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Association between meal skipping and the double burden of malnutrition among university students

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ABSTRACT

Background: The study delves into the nuanced relationship between meal skipping and the double burden of malnutrition among university students. It addresses a critical gap in understanding how young adults' irregular dietary patterns contribute to undernutrition and overnutrition, phenomena typically studied in isolation. **Aims:** This research aimed to shed light on the broader implications of meal skipping within the context of student health and well-being. **Subjects and Methods:** The study surveyed a representative sample of undergraduate students from various academic disciplines at Lead City University in Ibadan, Nigeria, utilizing a descriptive cross-sectional approach. Detailed questionnaires were administered to assess the frequency of meal skipping, dietary habits, and associated lifestyle factors. Body mass index (BMI) and self-reported health data were also collected. Statistical analyses, including univariate and bivariate analysis, were employed to identify the nutritional status and meal patterns of the students, Principal component analysis was employed to identify the dietary patterns prevalent among the students from the food frequency questionnaire administered. **Results:** The findings reveal a significant correlation between meal skipping and the risk of undernutrition and overnutrition. Students who regularly skip meals are likely at an increased risk of undernutrition, characterized by lower BMI and potential micronutrient deficiencies, and overnutrition, indicated by higher BMI and associated health risks. This dual risk factor challenges existing perceptions of nutrition among young adults, suggesting that meal skipping can be a critical determinant of diverse and complex nutritional outcomes. **Conclusion:** The study highlights the urgent need for comprehensive nutritional strategies at university campuses, focusing on educating students about the risks associated with inconsistent eating patterns. It calls for implementing targeted interventions and policy changes to address the double burden of malnutrition, promoting healthier lifestyles, and preventing long-term health issues among university students.

Keywords: Meal Skipping, Double Burden of Malnutrition, University Students, Nutritional Status, Dietary Patterns, Public Health Interventions, Young Adult Health.

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1 Introduction

The nutritional well-being of university students is a critical but often neglected aspect of public health. This demographic, undergoing a significant life transition, faces unique challenges that can impact their dietary habits, leading to the double burden of malnutrition encompassing both undernutrition and overnutrition [1]. Double-burden malnutrition, a worldwide health concern, is defined by the

simultaneous presence of undernutrition and overweight or obesity within individuals, households, or entire populations [2]. This malnutrition is evident in young adults who may exhibit stunted growth due to nutritional deficiencies early in life and subsequently experience excessive weight gain during adulthood [3]. Undernutrition can result in hindered physical and cognitive growth while being overweight or obese heightens the risk of non-communicable diseases such as heart disease and diabetes [4,5]. This dual challenge necessitates comprehensive strategies to encourage healthy eating habits and lifestyles among young adults [6]. Addressing these issues is vital to meeting Sustainable Development Goals focused on eradicating all forms of malnutrition and ensuring health and well-being for all. The phenomenon of meal skipping, prevalent among university students, is a key factor contributing to this nutritional dichotomy [6].

Meal skipping, often due to erratic academic schedules, financial constraints, and limited food literacy, has been linked to various adverse health outcomes [7]. Irregular eating patterns can disrupt metabolic processes, increasing susceptibility to under and over-nutrition [8]. While several studies have shed light on the individual consequences of meal skipping, such as weight gain [9] and micronutrient deficiencies [10], there is a scarcity of research exploring its dual impact on under- and over-nutrition, especially in university settings.

The literature reveals that skipping meals can lead to unhealthy compensatory behaviors like overeating, poor food choices, and reliance on energy–dense, nutrient–poor snacks [11]. Paradoxically, this behavior increases the risk of obesity [5] and nutrient deficiencies [5,11]. Conversely, studies indicate that meal skipping can contribute to undernutrition through reduced calorie and nutrient intake [11-13].

This issue is particularly prevalent among university students due to lifestyle changes, financial constraints, and stress factors associated with university life [14-16]. These factors often lead to unhealthy dietary habits, such as reliance on convenience foods, meal skipping, and overeating, contributing to both ends of the malnutrition spectrum [17-19]. University students are more predisposed to the double burden of malnutrition due to several factors [14,17,20]. Transitioning to university often brings significant lifestyle changes, including dietary habits [21,22]. Limited cooking skills or access to kitchen facilities can lead to a reliance on convenience foods, often high in calories but low in nutritional value [18,22]. Financial constraints can also influence dietary choices, with students on limited budgets often opting for cheaper, less nutritious food options [15,23,24]. Furthermore, the stress and irregular schedules associated with university life can lead to irregular eating patterns and overeating [26]. Therefore, a combination of lifestyle changes, financial constraints, and stress factors contribute to the predisposition of university students to the double burden of malnutrition.

This study aims to bridge the gap in current research by examining the association between meal skipping and the double burden of malnutrition among university students. It seeks to provide a holistic view of how meal skipping contributes to under and over-nutrition in this population. By doing so, our research contributes to the burgeoning field of nutritional epidemiology and offers insights critical for developing targeted public health interventions for university students.

The study's objective was to investigate the extent of double-burden malnutrition and determine the association between the meal-skipping pattern among university students and the dietary pattern among the students. The study's novelty lies in the analytical aspect of determining the dietary pattern using cluster analysis and factor analysis to determine the patterns of consumption from the reported food items classified into 12 food groups, namely cereal, roots and tubers, legumes and nuts, vegetables, fruits, eggs, meats, fish, milk and its products, oils and fats, sweets and lastly soda. This is a more reproducible method of determining the pattern of consumption among a plethora of food items that are uncorrelated with one another.

2 Subjects and Methods

2.1 Study design

The study was a descriptive cross-sectional study design carried out among apparently healthy undergraduate students in a tertiary university in Ibadan, Nigeria. Lead City University is a private university with over 14,000 students enrolled in the university, the University is partially residential with about a third of the students residing in the hostel facility which has kitchen outlets and facilities; the school has privately operated canteens in the designated areas inside the school campus while there are numerous other food outlets outside of the school serving the university population. There are a few local markets within a 5km radius of the school premises, and supermarkets within and outside the school campus also serve the university environment. A simple random sampling using the balloting method was used to select five faculties out of the ten faculties in the university. A simple random technique was employed to select willing students from the five faculties selected; with more students recruited from the faculties that have more students so the samples could be representative of the faculty.

2.2 Sample size determination

The sample size was determined using Leslie Fischer's cross-sectional study sample size formula.

$$n = \frac{Z^2 pq}{d^2}$$

Where,

n = the required sample size

Z = 95% confidence level with a standard value of 1.96

p = estimated overall pooled prevalence of underweight and overweight among undergraduate students (30.3%) in Abeokuta, Ogun State [20].

q = 1 – p

d = margin of error = 0.05

$$n = \frac{1.96^2 \text{x } 0.30 \text{ x } 0.70}{0.05^2}$$

n = 322.56, approximately 323

325 undergraduate students participated in the study.

2.3 Data collection procedure

The research instrument for this study was an interviewer-administered questionnaire adapted from previous literature [20,27]. The questionnaire was used to collect information on undergraduate students' socio-demographic characteristics, dietary practices, and lifestyle behavior.

The researcher and trained research assistants administered the questionnaire to the students at their various faculties and collected it at the point of administration. The research assistants were trained on how to carry out anthropometric measurements accurately.

2.4 Anthropometric measurements

The anthropometric measurement of height and weight for each student was taken at the questionnaire's administration point. It was ensured that the research assistants were trained in the usage of the equipment, it was ensured that the equipment was set on a flat solid surface that was not tilting, and the readings were taken in triplicates during the process of administering the questionnaire with the average readings recorded as the final for the participant. The weight was measured using an electronic scale and recorded to the nearest 0.10 kg, while the height was measured using a mobile stadiometer and recorded in meters. The weight and height were used to calculate the Body Mass Index (BMI) for the students.

$$\text{BMI} = \frac{weight\ (kg)}{height\ (\text{m}^2)}$$

The BMI was categorized according to the WHO classification for adults:

BMI	Category
18.5kg/m²	Underweight
18.5 – 24.9 kg/m²	Normal weight
25.0 – 29.9 kg/m²	Overweight
≥ 30.0 kg/m²	Obesity

2.5 Dietary Intake Assessment

Dietary intake was assessed using an adapted food frequency questionnaire (FFQ) from similar studies conducted in similar settings. The FFQ contained different food items, classified into 12 food groups (Cereal, Root and Tubers, Legumes and Nuts, Vegetables, Fruits, Eggs, Meats, Fish, Milk and Products, Oils and Fats, Sweets, and Soda). The frequency of consumption was assessed over daily, frequently (4–6 times/week), occasionally (1 – 3 times/week), and never.

2.6 Dietary pattern assessment

Principal Components Analysis (PCA) was used to derive dietary patterns empirically. The dietary data had a Kaiser–Meyer–Olkin test value at 0.922 and Bartlett's test of sphericity at p = 0.000. The varimax orthogonal rotation was used to simplify the data interpretation [21,22]. A total of 12 factors were retained based on the screen plot (Supplementary Figure 1) and the standard eigenvalues set at >1.0, which were defined as major dietary patterns [23-25]. Absolute factor loadings above 0.40 were considered to contribute significantly to the pattern. Consequently, a 2-factor solution was obtained, with factor 1 explaining 56.78% of the variance and factor 2 explaining 8.76%; together, they explained 65.54% of the total variance (Supplementary Table 1). Dietary Pattern 1 was composed of cereal, roots and tubers, legumes, nuts and seeds, vegetables, fruits, meats, milk products, fat and oils, sweets, and beverages, while Dietary Pattern 2 was composed of vegetables, fruits, eggs, meats, fish and seafood, milk and milk products, fats and oils, sweets, spices and condiments, and beverages. Observed dietary patterns were divided into quartiles and associated with some students' characteristics.

2.7 Data Analysis

Descriptive statistics of frequency, percentages, mean, and standard deviation were used to report the results, while Chi-Square was used to determine the association between the variables. Dietary pattern was identified using factor analysis. The factor analysis was used to identify latent food groups that were consumed, and principal component analysis was used to derive hidden patterns of consumption from the factor loadings of each dietary item. Statistical data analysis used Statistical Package for Social Sciences (SPSS) version 26.0.

2.8 Ethical Consideration

This study was conducted following the guidelines in the Helsinki Declaration and performing procedures involving

human subjects/participants. Ethics approval was obtained from Lead City University Research Ethics Committee, Ibadan Oyo State, with LCU-REC/22/045 approval. Participants were informed about the purpose of the research and written informed consent was obtained from them. Confidentiality was ensured by removing all possible identifiers on the questionnaire.

3 Results

3.1 Status of Food and Nutrition Security

Table 1 presents the essential characteristics of the study participants. Most respondents are between 19 and 22 years old, with an average age of 20.4 years. Females make up nearly 70% of the respondents. The study participants are from various faculties, with the most represented as Basic Medical and Health Science (34.4%) and the least represented as Management and Social Science (9.5%). The participants are relatively evenly distributed across levels 100 to 400, with slightly fewer in level 500 (6.1%). Regarding monthly allowance, most participants (44.9%) receive less than 20,000 NGN ($48), while a smaller proportion (13.5%) receive more than 60,000 NGN ($144).

Table 2, corroborated by Figure 1, shows the nutritional status of the participants. Most students fall within the normal weight range (66.2%), with a higher percentage of males (77.6%) than females (61.2%). Underweight students comprise 15.7% of the total, with a slightly higher prevalence in females (17.2%). Overweight and obese categories represent 11.7% and 6.4%, respectively, with both categories having a higher percentage of females.

Table 3 provides an overview of the participants' dietary habits, categorized by their nutritional status (underweight, normal, overweight). The daily meals consumed do not significantly differ across nutritional statuses (p=0.658). However, meal skipping is significantly associated with nutritional status (p=0.025), with a higher percentage of normal-weight individuals skipping meals. The type of meal frequently skipped, breakfast consumption pattern, the usual meal source, snacking in-between meals habit, type of snack consumed, fast food consumption habit, soft drink consumption habit, fruit consumption habit, and vegetable consumption habit do not significantly differ across nutritional statuses. Regarding specific dietary habits, most participants consume less than three meals daily and skip meals. Breakfast is the most frequently skipped meal. Most participants do not consume breakfast daily and have a mix of home-made and purchased meals. Snacking between meals is common, with biscuits/cookies being the most consumed

Table 1. Basic characteristics of the participants

Characteristics	Frequency	Percentage (%)
Age		
≤ 15	84	25.8
19 – 22	144	44.3
23 – 26	80	24.6
≥ 27	17	5.2
Mean ± SD	20.4±3.9	
Gender		
Male	98	30.2
Female	227	69.8
Faculty		
Public Health	86	26.5
Natural and Applied Science	42	12.9
Art and Education	54	16.6
Management and Social Science	31	9.5
Basic Medical and Health Science	112	34.4
Level		
100 (Year 1)	44	13.5
200 (Year 2)	116	25.7
300 (Year 3)	72	22.2
400 (Year 4)	73	22.5
500 (Year 5)	20	6.1
Monthly Allowance		
< 20,000	146	44.9
20,000 – 40,000	98	30.2
41,000 – 60,000	37	11.4
> 60,000	44	13.5

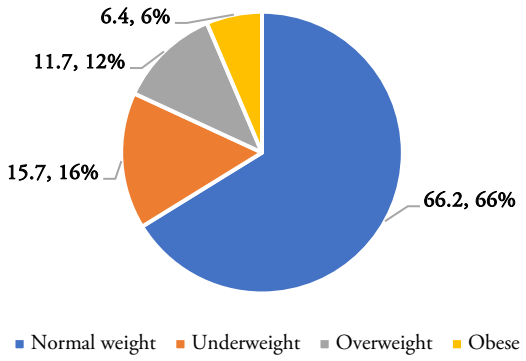

Figure 1. Nutritional status of undergraduate students

Table 2. Nutritional Status of Students

	Male (%)	Female (%)	Total (%)
Underweight	12 (12.2)	39 (17.2)	51 (15.7)
Normal	76 (77.6)	139 (61.2)	215 (66.2)
Overweight	9 (9.2)	29 (12.8)	38 (11.7)
Obese	1 (1.0)	20 (8.8)	21 (6.4)

Table 3. Dietary habits of participants

	Underweight n (%)	Normal n (%)	Overweight n (%)	Total n (%)	p-value
Number of meals consumed daily					0.658
< 3 meals	29 (15.2)	124 (64.9)	38 (19.9)	191 (100.0)	
meals per day	16 (16.7)	67 (69.8)	13 (13.5)	96 (100.0)	
> 3 meals per day	6 (15.8)	24 (63.2)	8 (21.1)	38 (100.0)	
Meal skipping					0.025*
Yes	41 (14.6)	183 (65.4)	56 (20.0)	280 (100.0)	
No	10 (22.2)	32 (71.1)	3 (6.7)	45 (100.0)	
Frequently skipped meal					0.902
Breakfast	39 (15.7)	162 (65.3)	47 (19.0)	248 (100.0)	
Lunch	11 (18.0)	42 (68.9)	8 (13.1)	61 (100.0)	
Dinner	1 (6.3)	11 (68.8)	4 (25.0)	16 (100.0)	
Breakfast consumption pattern					0.090
Daily	19 (18.8)	69 (68.3)	13 (12.9)	101 (100.0)	
Non-daily	32 (14.4)	146 (64.9)	49 (20.7)	224 (100.0)	
The usual source of meal					0.906
Home-made	14 (15.9)	56 (63.6)	18 (20.5)	88 (100.0)	
Purchased	11 (14.7)	49 (65.3)	15 (20.0)	75 (100.0)	
Both	26 (16.0)	110 (67.9)	26 (16.0)	162 (100.0)	
Snacking in-between meals habit					0.348
Yes	44 (16.2)	180 (66.4)	47 (17.3)	271 (100.0)	
No	7 (13.0)	35 (64.8)	12 (22.2)	54 (100.0)	
Type of snack consumed					0.313
Pastries	10 (11.1)	57 (63.3)	23 (25.6)	90 (100.0)	
Biscuits/cookies	34 (19.0)	118 (65.9)	27 (15.1)	179 (100.0)	
Fruits	4 (13.3)	22 (73.3)	4 (13.3)	30 (100.0)	
Locally made snacks	3 (11.5)	18 (69.2)	5 (19.2)	26 (100.0)	
Fast food consumption habit					0.836
Daily	9 (15.8)	42 (73.7)	6 (10.5)	57 (100.0)	
1 – 3 times per week	20 (15.0)	84 (63.2)	29 (21.8)	133 (100.0)	
4 – 6 times per week	9 (14.5)	41 (66.1)	12 (19.4)	62 (100.0)	
1 – 3 times per month	11 (17.2)	42 (65.6)	11 (17.2)	64 (100.0)	
None	2 (22.2)	6 (66.7)	1 (11.1)	9 (100.0)	
Soft drink consumption habit					0.744
Daily	14 (16.7)	55 (65.5)	15 (17.9)	84 (100.0)	
1 – 3 times per week	10 (13.2)	49 (64.5)	17 (22.4)	76 (100.0)	
4 – 6 times per week	18 (16.2)	75 (67.6)	18 (16.2)	111 (100.0)	
Never	9 (16.7)	36 (66.7)	9 (16.7)	54 (100.0)	
Fruit consumption habit					0.066
Daily	0 (0.0)	8 (66.7)	4 (33.3)	12 (100.0)	
– 6 times per week	5 (9.3)	37 (68.5)	12 (22.2)	54 (100.0)	
1 – 3 times per week	27 (18.6)	98 (67.6)	20 (13.8)	145 (100.0)	
Rarely	19 (16.6)	72 (63.2)	23 (20.2)	114 (100.0)	
Vegetable Consumption habit					0.272
Daily	20 (17.2)	73 (62.9)	23 (19.8)	116 (100.0)	
– 6 times per week	15 (16.9)	63 (70.8)	11 (12.4)	89 (100.0)	
1 – 3 times per week	12 (14.8)	55 (67.9)	14 (17.3)	81 (100.0)	
Rarely	4 (10.3)	24 (61.5)	11 (28.2)	39 (100.0)	

snack. Most participants consume Fast food 1-3 times per week and soft drinks 4-6 times weekly. Fruit and vegetable consumption varies, with most participants consuming fruits 1-3 times per week and vegetables daily or 4-6 times per week.

Table 4 presents the dietary patterns of undergraduate students, derived from a Principal Component Analysis. Two dietary patterns emerge: Pattern 1 is characterized by high loadings on cereal, root and tubers, legumes and nuts,

vegetables, fruits, meats, sweets, and soda. Pattern 2 is characterized by high loadings of vegetables, fruits, eggs, meats, fish, milk and products, oils and fats, sweets, and soda. The high loadings indicate that these food groups are consumed more frequently in their dietary patterns. The analysis suggests a diverse diet among the students, with some favoring a diet rich in plant-based foods (Pattern 1) while others favor a diet with more animal-based and fatty foods (Pattern 2).

Table 5 presents the association between observed dietary patterns and various student characteristics. The table is divided into two main sections, each representing a different dietary pattern. For each dietary pattern, the table provides a breakdown of student characteristics across four quartiles (Q1 to Q4), along with the total number of students and the p-value for each characteristic.

In the first dietary pattern, significant associations are observed with the level of study (p=0.029) and age (p=0.004). This suggests that these two factors may influence this dietary pattern. For instance, younger students (15-20 years old) are

Table 4. Dietary Patterns of the Undergraduate Students

Rotated Component Matrix [a]

	Dietary Pattern	
	1	2
Cereal	.765	
Root And Tubers	.831	
Legumes and Nuts	.805	
Vegetables	.709	.513
Fruits	.639	.530
Eggs		.853
Meats	.562	.546
Fish		.658
Milk and Products	.514	.624
Oils and Fats	.407	.712
Sweets	.625	.421
Soda	.612	.513

Extraction Method: Principal Component Analysis
Rotation Method: Varimax with Kaiser Normalization.
a: Rotation converged in 3 iterations.

Table 5. Association between the observed dietary pattern and some students' characteristics

	Dietary Pattern 1						Dietary Pattern 2					
	Q1	Q2	Q3	Q 4	Total	p-value	Q1	Q2	Q3	Q4	Total	p-value
Level of study												
100	0	24	18	1	43	0.029*	3	21	18	2	44	0.071
200	2	62	50	2	116		3	56	57	0	116	
300	0	39	31	2	72		1	30	37	4	72	
400	0	26	45	1	72		2	24	46	0	72	
500	0	8	9	1	18		2	7	10	0	19	
Monthly allowance												
< 20,000	1	77	64	3	145	0.211	4	56	84	1	145	0.031*
20,000 – 40,000	1	46	48	2	97		2	43	51	2	98	
41,000 – 60,000	0	18	18	0	36		2	20	14	1	37	
> 60,000	0	19	23	2	44		3	20	19	2	44	
Gender												
Male	0	49	47	2	98	0.898	3	41	53	1	98	0.811
Female	2	111	106	5	224		8	98	115	5	226	
BMI												
Healthy	1	105	103	5	214	0.650	8	92	109	5	214	0.880
Unhealthy	1	55	50	2	108		3	47	59	1	110	
Age												
15 – 20	2	87	64	2	155	0.004*	7	69	75	3	154	0.424
21 – 25	0	59	69	4	132		3	51	77	3	134	
26 – 30	0	9	18	1	28		1	14	14	0	29	
31 – 35	0	2	1	0	3		0	2	1	0	3	
Dietary Habit												
Healthy	0	59	92	6	157	0.000*	1	47	107	4	159	0.000*
Unhealthy	2	101	61	1	165		10	92	61	2	165	

* Means statistically significant; Dietary Pattern 1 was composed of cereal, roots and tubers, legumes, nuts and seeds, vegetables, fruits, meats, milk products, fat and oils, sweets, and beverages, while Dietary Pattern 2 was composed of vegetables, fruits, eggs, meats, fish and seafood, milk and milk products, fats and oils, sweets, spices and condiments, and beverages.

likelier to fall into the higher quartiles, indicating a stronger adherence to this dietary pattern. Similarly, students in their first year of study are more likely to fall into Q2 and Q3, suggesting a moderate adherence to this dietary pattern.

In the second dietary pattern, a significant association is observed with monthly allowance (p = 0.031). This suggests that students' financial resources may influence their adherence to this dietary pattern. For instance, students with a monthly allowance of less than 20,000 are more likely to fall into Q3, indicating a moderate adherence to this dietary pattern. Interestingly, both dietary patterns significantly correlate with dietary habits (p=0.000), suggesting that students' overall eating habits strongly influence their adherence to these patterns. The p-values for both Dietary Pattern 1 and Dietary Pattern 2 in relation to BMI are 0.650 and 0.880 respectively, which are greater than the commonly used significance level of 0.05. This suggests that the differences observed in the dietary patterns among individuals with healthy and unhealthy BMI are likely due to chance rather than a true difference.

4 Discussion

Transitioning from high school to university represents a critical phase marked by significant changes in dietary patterns, lifestyle habits, and nutritional status among students. Our study aimed to unravel the prevalence of double-burden malnutrition and its association with meal patterns in this demographic. Echoing findings by Sogari *et al.*, 2018 [26] and Martinez-Lacoba *et al.*, 2018 [27], most of our study participants were female, potentially reflecting the gender distribution of the university departments involved.

Regarding BMI categorization, while most students fell within the normal weight range, we observed a high prevalence of malnutrition. More than one-third were classified as underweight (15.7%) or overweight (18.1%), indicating a substantial presence of double-burden malnutrition. These results align with previous research [8,28-32], highlighting the critical nutritional challenges faced by this population. Notably, our gender-based analysis revealed higher rates of malnutrition among female students, underscoring distinct nutritional risks for men and women. This gender disparity, influenced by biological factors [33], societal norms [34], and lifestyle choices [35-37], suggests the need for targeted interventions, particularly for women.

Our findings also mirror global trends, where traditionally prevalent undernutrition in developing countries is now juxtaposed with rising overweight and obesity rates. The significant association between meal-skipping and malnutrition among students underscores this shift. The tendency to skip meals, especially breakfast and lunch, was prevalent and correlated with being underweight or overweight. This pattern of meal skipping, a common trend among university students [38-41], negatively impacts overall diet quality [42], potentially leading to depression [43], cognitive deficits [44], and chronic diet-related diseases [45-48].

The nutrition transition in Nigeria, shifting from traditional nutrient-dense snacks to sugar-sweetened beverages, is reflected in our findings. Most students consumed less than three meals daily, coupled with frequent unhealthy snacking. This dietary pattern, characterized by high consumption of energy-dense snacks and low intake of fruits and vegetables, is a common trait among university students and can lead to either undernutrition or overnutrition [46,47]. Our study identified two distinct dietary patterns among the students. The first pattern, which included a range of nutrient-dense foods, suggests healthier eating habits, while the second pattern, deficient in these foods, corroborates the high prevalence of double-burden malnutrition. This observation is consistent with previous research indicating unhealthy dietary habits among university students [49-52].

The strength of our study lies in the utilization of robust statistical techniques for dimension reduction, preserving the integrity and variation of dietary data. However, the study is not without limitations. The potential for recall bias among participants and the limited power of the study population due to sample size and representativeness are notable weaknesses that warrant consideration.

5 Conclusion

Our study sheds light on the meal-skipping pattern, the association between dietary status and meal-skipping pattern; also, and the intricate relationship between dietary patterns, nutritional status, and gender-specific challenges university students face. We identified a significant prevalence of both underweight and overweight conditions, highlighting the pressing issue of the double burden of malnutrition in this demographic. This phenomenon was especially pronounced among female students, who exhibited higher rates of these nutritional challenges than their male counterparts. Through our analysis, we discerned two distinct dietary patterns among the students. Each pattern demonstrated a unique association with the students' nutritional status, influenced by various factors, including their level of study, age, dietary habits, and monthly allowance. These findings align with existing literature and underscore the necessity for targeted nutritional interventions, especially for disproportionately affected women.

The study underscores the critical need for proactive measures such as nutritional education and the promotion of healthy eating habits. These interventions must be tailored to address the specific nutritional risks and dietary behaviors observed in the university student population.

Furthermore, our research advocates for implementing a comprehensive strategy that includes dietary modifications and the promotion of regular physical exercise. Such an approach is essential for maintaining desirable weight levels and preventing potential health issues in the future. This holistic strategy will address the immediate concerns of malnutrition and foster long-term health and well-being among undergraduate students.

In conclusion, our study contributes valuable insights to the ongoing discourse on student health and nutrition, highlighting the complex interplay of diet, gender, and nutritional status. It calls for concerted efforts from educational institutions, health policymakers, and students to implement effective strategies for improving nutritional health and overall well-being.

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