm$ 123.73	71.45 (51.55)
SFA (g)	23.22 $\pm$ 53.15	12.65 (13.45)
PUFA (g)	12.89 $\pm$ 13.28	10.00 (12.5)
Monos (g)	26.48 $\pm$ 51.86	17.00 (15.525)
Prot (g)	67.31 $\pm$ 122.94	48.25 (39.775)
CHO (g)	235.07 $\pm$ 355.02	186.50 (88.375)
Sugrs (g)	59.81 $\pm$ 152.16	33.90 (44.35)
Strch (g)	172.52 $\pm$ 217.79	143.80 (81.65)
NMES (g)	38.63 $\pm$ 79.07	22.10 (35.3)
NSP (g)	13.90 $\pm$ 8.16	13.30 (9.95)
Alcoh (g)	0.00 $\pm$ 0.00	0.00 (0)
Water (g)	983.62 $\pm$ 1890.98	751.55 (433.525)
VitA (μg)	480.21 $\pm$ 913.09	338.50 (332.75)
Thiam (mg)	1.08 $\pm$ 2.18	0.86 (0.4325)
Ribof (mg)	1.03 $\pm$ 3.10	0.63 (0.525)

Niac (mg)	29.70±38.46	22.75 (17.175)
VitB6 (mg)	1.51±2.36	1.20 (0.785)
B12 (µg)	2.52±7.71	1.07 (2.9625)
Fol (µg)	156.42±297.17	114.50 (84.75)
Pant (mg)	3.36±7.06	2.35 (2.1)
Biot (µg)	26.62±80.95	15.85 (13.1)
VitC (mg)	38.20±90.49	16.20 (29.7)
VitD (µg)	3.10±19.04	0.97 (1.455)
VitE (mg)	7.62±5.67	6.20 (7.7075)
Ca (mg)	609.92±1567.14	440.50 (301.75)
Mg (mg)	265.88±379.73	228.00 (139.25)
Na (mg)	1898.19±3712.07	1447.50 (1116.25)
K (mg)	2123.87±3083.08	1778.50 (1421.5)
Cl (mg)	2882.23±5709.03	2179.50 (1666.25)
P (mg)	1136.65±2287.09	843.50 (608.25)
Fe (mg)	12.11±15.80	9.45 (7.225)
Zn (mg)	9.70±16.86	6.95 (5.9)
Cu (mg)	1.20±1.46	0.98 (0.6225)
Mn (mg)	6.45±28.02	3.70 (2.27)
Se (µg)	28.81±59.05	18.00 (18)
I (µg)	78.30±253.57	42.00 (59)
DF (g)	21.56±22.99	18.65 (10.65)
Chol (mg)	334.68±1638.73	128.50 (271.5)
Retin (µg)	212.03±863.33	66.00 (140.25)
Carot (µg)	629.23±828.73	341.50 (783)

Table 10. Energy, macronutrient, and micronutrient intakes estimated from the 24-hour recall.

Variable	Spearman ρ	p-value
BMI	-0.019	0.817
Meal-skipping frequency	0.248	0.002**
Stress frequency	0.308	<0.001**
Self-rated mental health	0.359	<0.001**
Physical activity	-0.038	0.646
Sleep duration	-0.133	0.104
Screen time	0.014	0.865
Fast-food frequency	-0.009	0.913
Fruit/vegetable frequency	-0.058	0.481
Selenium intake	-0.171	0.037*

Table 11. Spearman rank correlations between BDI score and selected anthropometric, behavioral, and dietary variables.

Predictor	B	P
Stress	2.264	<0.001**
Meal skipping	1.387	0.014*
Sleep duration	-0.971	0.237
Physical activity	-0.389	0.661
Screen time	-0.511	0.472
BMI	-0.012	0.936
Selenium	-0.015	0.192

DISCUSSION

This study assessed depressive symptoms in relation to anthropometric status, dietary behaviors, nutrient intake, and lifestyle factors among 150 female undergraduate students. The main findings were that BDI scores were significantly associated with stress and meal-skipping frequency, whereas BMI was not significantly associated with depressive symptoms. In multivariable analysis, stress and meal skipping remained independently associated with BDI score.

The mean BMI was 21.81 ± 4.41 kg/m², with 54.7% of participants having normal BMI; however, 22.7% were underweight and 22.7% were overweight or obese. Despite this variation in nutritional status, BMI was not associated with BDI score, suggesting that body size alone may not adequately reflect

factors related to depressive symptoms in this population.

The mean BDI score was 15.83 ± 8.25 , indicating the presence of depressive symptoms across the study population. This finding is relevant in the context of Pakistani university students, among whom previous systematic reviews have reported a substantial burden of depressive symptoms, although estimates vary considerably according to population and assessment method.^{18,19} Because the BDI is a self-report screening instrument and this study was cross-sectional, the findings should not be interpreted as clinical diagnoses.

Stress showed a significant positive association with BDI score ($\rho = 0.308$, $p < 0.001$) and remained independently associated in multivariable analysis ($B = 2.264$, $p < 0.001$). This finding is consistent with the recognized psychological and academic pressures experienced by university students. However, the

cross-sectional design prevents determination of directionality; stress may contribute to depressive symptoms, while depressive symptoms may also increase perceived stress.

Meal-skipping frequency was positively associated with BDI score ($p = 0.248$, $p = 0.002$) and remained significant after adjustment ($B = 1.387$, $p = 0.014$). Meal skipping may reflect irregular routines, academic demands, food insecurity, appetite changes, or psychosocial difficulties. Conversely, depressive symptoms may reduce motivation or appetite and consequently contribute to irregular eating. Therefore, this association should not be interpreted as causal.

Self-rated mental health was also significantly associated with BDI score ($p = 0.359$, $p < 0.001$). This relationship is plausible because both measures assess overlapping aspects of psychological well-being. In contrast, physical activity, sleep duration, screen time, fast-food frequency, and fruit/vegetable frequency were not significantly associated with BDI score. These findings should be interpreted cautiously because broad frequency measures may not capture important dimensions such as sleep quality, overall dietary patterns, portion sizes, or total diet quality.

Selenium intake showed a weak inverse association with BDI score in the unadjusted analysis ($p = -0.171$, $p = 0.037$), but this association was not significant after adjustment ($B = -0.015$, $p = 0.192$). Previous evidence regarding selenium status and depression has been inconsistent, with systematic reviews concluding that evidence remains insufficient to establish a clear protective role. Thus, the present finding should be considered exploratory rather than evidence of a protective effect of selenium.

The lack of a significant association between fruit/vegetable frequency and BDI score also warrants cautious interpretation. Previous systematic reviews have reported inverse associations between greater fruit and vegetable intake and depression risk. However, the present study used broad frequency categories rather than a validated dietary-quality index, which may have limited its ability to detect associations with depressive symptoms.

The multivariable model explained 16.6% of the variance in BDI scores, indicating that depressive symptoms are influenced by multiple factors not fully captured in the present analysis. Factors such as academic stress, sleep quality, family relationships, social circumstances, and previous psychological symptoms may also contribute. Future studies should incorporate these factors and use longitudinal designs to establish temporal relationships.

Overall, the findings suggest that depressive symptoms among female university students may be more closely related to psychosocial and behavioral factors, particularly stress and meal regularity, than to BMI alone. Universities may benefit from integrated approaches that combine mental-health support with practical nutrition education. However, longitudinal and intervention-based studies are needed to determine whether modifying these factors can improve psychological well-being.

Limitations

This study has some limitations. Its cross-sectional design prevents conclusions about causality, while inclusion of only female undergraduates from a single university limits generalizability. Dietary intake was based on a 24-hour recall and may be affected by recall error, skewness, and extreme values.

CONCLUSION

Among female undergraduate students in this study, depressive symptoms were common across the observed BDI categories despite a mean BMI within the normal range. BDI score was significantly associated with more frequent meal skipping,

greater stress, and poorer self-rated mental health, whereas BMI was not associated with depressive symptoms. Stress and meal-skipping frequency remained independently associated with BDI score after multivariable adjustment. Most measured nutrient variables were not significantly associated with BDI score, and the isolated unadjusted selenium association was not retained after adjustment. These findings suggest that psychosocial and behavioral factors may be more informative correlates of depressive symptoms than BMI alone in this population. Longitudinal studies using repeated dietary measurements, validated mental-health instruments, and broader psychosocial variables are recommended.

Ethical Approval

Ethical approval for the conduct of this study was obtained from the Khyber Medical University (KMU), Peshawar, Khyber Pakhtunkhwa (KP), Pakistan. The study was conducted in accordance with applicable ethical principles and institutional requirements governing research involving human participants.

Data Availability

The data analyzed in this study are available from the corresponding author upon reasonable request.

Author Contributions

Conceptualization: Nida Khan

Methodology: Nida Khan, Aleena Bibi, Arfa Anjum, Wajeeha Sarfaraz,

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All authors agree to be accountable for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Informed Consent

Informed consent was obtained from all participants before their enrollment in the study. Participants were adequately informed about the study objectives and procedures, and their privacy and confidentiality were maintained throughout the study.

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Conflict of Interest

The authors declare no conflict of interest.

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Declaration of AI-Assisted Language Editing

Grammarly AI was used for language and grammar correction. The authors reviewed and approved the final content and remain responsible for the accuracy and integrity of the manuscript.

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