JHWCR JOURNAL OF HEALTH, WELLNESS AND COMMUNITY RESEARCH 3007-0570

DOI: https://doi.org/10.61919/qhec9w25

Original Article

Comparative Analysis of Eating Patterns and Their Association with Nutritional Status Among Undergraduate Nutrition Students in Lahore, Islamabad and Faisalabad

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"Cite this Article" **Received**: 11 November 2025; **Accepted**: 22 January 2026; **Published**: 30 January 2026

Author Contributions: Concept: TF; Design: TF, SR; Data Collection: SR, MB, MA; Analysis: TF, MB; Drafting: TF, SR, MB, MA. **Ethical Approval**: Superior University, Lahore, Pakistan. **Informed Consent**: Written informed consent was obtained from all participants; **Conflict of Interest**: The authors declare no conflict of interest. **Funding**: No external funding; **Data Availability**: Available from the corresponding author on reasonable request; **Acknowledgments**: NA

ABSTRACT

Background: Eating behavior during university education is influenced by academic, social, behavioral, and environmental factors, and formal education in nutrition does not necessarily ensure consistently healthy dietary practices. Objective: This study assessed eating habits and nutritional status among undergraduate nutrition students recruited from university sites in Lahore, Islamabad, and Faisalabad and examined the associations of eating-habit status with study site and BMI category. Methods: A descriptive cross-sectional study included 359 undergraduate nutrition students selected through purposive sampling from Superior University, Lahore (n=177), Hamdard University, Islamabad (n=89), and Riphah International University, Faisalabad (n=93). Data were collected through face-to-face interviews using a structured, pre-tested questionnaire incorporating food-frequency and lifestyle items. Height and weight were assessed for BMI calculation, and participants were classified using Asian BMI categories. Categorical associations were evaluated using the chi-square test with statistical significance set at $p \leq 0.05$. Results: Participants had a mean age of 21.52±2.08 years, and 71.0% were female. Normal BMI was observed in 44.8%, while 22.0% were underweight and 33.1% were overweight or obese. Overall, 57.9% had poor, 39.6% moderate, and 2.5% healthy eating habits. Poor eating habits were most frequent at the Faisalabad site (72.0%), compared with Lahore (54.2%) and Islamabad (50.6%). Eating-habit status differed significantly across study sites ($\chi^2=16.401$, df=4, p=0.003) but was not significantly associated with BMI category (p=0.549). Conclusion: Unhealthy eating habits were common among undergraduate nutrition students and differed significantly across the participating university sites, whereas eating-habit classification was not associated with BMI category. The findings support greater emphasis on practical behavior-oriented approaches to healthy eating within university nutrition education. Keywords: Eating habits; nutritional status; body mass index; nutrition students; dietary behavior; university students.

INTRODUCTION

Nutritional status reflects the balance between nutrient intake, physiological requirements, and the broader behavioral and environmental factors that influence energy consumption and expenditure. University students represent a population undergoing substantial changes in daily routine, autonomy, academic workload, sleep, physical activity, and food choice, all of which can influence dietary behavior and body composition. Studies among university populations have linked nutritional status with lifestyle characteristics, body dissatisfaction, academic stress, meal patterns, and sedentary behavior, indicating that student nutrition is determined by more than nutritional knowledge alone (1–3).

Students enrolled in nutrition and health-related disciplines are generally expected to possess greater awareness of healthy dietary principles, but improved knowledge does not necessarily translate into consistent dietary practice. Research among university students has shown that nutritional knowledge may coexist with irregular meals, suboptimal food choices, and unhealthy lifestyle behaviors (4). Similar findings have been reported among undergraduate nutrition students in Lahore, where unhealthy eating patterns and variations in nutritional status were observed despite formal training in human nutrition, while assessments of dietary knowledge, attitudes, and practices among other university populations have likewise demonstrated discrepancies between awareness and actual eating behavior (5,6). These findings suggest that dietary behavior among students is influenced not only by knowledge but also by behavioral, academic, social, and environmental factors.

Meal skipping, convenience-food consumption, sedentary behavior, and imbalanced nutrient intake are recurring concerns among university populations in South Asia. Breakfast skipping has been reported frequently among university students in Bangladesh, with sociodemographic and lifestyle characteristics influencing this behavior (7). Pakistani studies have similarly identified both undernutrition and excess body weight among undergraduate populations, illustrating the coexistence of different forms of malnutrition within young adult groups (8,9). This dual burden is particularly relevant during early adulthood because dietary and lifestyle practices established during university years may persist beyond graduation and influence longer-term health behavior.

Evidence from Pakistan remains heterogeneous because most studies have been conducted within individual institutions, specific academic disciplines, or single geographical settings. Previous work in Lahore has documented dietary and nutritional concerns among undergraduate nutrition students, while studies conducted among medical and other university populations in Punjab and elsewhere have demonstrated variation in nutritional status and its potential socioeconomic and behavioral correlates (5,10). Consequently, findings from a single university may not adequately describe the eating patterns of nutrition students studying in different institutional and geographical contexts.

A multisite assessment can therefore provide useful comparative evidence regarding whether dietary behavior and nutritional status differ across university settings. The present study aimed to assess eating habits and nutritional status among undergraduate nutrition students recruited from universities located in Lahore, Islamabad, and Faisalabad and to examine the association of eating-habit status with study site and body mass index (BMI). By focusing specifically on students receiving formal education in nutrition, the study also provides evidence relevant to the broader question of whether professional nutritional training is accompanied by consistently healthy dietary behavior (4,5).

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted over a three-month period following ethical approval among undergraduate nutrition students recruited from three university sites in Pakistan: Superior University, Lahore; Hamdard University, Islamabad; and Riphah International University, Faisalabad. The study included 359 participants, comprising 177 students from Lahore, 89 from Islamabad, and 93 from Faisalabad. The recruiting institution defined the study site for comparative analyses; therefore, the Lahore, Islamabad, and Faisalabad groups represented the participating university sites rather than independent population-based samples of the respective cities.

Undergraduate students enrolled in nutrition-related degree programs were eligible to participate irrespective of sex. Students with diagnosed medical conditions were excluded, as were individuals who declined participation or otherwise did not satisfy the study eligibility criteria. Participants were selected using purposive sampling. The target sample size was 359, calculated using a 95% confidence level and a 5% margin of error.

Data were collected through face-to-face interviews using a structured, pre-tested questionnaire incorporating food-frequency items and questions addressing dietary habits, lifestyle characteristics, and relevant participant characteristics. Eating-habit status was categorized for analysis as poor, moderate, or healthy according to the questionnaire-based classification used in the study. Sociodemographic information included sex, socioeconomic status, study site, and self-reported intolerance or allergy. Dietary and lifestyle characteristics were considered explanatory variables, while BMI and the resulting nutritional-status categories were assessed as principal nutritional outcomes.

Anthropometric assessment included body weight, height, BMI, and waist circumference. BMI was calculated as body weight in kilograms divided by the square of height in metres. Participants were categorized according to the Asian BMI classification applied in the study as underweight (<18.5 kg/m²), normal weight (18.5–22.9 kg/m²), overweight (23.0–24.9 kg/m²), obese I (25.0–29.9 kg/m²), obese II (30.0–34.9 kg/m²), or obese III (≥35.0 kg/m²). The use of lower BMI action thresholds in Asian populations reflects evidence that metabolic and adiposity-related health risks may occur at comparatively lower BMI values than in some other populations (11).

Data were analyzed using IBM SPSS Statistics. Continuous variables were summarized using mean and standard deviation together with observed minimum and maximum values, while categorical variables were presented as frequencies and percentages. The chi-square test of independence was used to examine the association between eating-habit status and study site and between eating-habit status and BMI category. Statistical significance was defined as $p \leq 0.05$. The previously reported numerical Pearson correlation between study site and eating-habit category was not retained because study site is a nominal categorical variable and its arbitrary numerical coding does not provide a meaningful basis for Pearson correlation.

Ethical approval was obtained from the Superior University Ethical Review Committee. Written informed consent was obtained from all participants before data collection, and participation was voluntary.

RESULTS

A total of 359 undergraduate nutrition students were included in the analysis. Females represented 71.0% (n=255) of the sample and males 29.0% (n=104). The Lahore study site contributed 177 participants (49.3%), Islamabad 89 (24.8%), and Faisalabad 93 (25.9%). Most participants belonged to the middle socioeconomic category (86.6%), whereas 7.0% and 6.4% belonged to the lower and upper socioeconomic categories, respectively. Eighteen participants (5.0%) reported an intolerance or allergy.

Table 1. Sociodemographic Characteristics of Study Participants (n=359)

Variable	Category	n	%
Sex	Male	104	29.0
	Female	255	71.0
Study site	Lahore	177	49.3
	Islamabad	89	24.8
	Faisalabad	93	25.9
Socioeconomic status	Lower	25	7.0
	Middle	311	86.6
	Upper	23	6.4
Self-reported intolerance/allergy	Yes	18	5.0
	No	341	95.0
Reported intolerance/allergy category[a]	Lactose intolerance	7	1.9
	Wheat intolerance	9	2.5
	Dust allergy	1	0.3
	Pollen allergy	1	0.3
	Soybean allergy	1	0.3

[a] Percentages for individual categories are calculated using the total sample (n=359). The listed category counts sum to 19, whereas 18 participants reported an intolerance/allergy; therefore, these categories

should not be interpreted as mutually exclusive participant totals. The listed intolerance/allergy categories accounted for 19 reported category counts, including wheat intolerance (n=9), lactose intolerance (n=7), and one report each of dust, pollen, and soybean allergy (Table 1).

The mean age of participants was 21.52 ± 2.08 years, with an observed range of 17–32 years. Mean body weight was 57.05 ± 10.45 kg and mean height was 162.57 ± 9.02 cm. Participants had a mean BMI of 22.68 ± 3.92 kg/m², while mean waist circumference was 74.14 ± 9.03 cm. The corresponding observed ranges were 36–89 kg for weight, 126–187 cm for height, 12.80–37.00 kg/m² for BMI, and 50–100 cm for waist circumference (Table 2; Figure 1).

Table 2. Anthropometric Characteristics of Study Participants (n=359)

Variable	Mean ± SD	Minimum	Maximum
Age (years)	21.52 ± 2.08	17	32
Weight (kg)	57.05 ± 10.45	36	89
Height (cm)	162.57 ± 9.02	126	187
BMI (kg/m²)	22.68 ± 3.92	12.80	37.00
Waist circumference (cm)	74.14 ± 9.03	50	100

Abbreviations: BMI, body mass index; SD, standard deviation

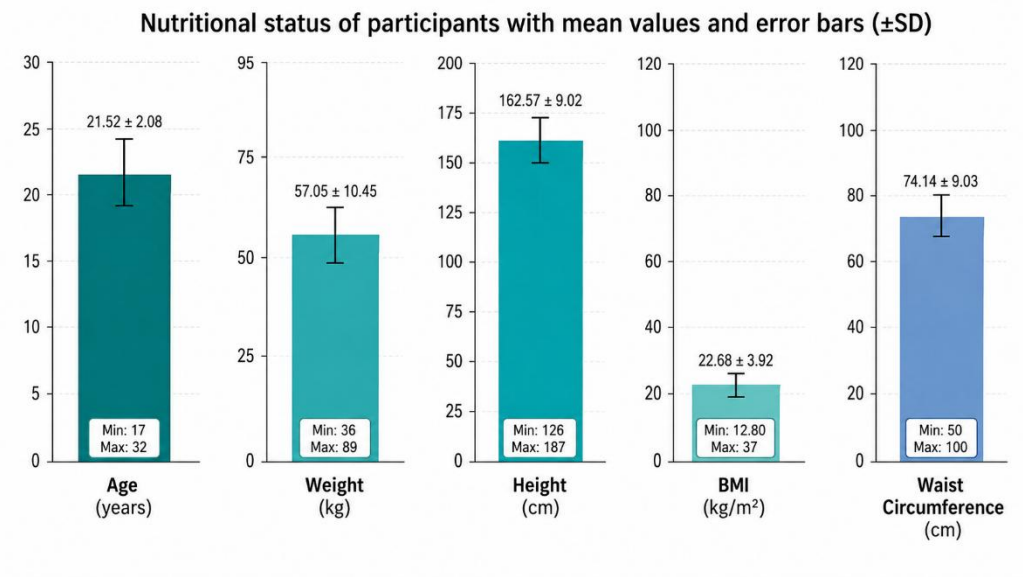

Figure 1. Anthropometric and nutritional characteristics of study participants. Bars represent mean values for age, body weight, height, BMI, and waist circumference, with error bars representing ±1 SD. Minimum and maximum observed values are displayed within each panel.

BMI classification demonstrated substantial variation in nutritional status. Normal BMI was observed in 161 participants (44.8%), whereas 79 (22.0%) were underweight. Fifty-five participants (15.3%) were overweight, 50 (13.9%) were classified as obese I, 13 (3.6%) as obese II, and one (0.3%) as obese III. Overall, 119 participants (33.1%) were overweight or obese, demonstrating the coexistence of underweight and excess body weight within the study population (Table 3).

Table 3. Distribution of Participants According to BMI Category (n=359)

BMI (kg/m²)	Classification	n	%
<18.5	Underweight	79	22.0
18.5–22.9	Normal	161	44.8
23.0–24.9	Overweight	55	15.3
25.0–29.9	Obese I	50	13.9
30.0–34.9	Obese II	13	3.6
≥35.0	Obese III	1	0.3
Total		359	100.0

BMI, body mass index.

Eating-habit status varied across the three participating university sites. Poor eating habits were observed in 96 of 177 participants in Lahore (54.2%), 45 of 89 in Islamabad (50.6%), and 67 of 93 in Faisalabad (72.0%). Moderate eating habits accounted for 41.2%, 49.4%, and 26.9% of participants at the Lahore, Islamabad, and Faisalabad sites, respectively. Healthy eating habits were uncommon, occurring in eight participants in Lahore (4.5%), none in Islamabad, and one in Faisalabad (1.1%). Overall, 208 participants (57.9%) had poor eating habits, 142 (39.6%) had moderate eating habits, and only nine (2.5%) were classified as having healthy eating habits (Table 4).

The distribution of eating-habit categories differed significantly across study sites (χ^2=16.401, df=4, p=0.003). The corresponding Cramér's V was 0.151, indicating a small magnitude of association between study site and eating-habit status. Because each city was represented by a different university, this finding represents a study-site association and should not be interpreted as an independent geographical or city effect.

Table 4. Eating-Habit Status According to Study Site (n=359)

Study site	Poor, n (%)	Moderate, n (%)	Healthy, n (%)	Total, n
Lahore	96 (54.2)	73 (41.2)	8 (4.5)	177
Islamabad	45 (50.6)	44 (49.4)	0 (0.0)	89
Faisalabad	67 (72.0)	25 (26.9)	1 (1.1)	93
Total	208 (57.9)	142 (39.6)	9 (2.5)	359

Chi-square test: χ^2=16.401, df=4, p=0.003; Cramér's V=0.151. Percentages within individual study-site rows are calculated using the corresponding site denominator.

Finally, eating-habit status was not significantly associated with BMI category (p=0.549). Thus, although dietary-behavior categories differed across participating study sites, the available analysis did not demonstrate a statistically significant relationship between eating-habit classification and BMI category.

DISCUSSION

This multisite cross-sectional study identified a substantial burden of unhealthy eating behavior among undergraduate nutrition students, with 57.9% classified as having poor eating habits and only 2.5% meeting the study criteria for healthy eating habits. Nutritional status was also heterogeneous: although 44.8% of participants had a normal BMI, 22.0% were underweight and 33.1% were overweight or obese. Eating-habit status differed significantly across the three participating university sites, whereas no statistically significant association was observed between eating-habit category and BMI. These findings indicate that unhealthy dietary behavior can coexist with both low and elevated BMI and that variation in eating behavior across the participating settings cannot be interpreted solely through body-weight status.

The high prevalence of poor eating habits among students formally studying nutrition reinforces evidence that nutritional knowledge alone may not reliably translate into healthy dietary practice. University students may possess theoretical knowledge while continuing to experience irregular eating schedules, convenience-driven food choices, academic stress, sedentary behavior, and other lifestyle constraints that affect day-to-day dietary decisions (1–4). A study among undergraduate human-nutrition students in Lahore similarly documented unfavorable eating patterns and variable nutritional status, supporting the observation that professional nutrition education does not automatically result in optimal dietary behavior (5). Research examining nutritional knowledge among university students has likewise shown that knowledge and actual lifestyle practices may diverge, emphasizing the importance of behavioral and environmental determinants in addition to educational exposure (4,6).

The BMI distribution demonstrated a concurrent burden of underweight and excess body weight. Approximately one in five participants was underweight, whereas approximately one in three was overweight or obese according to the Asian BMI classification applied in the study. Comparable heterogeneity in nutritional status has been reported among Pakistani university populations, including

undergraduate students in Bahawalpur and nursing students residing in public-sector hostels in Peshawar (8,9). Such findings are relevant in Asian populations because adiposity-related metabolic risks may emerge at comparatively lower BMI levels, which has led to the use of lower BMI action points for risk assessment in many Asian settings (11). The simultaneous presence of underweight and excess weight within a relatively young university population therefore illustrates a dual nutritional burden rather than a single-direction problem of obesity alone.

Eating-habit status differed significantly across the participating university sites, with poor eating habits occurring in 72.0% of students recruited in Faisalabad, 54.2% in Lahore, and 50.6% in Islamabad. This finding should be interpreted as a study-site difference rather than an independent city effect, because each geographical location was represented by a different university and institutional and geographical influences could not be separated analytically. Dietary practices among university students can vary according to living arrangements, academic routines, food availability, socioeconomic circumstances, meal access, and other environmental influences (2,3,10). Accordingly, the observed site-level variation may reflect a combination of institutional and contextual factors rather than geographical residence alone.

The absence of a statistically significant association between eating-habit status and BMI category ($p=0.549$) indicates that the questionnaire-based dietary classification did not discriminate BMI categories within this sample. This finding differs from evidence from tertiary students in Port Harcourt, where meal frequency, breakfast patterns, fast-food consumption, and other eating behaviors were associated with nutritional status (12). Differences in dietary measurement, population characteristics, sampling, and BMI classification may partly account for this discrepancy. BMI is also a composite anthropometric indicator influenced by energy balance over time rather than a direct measure of current dietary quality; therefore, a broad categorical eating-habit score may not correspond closely to cross-sectional BMI classification. Research in young Spanish populations has similarly demonstrated that nutritional status occurs within a broader pattern of educational, lifestyle, and behavioral influences rather than being explained by one dietary measure alone (13).

The findings also have practical implications for nutrition education. Students training for careers in nutrition are likely to become future sources of dietary counselling and health promotion, making the translation of nutritional knowledge into sustainable personal behavior professionally relevant. Evidence from university populations suggests that educational interventions may be more effective when they extend beyond factual knowledge and incorporate behavioral skills, meal planning, self-monitoring, supportive food environments, and lifestyle modification (4,15). Campus-based nutrition initiatives may therefore benefit from combining curricular knowledge with practical behavior-change strategies while recognizing that needs can vary across institutional settings.

Several limitations should be considered when interpreting the findings. The cross-sectional design prevents determination of temporal or causal relationships between eating behavior and nutritional status. Purposive sampling limits population-level representativeness, and each city was represented by a single university, resulting in complete confounding between institution and geographical study site. Consequently, differences observed across Lahore, Islamabad, and Faisalabad cannot be attributed independently to city-level characteristics. Dietary behavior was assessed using questionnaire-based information and was therefore susceptible to recall and social-desirability bias. In addition, only nine participants were classified as having healthy eating habits, producing a highly unbalanced distribution that may have reduced the ability to detect associations involving this category. BMI provides a useful population-level anthropometric indicator but does not directly quantify body composition or dietary quality, and studies incorporating body-composition and fitness measures have shown that individuals with similar BMI values may differ in important aspects of nutritional and physical status (14).

Despite these limitations, the study provides comparative evidence from 359 undergraduate nutrition students across three university sites and demonstrates that poor dietary behavior was frequent even

within a population receiving formal nutrition education. The results support a shift from interpreting university nutrition problems primarily as deficits in knowledge toward considering the behavioral and institutional contexts in which food choices are made. Future multisite studies using probability-based sampling, validated dietary scoring instruments, detailed measures of physical activity and food environment, and multivariable analysis would help clarify the relative contributions of behavioral, institutional, and geographical factors to nutritional status.

CONCLUSION

Unhealthy eating habits were common among undergraduate nutrition students participating in this study, with poor eating-habit status affecting more than half of the sample and varying significantly across the three university sites. Nutritional status reflected a dual burden of underweight and excess body weight, while eating-habit category was not significantly associated with BMI. Because institution and geographical location were inseparable in the study design, the observed differences should be interpreted as site-level rather than independent city effects. The findings indicate that formal education in nutrition does not necessarily correspond to consistently healthy personal dietary behavior and support greater integration of practical, behavior-oriented nutrition strategies within university settings.

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