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Perceived stress and eating behavior among pharmacy students at a public university in Mozambique: a cross-sectional study

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Abstract

Academic stress is associated with eating behavior changes, but evidence from sub-Saharan Africa is still limited. This study examined the relationship between perceived stress and eating behavior among pharmacy students in Mozambique. A cross-sectional study was conducted with 40 second- and third-year pharmacy students at Lúrio University between June and July 2025. Perceived stress was assessed using the Perceived Stress Scale and eating behavior under stress was measured using the Salzburg Stress Eating Scale. Spearman's rank correlation was performed to analyze the relationship between variables. Moderate stress levels predominated (97.5%, n=39). Academic pressure was the most frequently reported stressor. Regarding eating behavior under stress, 42.5% maintained habitual intake, 40.0% reported reduced consumption, and 17.5% reported increased intake. A weak negative correlation was found between perceived stress and eating behavior (95% confidence interval: -0.530 to 0.065; p=0.110), which was not statistically significant. Perceived stress alone may not be a strong predictor of eating behavior changes in this population. Cultural factors and individual coping styles may play important mediating roles among African university students.

Key words: perceived stress, eating behavior, students, pharmacy, cross-sectional studies, Mozambique.

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Introduction

Stress is the physiological or psychological response to internal or external stressors. It involves changes affecting nearly every system of the body, influencing how people feel and behave.¹ Stressful events may either reduce or increase eating, depending on the nature and/or severity of the stressor.² Research conducted in both laboratory settings and through self-reports indicates that people's eating responses to stress vary, with factors such as gender, body weight, and eating styles – specifically restraint, emotional eating, external eating, and disinhibition – serving as important moderators in the relationship between stress and eating behavior.³ During acute stress, appetite is commonly suppressed. Chronic stress promotes wanting, seeking, and intake of highly palatable, high-fat, and energy-dense foods. Despite growing evidence on stress-eating relationships in high-income countries, a significant geographical gap exists. A recent systematic review identified limited studies examining behavioral correlates of stress among university students in sub-Saharan Africa, and a meta-analysis reported that two-thirds of African university students experienced perceived stress. One of the most reported stressors by the African university students was financial difficulties.⁴ To our knowledge, this is the first study to examine the stress-eating relationship among pharmacy students in Mozambique. Due to the lack of evidence in African contexts in

general, and particularly in Mozambique, this study aimed to analyze the influence of perceived stress on eating behavior among pharmacy students at Lúrio University. We hypothesized that higher levels of perceived stress would be associated with an increased likelihood of changes in eating behavior among pharmacy students.

Materials and Methods

Study design and setting

An observational, descriptive, cross-sectional study with a quantitative approach was conducted at the Faculty of Health Sciences of Lúrio University, Nampula province, northern Mozambique, between June and July 2025. The study followed the STROBE (The Strengthening the Reporting of Observational Studies in Epidemiology) guidelines for cross-sectional studies.⁵

Population and sample

The study population comprised undergraduate students enrolled in the pharmacy program during the academic year 2025, totaling 48 students (25 from second year, 23 from third year). Sample size was calculated using Cochran's formula for proportions, considering a 95% confidence level (CI) (Z=1.96), expected proportion p=0.5, and 5% margin of error, resulting in an initial

sample of 384 participants. Applying finite population correction for 48, the required sample was 43 participants. Proportional stratified sampling was employed, yielding 22 students from the second year and 21 from the third year. Due to availability constraints during data collection, where 3 students were not present (2 from second year and 1 from third year) during data collection, only 40 students participated (20 from each year), representing a response rate of 93.02%. This discrepancy between the calculated sample ($n=43$) and actual sample ($n=40$) is a 6.98% shortfall, which may have modestly influenced on statistical power and acknowledged as a limitation. Regarding sample representativeness, the proportional stratified sampling approach ensured that both academic years were represented proportionally (second year: 52.1% of population, 50.0% of sample; third year: 47.9% of population, 50.0% of sample). The sex distribution in the sample (47.5% female, 52.5% male) closely approximated the program's enrollment data (48.0% female, 52.0% male), which is adequate representativeness by sex. Several measures were implemented to minimize selection bias: i) all eligible students present during the data collection period were invited to participate, with no pre-selection based on stress levels or eating patterns; ii) data collection was scheduled to be collected on gaps between morning and afternoon classes, during regular academic activities to maximize availability; iii) the purpose and voluntary nature of participation were clearly explained to reduce self-selection based on personal interest in the topic; and iv) confidentiality was assured to encourage honest responses regardless of stress or eating behavior status. Nevertheless, the possibility of selection bias cannot be entirely excluded, as students experiencing higher stress levels or eating-related concerns may have been differentially motivated to take part or decline.

Inclusion and exclusion criteria

Inclusion criteria: i) regular enrollment in the second or third year of the pharmacy program; ii) age ≥ 18 years; iii) provision of written and signed informed consent; iv) ability to complete the questionnaire. Exclusion criteria: i) academic leave or suspended enrollment; ii) diagnosed eating disorders – assessed by asking respondents if they had been diagnosed an eating disorder in the past 90 days; iii) use of medications affecting appetite in the previous 30 days – assessed by asking participants if they used any medication during such period; if yes, they were asked to specify the medication. If the respondent could not recall, they were asked to provide a photo of the prescription for verification. If the prescription was unavailable, a list of commonly used medications in Mozambique known to affect appetite was presented, from which the respondent could identify any taken; iv) incomplete questionnaire responses.

Data collection instruments

Data collection was conducted using KoboCollect tool.

Perceived stress was assessed using the Perceived Stress Scale (PSS-10), validated in Brazilian Portuguese, showing good reliability (Cronbach's $\alpha=0.87$ for total score).⁶ Eating behavior under stress was assessed using the Salzburg Stress Eating Scale (SSES),⁷ with the Brazilian Portuguese version showing good internal consistency ($\alpha=0.81$).⁸ Brazil and Mozambique are both Portuguese-speaking countries; however, some linguistic differences exist. So, the authors adapted the validated instrument in Brazil for use in Mozambique, adjusting some words to make them easier and more familiar to be understood by the Mozambican population.

Data analysis

Descriptive analyses were conducted using Minitab® (version 21.4.3, 64-bit). Given that eating behavior (SSES) was measured on a five-point Likert scale, a non-parametric approach was considered proper. So, Spearman's rank correlation coefficient (ρ) was used to assess the relationship between perceived stress scores and eating behavior. Statistical significance was set at $\alpha=0.05$.

Ethical considerations

The Scientific Committee of the Nutrition Program at Lúrio University gave their approval for the study protocol. All procedures adhered to the Declaration of Helsinki.⁹ Written informed consent was obtained from all participants.

Results

Sociodemographic characteristics

The sample comprised 40 students: 19 (47.5%) females and 21 (52.5%) males. The mean age of the participants was 24.63 years [standard deviation (SD)=4.34], ranging from 19 to 36 years. The median age was 24 years, and the mode was 22 years ($n=7$). According to academic year, the students have been distributed in 20 students (50.0%) in the second year and 20 students (50.0%) in the third year. On sex-specific characteristics (Table 1), female students had a mean age of 23.79 years (SD=3.78), while male students presented a slightly higher mean age of 25.38 years (SD=4.75). When analyzed by academic year, second-year students had a mean age of 23.40 years (SD=4.63), while third-year students were older on average, with a mean age of 28.85 years (SD=3.75).

Perceived stress levels

The mean PSS-10 score was 20.52 (SD=2.68), ranging from 14 to 27. Most participants had moderate stress levels (97.5%; $n=39$), with only one participant (2.5%) classified as having high stress. No participants had low stress.

Table 1. Sociodemographic characteristics.

Variable	n (%)	Mean (standard deviation)
Age (years)	-	24.63 (4.34)
Sex - female	19 (47.5)	23.79 (3.78)
Sex - male	21 (52.5)	25.38(4.75)
Academic year - 2 nd	20 (50.0)	23.40 (4.63)
Academic year - 3 rd	20 (50.0)	28.85(3.75)

Sources of stress

Academic pressure was the most reported stressor (n=22), followed by family conflicts or responsibilities (n=16) and financial difficulties (n=16) (Table 2). The other category of stress were romantic or affective relationships (n=9), and physical or mental health concerns (n=8) were less commonly shown. A total of 5 participants reported work as stressor, while other unspecified sources were rarely mentioned (n=1). The total number of responses (n=77) exceeded the sample size (n=40) because the participants were allowed to select multiple stressors. On average 1.93 stressors were reported, reflecting the multidimensional nature of stress exposure in this population.

Relationship between stress and eating behavior

Eating behavior under stress

The SSES scores ranged from 1 to 4, with a mode of 3, observed in five cases. Regarding to changes in eating behavior under stress, 17 students reported eating *the same amount as usual*. A similar proportion (n=16) reported eating less or *much less than usual*. In contrast, 7 of them reported eating *more than usual*, representing a smaller subgroup characterized by increased intake in response to stress. No participants were classified in the *much more than usual* category.

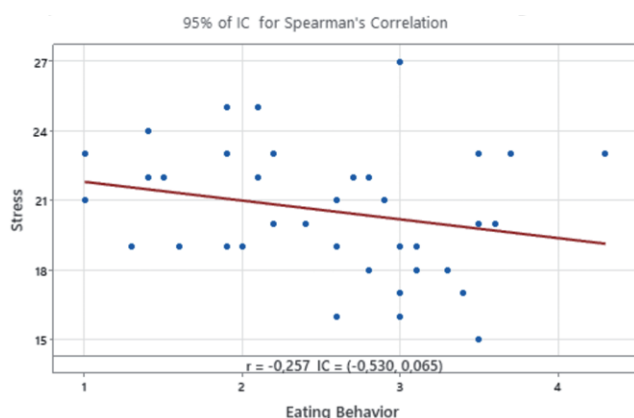


Figure 1. Spearman's matrix dispersion between stress and eating behavior.

Table 2. Ranking of main sources of perceived stress. *

Source of stress	n	Rank
Academic pressure	22	1st
Family conflicts/responsibilities	16	2nd
Financial difficulties	16	2nd
Relationship issues	9	4th
Health concerns	8	5th
Work-related stress	5	6th

Multiple responses permitted; percentages not calculated due to non-exclusive categories.

Eating behavior by sex under stress

When eating behavior was analyzed according to sex, the category *the same amount as usual* was the most frequently reported for both groups, with a higher frequency among males (n=10) compared to females (n=7). In the *less than usual* category, males also presented a higher frequency (n=7) than females (n=4). Conversely, in the *much less than usual* category, females predominated with 4 occurrences, while only 1 male participant was classified in this category. In increased intake, the category *more than usual* showed similar distribution between sexes, with a slight predominance among females (n=4) compared to males (n=3). No participant of either sex was classified in the *much more than usual* category.

Eating behavior by academic year under stress

Changes in food intake under stressful conditions were examined by academic year. The category *the same amount as usual* was the most frequently reported in both groups, 8 for second-year students, and 9 (nine) for third-year students. The *less than usual* category was reported by 6 of second-year students and 5 of third-year students. A more pronounced reduction, classified as *much less than usual*, was observed in 2.5% (n=1) of second-year students and 10.0% (n=4) of third-year students. Regarding increased intake, 5 second-year students reported eating *more than usual*, compared with 2 third-year students. No participants from either academic year were classified in the *much more than usual* category.

Correlation analysis

Spearman's rank correlation analysis (Figure 1) revealed a weak negative monotonic relationship between perceived stress scores and eating behavior ($\rho=-0.257$; 95% CI: -0.530 to 0.065; $p=0.110$). This finding shows that the correlation did not reach statistical significance.

Discussion

Three main findings appeared: moderate stress levels were nearly universal with academic pressure as the predominant stressor; heterogeneous eating responses to stress were observed, with hypophagia more prevalent than hyperphagia; and the correlation between perceived stress and eating behavior was weak and non-significant.

Stress levels and sources

A different result was found among university students in Saudi Arabia where perceived stress levels was moderate for 57.9% of the students, while 41.5%¹⁰ reported high levels of stress. This is in contrast with a sample of 121 medical students

in India, where 33.8% of participants had perceived stress scores of >28 , which the authors considered state of being under moderate stress.¹¹ However, the near absence of low stress (0%) contrasts with these studies, where 64.5% of students reported low stress levels. This discrepancy may reflect genuine higher stress burden in the Mozambican context, potentially related to limited academic resources, economic challenges, and infrastructure constraints characteristic of many sub-Saharan African universities. Alternatively, this finding may reflect measurement artifacts related to cultural interpretation of PSS items. Cultural habits and norms related to stress management, as well as factors beyond students' control, such as socioeconomic conditions, should be considered. Mozambique, as is known, has a low-income level country compared to the countries cited above (Saudi Arabia and India),¹² and such fact may also influence stress management and its occurrence.

Academic pressure raised as the primary stressor. The competitive nature of health sciences programs, combined with the rigorous curriculum requirements of pharmacy education, may create a particularly stressful environment. Financial hardship and family conflicts also emerged as significant stressors, reinforcing the multidimensional nature of student stress in this context. This finding reflects the intersection of economic vulnerability with academic demands, a characteristic feature of many African university populations where students often balance educational responsibilities with financial pressures and extended family obligations.^{13,14}

Eating behavior patterns under stress

The findings show that most students kept stable eating patterns under stress (42.5%), with hyperphagia exceeding hypophagia (40.0% vs. 16.5%). This contrasts with some Western studies reporting stress-induced overeating,¹⁵ but corroborates research in non-Western populations where anorectic stress responses were more observed.¹⁶ This pattern has important implications for understanding how culture shapes the stress-eating relationship. According to Macht's Five-Way Model,¹⁷ stress may lead to either hypophagia or hyperphagia depending on individual characteristics, stressor intensity, and available coping alternatives. The predominance of hypophagic responses in our sample may reflect cultural differences in coping strategies, where food is not traditionally used as a primary emotional regulation mechanism in Mozambican culture.

The heterogeneous eating behavior observed may also reflect individual differences in reactivity, glucocorticoid sensitivity, and coping styles. Biological research has demonstrated that stress-induced cortisol release can either stimulate or suppress appetite depending on individual sensitivity patterns and the chronicity of stress exposure.¹⁷ The absence of any participants reporting *much more than usual* food intake (category 5 on SSES) suggests that extreme hyperphagic responses to stress may be less common in this population, possibly reflecting the absence of established emotional eating patterns or the protective influence of traditional dietary practices.

Sex and academic year differences eating behavior under stress

Sex differences in stress responses are well-documented in the literature. Women demonstrate greater reactivity to psychosocial stressors and are more likely to engage in emotion-focused coping strategies, including emotional eating.^{18,19} In the present study, the

category *the same amount as usual* was often reported for both sexes, with males (n=10) showing higher frequency than females (n=7). Females predominated in the *much less than usual* category (n=4 vs. n=1 for males), while the *more than usual* category showed similar distribution between sexes (n=4 females vs. n=3 males). This pattern suggests that females may be more prone to extreme reductions in food intake under stress, while both sexes showed similar tendencies toward increased intake. A different result was found where most males (77.2%) reported less eating during stress compared to females.²⁰

Regarding academic year differences, third-year students showed greater tendency toward hypophagia compared to second-year students. Students at the beginning of their academic trajectory may be less adapted to academic demands and consequently use food consumption as a coping mechanism for emotional regulation.²¹ Furthermore, a study that had taken place in Ghana among pharmacy university students, showed no difference in stress among first- and second-year students.²²

The non-significant correlation

The weak, non-significant correlation between perceived stress and eating behavior ($\rho=-0.257$; 95% CI: -0.530 to 0.065; $p=0.110$) suggests that perceived stress alone may not be a strong predictor of eating behavior changes in this population. Several factors may explain this finding these include the small sample size (n=40) may have limited the ability to detect statistically significant associations, restricted range of stress scores (97.5% moderate) may have attenuated correlations through range restriction, limiting our ability to detect associations that might be clear in a more diverse sample. This homogeneity in stress levels may reflect genuine characteristics of this population or measurement limitations of the PSS-10 in this cultural context, the last and perhaps most important, the stress-eating relationship appears to be mediated by multiple factors not assessed in this study, including individual coping styles, social support networks, emotional regulation capacity, and food security status. Cultural factors may significantly influence this relationship in African contexts, where traditional diets may have different reward properties compared to Western ultra-processed foods. Furthermore, strong family and community support networks characteristic of many African cultures may buffer stress, reducing the need for maladaptive coping through food.²³

Implications for practice

These findings have important implications for student health services in African universities. The high prevalence of moderate stress suggests a clear need for stress management interventions, potentially integrated into curriculum structures. Given the heterogeneous nature of eating behavior to stress, one-size-fits-all nutritional counseling approaches may not be enough; personalized approaches considering individual stress-response patterns may be more effective. Universities should consider implementing comprehensive student support programs that integrate stress management with nutritional education, recognizing the bidirectional relationship between mental health and eating behaviors. Specific interventions might include incorporating stress management modules into the pharmacy curriculum; setting up peer support networks for students during examination periods; providing accessible nutritional counseling services; and training faculty to recognize signs of maladaptive stress responses.

Limitations and strengths

Limitations

Several limitations should be acknowledged. First, the sample size (n=40) was small, which may have limited the ability to detect statistically significant associations. Second, the cross-sectional design precludes causal inferences about the temporal relationship between stress and eating behavior. Third, potential confounding factors (body mass index, physical activity, sleep quality, food insecurity, social support) were not assessed, limiting interpretation of the observed associations. Fourth, instruments validated in Brazilian Portuguese rather than Mozambican Portuguese may have introduced measurement error. Fifth, self-reported measures introduce social desirability and recall biases. Sixth, single-institution design limits generalizability. Seventh, the restricted range of stress scores may have attenuated correlations. Eighth, mediating variables such as coping styles and emotional regulation were not assessed.

Methodological considerations

The use of Spearman's correlation was appropriate because of the ordinal nature of the eating behavior variable measured by the SSES. The five-point Likert-type scale captures categories of change in food intake that are inherently ordered but not necessarily equidistant, making non-parametric correlation analysis the statistically sound choice. Future studies might consider additional approaches such as ordinal regression or categorical data analysis to further explore predictors of eating behavior categories.

Conclusions

We conclude that pharmacy students at Lúrio University experience moderate stress, and their eating responses under stress are heterogeneous, hypophagia being more prevalent than hyperphagia. The non-significant correlation between perceived stress and eating behavior shows that stress intensity alone, may not be able to explain variance in eating responses. These findings point to the need to adopt institutional and social strategies aimed at mitigating the effects of academic stress and its impact on students' lifestyles. Such strategies may include reassessing course loads and teaching methods to reduce academic pressure, as well as strengthening psychological support services within universities, particularly those focused on family and relationship issues. In addition, social support programs and the provision of scholarships can help minimize the impact of financial difficulties, another significant factor in triggering stress. Cooperation between universities, health agencies, government ministries, and non-governmental organizations is essential for building a healthier academic environment capable of reducing stress levels and, so, preventing negative repercussions on students' eating behaviors. Addressing both stress management and eating behaviors through integrated student support strategies should be a priority for universities seeking to promote student well-being.

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Conflict of interest: the authors declare no conflict of interest.

Ethics approval and consent to participate: the study protocol was approved by the Scientific Committee of the Nutrition Program at Lúrio University and followed the ethical principles of the Declaration of Helsinki.

Informed consent: written informed consent was obtained from all participants prior to data collection. All participants were 18 years or older. The consent process was conducted in Portuguese, ensuring full comprehension.

Patient consent for publication: all participants were informed that the data would be published anonymously, analyzed as a whole and not individually, and that the questionnaire had no fields that could allow their identification. All participants consented to the publication of the results.

Availability of data and materials: the datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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