MEDIATING EFFECT OF MENTAL STRESS IN THE IMPACT OF FOOD INSECURITY ON ACADEMIC PERFORMANCE OF UNDERGRADUATE STUDENTS IN NIGERIA

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ABSTRACT

This study aimed to investigate the relationships among food insecurity, mental stress, and academic performance among Nigerian university students. The Slovin formula was used to determine the sample size of 399 undergraduate students from a population of 6,600,000 Nigerian undergraduates. A multistage sampling approach was employed to select the sample, ensuring representation from all categories of Nigerian universities across all geopolitical zones. The average respondent age was 22.8 years, with a notable majority (58%) being male and 81% living off campus due to limited on-campus accommodation. Moreover, close to 34% of respondents were within 2.50-3.49 CGPA. Close to 60% of the students were food insecure (males: 51% & females: 49%), and approximately 40% (males: 56% & females: 44%) were food secure. Financial strain, longer commutes, and unhealthy habits were also prevalent, impacting academic performance. Statistical analysis revealed significant associations between socioeconomic characteristics and food security status, with food insecurity negatively affecting academic outcomes. Addressing food insecurity, mental stress, and socioeconomic factors is crucial for enhancing academic performance. Policymakers and educators should develop targeted interventions, such as increasing access to affordable and nutritious food, providing mental health support services, and improving on-campus accommodation to foster a conducive environment for academic success and overall student welfare.

Keywords: *Food insecurity, Mental stress, Academic performance, Nigerian university students, Socioeconomic characteristics, Logistical barriers*

JEL Codes: I12, I21, I23, I24, I25, J10

1.0 INTRODUCTION

The increasing issue of food insecurity among students is a matter of increasing humanitarian and health significance, given that undergraduate students face more adverse physical and mental health outcomes than their counterparts who have secure access to food (Cedillo et al., 2023). Most undergraduate students are in adolescence, which is a critical period for the formation of lifelong behaviours. During this period, nutritional needs and explorations increase due to the increased growth rate and changes in body composition (Gonete et al., 2020). The dramatic increase in energy and nutrient requirements in this period coincides with other factors that affect adolescents' food choices and nutrient intake and thus nutritional status. These factors, including the quest for independence and acceptance by peers, greater time spent at school/playgrounds, and preoccupation with one's self-image, contribute to erratic and unhealthy eating habits (Ochoa-Avilés et al., 2013). However, in sub-Saharan Africa (SSA), a pronounced state of poverty, food insecurity, limited access to healthcare, and inadequate educational resources significantly influence the dietary habits and nutritional well-being of people, particularly students. According to Bruening et al. (2017), approximately 32.9% of college students in the United States encounter food insecurity.

It is well known that students of tertiary institutions in subregions are confronted with myriads of challenges, including the task of handling the financial obligations associated with schooling, such as accommodation, tuition, and basic necessities such as regular meals and sleep routines. According to Sedillo et al. (2023), the situation described above is similar to that of college students in the United States; however, there is concern that the prevalence of food insecurity

among undergraduates in SSA is greater than that in developed countries. It suffices to state that food is critical to human development. In Nigeria, the prevalence of food insecurity and poverty among students can worsen both the learning culture and the human development index of the country, which can affect individuals' commitment to self-empowerment and self-realization as well as reduce their contributions to national development (Audu et al., 2014). According to the 2022 Multidimensional Poverty Index (MPI) report from the National Bureau of Statistics, 133 million people currently experience multidimensional poverty in Nigeria. This figure constitutes 63% of the country's total population of 211 million individuals. From this, it can be inferred that many students come from low-income households or communities where access to nutritious food is limited.

In addition, the high cost of healthy food coupled with financial constraints may force students to rely on inexpensive, calorie-dense, but nutrient-poor foods. This can lead to imbalanced diets lacking the essential vitamins, minerals, and macronutrients necessary for optimal health and academic performance. Although Stamp et al. (2014) and Duane et al. (2006) argued that poor dietary quality is linked to mental imbalance, which directly fuels poor academic performance, increased rates of attrition, and suicidal thoughts among students, there is no evidence that dietary quality directly affects students' academic performance or development. Despite the possible consequences that are intertwined between inadequate consumption of a quality diet (dietary quality) by students and poor development of students, especially those in tertiary institutions, related literature on this subject matter is scarce. Overall, the moderating effects of poverty status on the interaction between students' consumption of food (food security status) and students' performance (development) are examined.

2.1 Food Consumption Score as a Proxy for Food Security Status

According to the findings of Coates et al. (2007), Weismann et al. (2009) and Kennedy et al. (2010), the FCS serves as a substitute measure for caloric availability within a student household. Research validating this score has shown that it correlates with both caloric intake and the dietary diversity score (DDS). Although the possibility of proxying food consumption scores for food security has been explored in the literature, the debate remains inconclusive. Despite this inconsistency, scholars such as Wiesmann et al. (2009) and Huang et al. (2018) have argued that the food consumption score (FCS) developed by the WFP is an effective indicator of food security (FS), especially for the food access dimension. According to Wiesmann et al. (2009), the food consumption score does not indicate per capita calorie intake; instead, it reflects dietary quality (DQ). This is because incorporating animal source foods, fruits, vegetables, and dairy products into diets enhances the consumption of crucial micronutrients, as noted by Wiesmann (2006). Therefore, in the course of this study, the terms FCS, DQ, FS and DDS were used interchangeably.

Undergraduate students experiencing food insecurity tend to have poorer overall dietary quality than their peers with a high level of food security (Bruening et al., 2018; El Zein et al., 2020). This includes behaviours such as skipping meals, particularly breakfast, as identified in studies by Bruening et al. (2018, 2016) and Shi et al. (2012). Moreover, students with a low food security status are prone to consuming more food and beverages with added sugars (El Zein et al., 2020) and fewer fruits and vegetables, as noted in studies by Bruening et al. (2018), El Zein et al. (2020), Shi et al. (2012), Farahbakhsh et al. (2017), Hall et al. (2019), Martinez et al. (2019), Mei et al. (2021), and Mirabitur et al. (2016).

In addition to less healthy dietary behaviors, Bruening et al. (2018) revealed that students with lower food security status have lower levels of physical activity and insufficient sleep. Notably, El Zein et al. (2020) reported that food insecurity increased the possibility of a student becoming overweight fivefold. Furthermore, food insecurity among students is strongly associated with various aspects of emotional health, including increased rates of anxiety, depression, stress,

and/or psychological well-being (PWB) (Bruening et al. 2018 and Coffino et al., 2021). While general stress among college students has long been acknowledged (Mahmoud et al., 2011; Soet and Sevig, 2006; Cohen et al., 1983), recent recognition reveals that students with a low level of food security are twice as likely to experience stress compared to those without basic needs struggles (Bruening et al., 2018). Similarly, Coffino et al. (2021) reported that stress among students tends to increase with the severity of food insecurity. Differences in psychological well-being (PWB) have also been observed among students with food insecurity, with PWB encompassing aspects that contribute to a fulfilling quality of life, such as positive social relationships, values, and other meaningful factors (Diener et al., 2010; Kansky, 2017; Diener et al., 2018).

The African philanthropy network reported on a study conducted in 2019 called "Studying on Empty: A Qualitative Study of Low Food Security Among College Students", which highlighted the positive impact of food security on students' readiness to study (Fernancdez et al., 2019). However, the issue of food insecurity among college students in higher education institutions in Africa has not received enough attention. Survey results show that food insecurity can have negative effects on students' academic performance, physical health, and mental well-being (Cady, 2014; Ukegbu et al., 2019). Unfortunately, underperformance or the failure to achieve optimal academic excellence among undergraduates is often wrongly attributed to other factors. Food insecurity can also negatively affect students' sociopsychological status and self-esteem, thereby impacting their academic performance. Another study on Perceived Hunger in College Students found that hunger has an influence on students' academic performance (Hickey et al., 2019). In this literature, a significant percentage of students strongly agreed or somewhat agreed that hunger had hindered their performance in class. Moreover, students who reported experiencing hunger had lower GPAs than did their peers who did not face food insecurity

Linked to various negative health consequences (Gundersen & Ziliak, 2015; Laraia, 2013; Bruening et al., 2017) and academic results (Belsky et al., 2010), food insecurity could impede student success and limit the ability to use education as a means to address health disparities. Psychosocial health plays a crucial role in the relationship between food insecurity and academic performance among college and university students (Raskin et al., 2019). When individuals experience food insecurity, it not only affects their physical well-being but also has a profound impact on their mental and emotional state. One important aspect of psychosocial health is the psychological well-being of students. Food insecurity can lead to increased stress, anxiety, and depression, as individuals are constantly worried about their next meal or lack access to nutritious food. These psychological factors can impede concentration, memory, and cognitive abilities, thereby negatively affecting academic performance. Moreover, food insecurity can also affect the social well-being of students. Limited access to food can contribute to social isolation, as individuals may feel ashamed or embarrassed about their situation. This social isolation can result in decreased motivation, engagement, and a sense of belonging within the academic environment, subsequently hindering academic performance.

Furthermore, self-esteem and self-confidence are integral components of psychosocial health. Students experiencing food insecurity may feel a sense of inadequacy or shame, which can undermine their self-esteem. This diminished self-esteem may lead to feelings of hopelessness, lack of motivation, and decreased academic engagement, ultimately impacting overall academic performance.

Previous research has predominantly focused on the connection between food insecurity and academic success during early childhood (Perez-Escamilla & Pinheiro de Toledo Vianna, 2012). Food insecurity has been linked to lower mental proficiency in toddlers (Zaslow et al., 2009), difficulties in reading and math skills, and lower standardized test scores among school-aged children (Jyoti et al., 2005; Faught et al., 2017). The psychological and emotional stress stemming from food insecurity is believed to be a crucial factor in this association (Jyoti et al., 2005; Perez-

Escamilla & Pinheiro de Toledo Vianna, 2012; Whitaker et al., 2006; Knowles et al., 2016). Garcia et al. (2023) found a very strong link between socioeconomics and the psychological well-being of individuals. Few studies exploring health outcomes have identified psychosocial factors as mediators of the relationship between food insecurity and various health outcomes, such as weight status (Willis & Fitzpatrick, 2016), sleep quality (Bermudez-Millan et al., 2016), and child cognitive development (Zaslow et al., 2009).

Thoits (2010) introduced a different discussion to the debate by positing that poor individuals, more than nonpoor individuals, report greater chronic stress and cumulative stress exposure across their lives. Similarly, low-income students typically achieve examination scores that are 0.4 to 0.6 points lower than those of their peers. Past empirical research has identified several factors related to food insecurity among students. Students from low-income backgrounds are more likely to experience food insecurity (Davidson & Morrel, 2020; Wan Azdie et al., 2019), as are male students (Rajikan et al., 2019) and those living apart from their parents (Whatnal et al., 2020). Interestingly, students receiving financial aid are also at a greater risk of facing food insecurity (Whatnal et al., 2020). The increase in tuition fees, insufficient financial aid, and high living costs have been proposed as potential reasons contributing to students' experiences of food insecurity (Ramlee et al., 2019). The financial challenges encountered by students exacerbate their food insecurity, preventing them from affording an adequate and nutritious diet essential for their well-being and academic performance (Nurulhudha et al., 2020).

To date, no studies have thoroughly examined how food insecurity specifically impacts the academic performance of undergraduate students, particularly in Nigeria. Exploring similar pathways among undergraduate students could provide insights into the complex mechanisms underlying the early evidence linking food insecurity to poorer health and academic outcomes (Raskind et al., 2019 l and Shankar & Park, 2019).

2.2 Linkage between Food Insecurity (Fins) and Students' Academic Performance (SAP)

The connection between food security and students' academic performance is best explained using cognitive-resource theory (Fiske and Taylor, 1991). This theory suggests that limited cognitive resources are available to individuals, and factors such as hunger or food insecurity may deplete these resources, impacting cognitive functioning and academic performance. Quality education enhances the effective development of individuals, and according to Okolie (2009), development enhances human potential and capabilities, leading to the mitigation or elimination of poverty, destitution, inequality, unemployment, and overall improvement in the conditions for human survival and self-renewal. Therefore, in this study, the conceptual construct that defines the relationship between food insecurity and students' academic performance is described in Figure 1. According to Crutchfield & Maguire (2018) and Eisenberg et al. (2016), deprived (starving) students experience unfavourable outcomes in their development. In this study, students' academic performance is considered one of these outcomes. Therefore, this study hypothesized that food insecurity, mediated by students' mental stability, can have a significant effect on students' academic performance. This assumption is fueled by the fact that students who are food insecure tend to be psychologically stressed and unbalanced (Cedillo et al. (2023), which can consequently throw them off their mental stability. Intuitively, the distance that students travel daily between their residential accommodations and campus can constitute stress, which can define the state of their mental health and can also affect their academic performance. Other covariates that may affect the mental stability of students include age, gender, poverty status, class status/level, students' habits, sponsors' income, whether students engaged in economic activities outside of school hours to earn income, and the distance between residential accommodations and campuses. All these factors are expected to positively correlate with mental stability and students' academic performance.
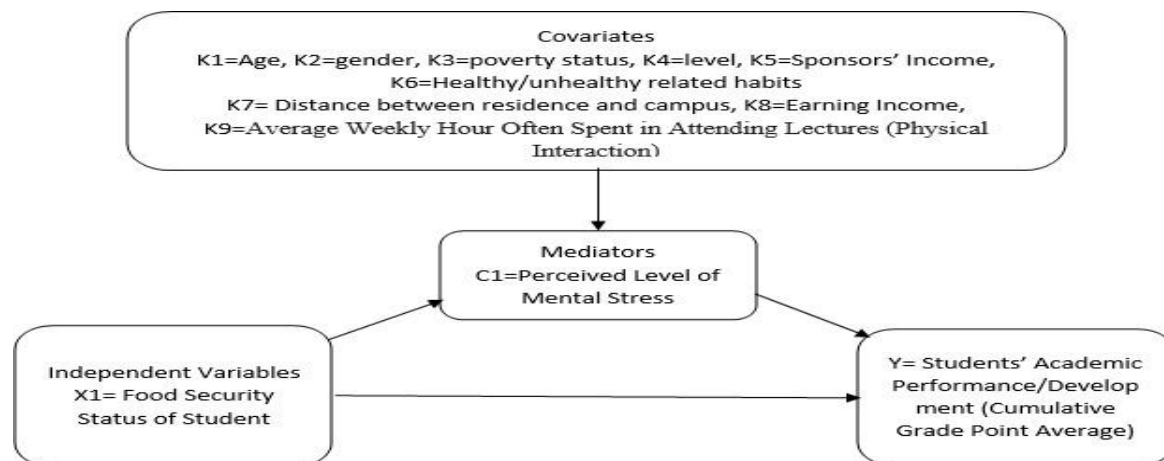
Figure 1: Conceptual Model Linking Students' Food Security Status and Academic Performance

Therefore, this study has the following objectives:

1. To describe the socioeconomic characteristics of the respondents
2. To determine the effect of food insecurity on students' academic performance.
3. To determine the mediating effect of students' perceived mental stress on the relationship between food insecurity and students' academic performance.

Hypotheses:

H_{01}: Food insecurity, students' perceived mental stress, and socioeconomic factors do not significantly affect students' academic performance.

H_{02}: Students' perceived mental stress does not have a mediating effect on the relationship between students' food insecurity status and students' academic performance.

2.0 MATERIALS AND METHODS

This study was carried out among students at universities in Nigeria. There are 174 universities in Nigeria; 79 are owned by private individuals; 43 are owned by the federal government; and 52 are owned by state governments, with the total population of students in each of the private, federal and state-owned universities given as 102,500, 1,206,825, and 544,936, respectively (Statista, 2022). This implies that the federal government, state government, and privately owned universities each have an average of 28,066, 10,480, and 1,297 students, respectively. All these universities are distributed across the six regions in Nigeria. The study randomly selected one university each from private universities, state universities and federal universities in each region for a total of 18 universities (Statista, 2022). The need to select students across the regions and universities was based on the unique characteristics identified with students who were studying across these different regions. The specific emphasis was on understanding how students articulate their encounters with food insecurity and stress, as well as how they integrate other factors into enhancing their academic performance.

The sample size for this study was determined using the Yamane (1967) Slovin formula. The sample size based on an assumed 5% margin of error, 95% confidence interval and the application of a finite correction factor was determined from the total number of students. In the Slovin formula, $n_0 = N/(1+N(e^2))$, where n_0 = the sample size, e = 0.05, and N = the total number

of observations. According to data obtained from the National University Commission (NUC), Joint Admission Matriculation Board, and Ministry of Education, the total population of students in Nigerian universities is 6,600,000. A total of 399 students (respondents) were included in the sample. From each of the institutions, a proportional subsampling approach, such as (number of students in each selected institution)/(total number of students in the 18 selected institutions)*n_0, was used to determine the minimum number of respondents selected per university.

The choice of 18 institutions was to give all the institution categories (federal, state and private institutions) a chance to be included in the sample. The proportional subsamples from each of the selected universities were obtained using the admission lists provided by the randomly selected institution. From each of the lists prepared in the Excel spreadsheet, random numbers were generated corresponding to each matriculation number, and the random numbers expanded to their respective matriculation numbers were sorted in descending order. After sorting, the number of respondents equal to the proportional subsample for each selected institution was sampled. This resulted in an average of 47 respondents from each federal government-owned university selected, an average of 18 students sampled from state government-owned institutions selected, and an average of 2 students from each privately owned university selected.

In the current investigation, a sample of 399 students was chosen from Nigerian universities across 6 regions in the country, with a specific focus on full-time students. A well-structured questionnaire was developed to elicit relevant responses (data) to provide answers to the research questions from the respondents. Data were obtained on the demographic details of the students, such as age, gender, poverty status, class status/level, income, health/unhealth-related habits (students were asked to rank their first five frequent activities [habits]: deworming, routine fruit consumption, alcohol consumption, high salt intake, eating of junks, smoking, low water intake, physical activity, sleeping minimum of 6 hours), distance between residence and campus (measured using the Google Maps), student earnings, and mental stability (measured in terms of stress).

This study utilized the Perceived Stress Scale (PSS-10) to measure the perceived mental stress of undergraduate students. The PSS is a well-known stress assessment tool that has been used since its development by Cohen et al. (1983). It helps researchers understand how different situations impact an individual's feelings and perceived stress levels. The scale consists of 10 questions that asked about respondents' feelings and thoughts about their academic programme during the past month. Each question required the participants to indicate how frequently they experienced a certain feeling or thought. The response options for each question ranged from 0 (never) to 4 (very often). To interpret the results, the scores obtained from the PSS are categorized into different levels of stress. A student with an average score less than or equal to 2 was considered to indicate low or no stress. An average score between 3 and 4 indicates moderate stress. A score of 4 indicates very high stress. Cronbach's α in the analytic sample was 0.86.

Similarly, the average weekly hours often spent attending lectures—physical interaction (respondents were asked to rate the number of hours spent participating in lectures in a week out of the total number of lecture hours in a week)—these details proved valuable in drawing inferences from the study findings. Academic performance, measured through the cumulative grade point average (CGPA), was also considered in the assessment. Food security was measured using food consumption scores.

The survey instruments were administered through trained enumerators for this purpose. Each enumerator was sent to each of the 18 selected universities to spend an average of one week each to administer questionnaires to 399 students who had been randomly selected.

2.1 Analytical technique

2.1.1 Calculating and Interpreting Dietary Diversity (Food Security) among Respondents

In the analysis, food items were grouped according to food groups (Wiesmann et al., 2009), and the frequencies of all the food items that were surveyed in each food group were summed. It should be noted that any summed food group frequency value greater than 7 is recoded as 7.

Each food group is assigned a weight, as shown in Table 1, reflecting its nutrient density. For example, beans, peas, groundnuts, and cashew nuts are given a weight of 3, reflecting the high protein content of beans and peas and the high fat content of nuts. Sugar is given a weight of 0.5, reflecting its absence of micronutrients and the fact that it is usually eaten in relatively small quantities. For each student, the food consumption score is calculated by multiplying each food group frequency by each food group weight and then summing these scores into one composite score.

The student's score can reach a maximum value of 112, which implies that each of the food groups was consumed every day for the last seven days.

The student's score is compared with preestablished thresholds that indicate the status of the student's food consumption. The WFP finds the following thresholds to be applicable in a wide range of situations:

Poor food consumption: 0 to 21 (Food Insecure Students)
Borderline food consumption: 21.5 to 35 (Students at Risk of Food Insecurity) Acceptable food consumption score: > 35 (Food Secure Students)

The food consumption score is calculated using the following approach:
FCS= ∑(W_A*Dn) Given that
W_A= Weight of each group:
The weight of Group 1 (cereals, tubers, and root crops) =2, and the weight of Group 2 (pulse) =3.
Weight of Group 3 (Vegetables) =1 Weight of Group 4 (Fruits) =1 Weight of Group 5 (Meal & Fish) =4 Weight of Group 6 (Milk) =4 Weight of Group 7 (Sugar) = 0.5 Weight of Group 8 (Oil) = 0.5
Dn = Number of days any of the items in the groups were eaten in the past 7 days

In this study, both regression analysis and structural equation modelling were used.

2.1.2 Multiple Regression

Cedillo et al. (2023) modelled the relationship between food security and body mass index. Therefore, a multiple regression model was used to examine how changes in food security are related to changes in academic performance. Multiple regression accounts for the influence of other variables, allowing researchers to isolate the impact of food security. The implicit multiple regression model is given as:

$$Y = f(X_1, C_1, K_1, K_2, K_3, K_4, K_5, K_6, K_7, K_8) \dots\dots\dots (1)$$

where X_1, C_1, K_1, K_2, K_3, K_4, K_5, K_6, K_7, and K_8 are defined in the conceptual diagram. All preliminary and diagnostic tests showed that the double-log functional form best fit the data obtained for this study.

2.1.3 Structural equation modelling (SEM)

Structural equation modelling (SEM) allows researchers to test complex relationships among multiple variables. It can be useful for investigating the direct and indirect effects of food security on academic performance, considering mediating or moderating factors. In this study, food insecurity (FI) was the independent variable, mental stress (MI) was the mediator, and academic performance (SAP) was the dependent variable. The SEM was specified as follows:

Latent Variables:

FI: Food Insecurity

MI: Mental Stress (Mediator)

   SAP: Student Academic Performance Observed Variables

x: Indicators for measuring Food Insecurity (Observed variables loading onto FI) c: Indicators for measuring Mental Stress (Observed variables loading onto MI)

   y: Indicators for measuring academic performance (observed variables loading onto AP) structural equations:

FI → MI: Path representing the effect of Food Insecurity on Mental Stress

   MI → SAP: Path representing the effect of mental stress on the effect of academic performance mediation

 FI → MI → AP: Indirect path representing the mediating effect of food insecurity on academic performance through mental stress

The structural equations can be written as follows:

$$FI = \lambda_1 x + \varepsilon_1 \quad \text{.. (3)}$$
$$MI = \beta c + \lambda_2 FI + \varepsilon_2 \quad \text{.. (4)}$$
$$AP = \gamma y + \lambda_3 MI + \varepsilon_3 \quad \text{.. (5)}$$

Here, λ_1, β and γ are the respective factor loadings for the observed indicators on the latent variables. Paths (λ_2, λ_3) represent the direct effects, and $\varepsilon1$, $\varepsilon2$, and $\varepsilon3$ are the error terms.

The mediation effect (indirect effect) can be calculated as the product of the path coefficients along the indirect path (FI → MI → AP). The total effect of Food Insecurity on Academic Performance is the sum of the direct effect (FI → AP) and the mediated effect.

This representation outlines the structural relationships among the latent variables and the observed indicators and reflects the mediation hypothesis that mental stress mediates the relationship between food insecurity and academic performance.

3.0 RESULTS AND DISCUSSION

3.1 Results

Table 1 reveals the respondents' socioeconomic characteristics by their dietary diversity (food security status). A total of 399 students were randomly selected through multistage sampling. Only 392 questionnaires were returned. The key findings revealed that the 21-25 age group had the highest percentage (46.88%) of poor food consumption, indicating a prevalence of inadequate food intake. Conversely, the >30 age group had the highest percentage (19.62%) of acceptable food consumption, suggesting a relatively healthier pattern.

According to the table, among males, 43.75% exhibit poor food consumption, while 55.70% have acceptable food consumption. For females, 56.25% had poor food consumption, and 44.30% had acceptable food consumption. This report underscores gender-based disparities in food consumption patterns, emphasizing the need for targeted interventions to address these variations.

Table 1 also reveals the variations in food consumption patterns across academic levels. For instance, at the 100% level, 21.88% exhibited poor food consumption, while 24.68% had acceptable food consumption. These results indicate potential associations between academic levels and dietary habits, highlighting the need for targeted interventions to address food consumption disparities among different academic cohorts.

Poverty status is categorized as "poor" or "nonpoor," and the percentages and actual counts (n) for each food consumption category (pool, poor, borderline, acceptable) are provided. Key findings indicate that individuals classified as "poor" exhibit higher percentages of poor and borderline food consumption (75.0% and 63.86%, respectively) than those in the "nonpoor" group. These results suggest a correlation between poverty status and less favourable food consumption

patterns, underscoring the importance of addressing economic disparities in interventions aimed at improving dietary habits.

The accommodation locations are classified as "Off-Campus" or "On-Campus," with percentages and actual counts (n) provided for each food consumption category (Pool, Poor, Borderline, Acceptable). The key findings revealed that individuals residing "Off-Campus" exhibit higher percentages of food consumption categories, particularly in the Pool and Acceptable categories. Conversely, those living "On-Campus" were more prevalent in the Poor and Borderline categories. These results suggest potential associations between accommodation location and dietary patterns, emphasizing the need for targeted interventions based on students' living arrangements.

The distances are categorized into ranges (<1.00 km, 1.00–2.00 km, 3.00–4.00 km, 5.00–6.00 km, and >6.00 km), and percentages along with actual counts (n) are provided for each food consumption category (Pool, Poor, Borderline, and Acceptable). Key findings suggest variations in food consumption patterns based on the distance of accommodation. Notably, individuals residing within 1.00 km exhibit relatively higher percentages of acceptable food consumption, while those living 5.00–6.00 km away show a higher percentage of borderline food consumption. These results imply potential associations between the proximity of accommodations and dietary habits, emphasizing the importance of considering distance-related factors in interventions aimed at improving students' food consumption.

By exploring the distribution of respondents by their healthy and unhealthy habits, key findings indicate that a significant majority of the population (72.19%) reports having more unhealthy than healthy habits, with variations observed across different food consumption categories. Notably, a greater percentage of individuals with more unhealthy habits fall into the poor and acceptable food consumption categories. These findings underscore the importance of addressing and promoting healthier habits in interventions aimed at improving dietary patterns within the studied population.

The respondents were also categorized into two groups: "yes" for those earning income and "no" for those not earning income. Percentages and actual counts (n) are provided for each group across different food consumption categories (Pool, Poor, Borderline, and Acceptable). Key findings reveal that a smaller percentage (18.90%) of the population earns income, and this group exhibits variations in food consumption patterns. Notably, a greater percentage of those not earning income fall into the poor and acceptable food consumption categories. These findings suggest potential associations between income status and dietary habits, emphasizing the need to consider financial factors in interventions aimed at improving food consumption patterns.

This table provides the distribution of respondents based on their sponsors' monthly income in Nigerian Naira (N). The respondents are further categorized into income brackets (< 30,000, 30,001 – 60,000, 60,001 – 90,000, and > 90,000), and the percentages and actual counts (n) are presented for each income category across different groups (total sample, a subset of 32, a subset of 202, and a subset of 158). The data unveil nuanced insights into the distribution patterns. Among respondents with a monthly income of less than 30,000 Naira, approximately 20.92% fell into this bracket, with varying proportions across the unspecified outcome variable categories. Notably, a considerable percentage of this group, comprising 37.5%, leans towards one particular category, while smaller percentages gravitate towards the other two categories. Moving up the income spectrum, the 30,001–60,000 Naira bracket encompasses a substantial share of respondents, with 39.97% falling within this range. Within this cohort, the distribution across outcome variable categories reflects a similar trend, albeit with different proportions.

The table also shows the distribution of respondents based on the percentage of average weekly hours spent attending lectures with physical interaction. The respondents were categorized into four groups: 0% – 25%, 26% – 50%, 51% – 75%, and 76% – 100%. The percentages and actual counts (n) are provided for each category across different subsets of the

sample population (total sample, a subset of 32, a subset of 202, and a subset of 158). Key findings include variations in the distribution of the percentage of weekly hours spent in physical interaction across the different categories. The majority of respondents in each subset fall into the 51% - 75% category, indicating that a significant proportion of students spend more than half of their weekly hours in physical interactions during lectures.

The respondents were also grouped into three groups based on perceived mental stability: "relatively low or no stress", "moderately high stress", and "very high stress". Percentages and actual counts (n) are provided for each group across different food consumption categories (Pool, Poor, Borderline, and Acceptable). According to the table, the majority of the population perceives themselves to be moderately stable, with variations in food consumption patterns across stress levels. Notably, individuals with high stress levels exhibited higher percentages in the poor and borderline food consumption categories. These findings suggest a potential association between mental well-being and dietary habits, highlighting the importance of considering mental health factors in interventions aimed at improving food consumption patterns.

The respondents were categorized into two groups: "Yes" for those who felt that their mental health pressureed them to violate the rules and "No" for those who did not feel such pressure; percentages and actual counts (n) are provided for each group. Table 1 reveals that a notable percentage (32.40%) of the overall population and an even greater percentage among the subset of 32 individuals feel that their mental health pressures them to violate school rules. Conversely, a significant majority (67.6%) of the total population and a greater percentage of the 32 individuals did not feel mental health pressure in this regard. These results suggest a potential link between mental health and adherence to school rules, emphasizing the need for mental health support and interventions to address behavioural challenges among students.

Academic performance is categorized into five groups based on grade range (1.00–1.49, 1.50–2.49, 2.50–3.49, 3.50–4.49, 4.50–5.00). Percentages and actual counts (n) are provided for each group across different food consumption categories (Pool, Poor, Borderline, and Acceptable). Key findings indicate variations in food consumption patterns across different academic performance groups. Notably, individuals with higher academic performance (grades 4.49–5.00) exhibit lower percentages in the poor and borderline food consumption categories. These findings suggest a potential association between academic success and healthier food consumption patterns, emphasizing the need for comprehensive support and interventions to address academic and nutritional aspects of students' well-being.

This study acknowledges the need for statistical significance testing, such as chi-square analysis, to validate these associations and emphasizes the importance of targeted interventions and policies based on age-related disparities in food consumption. This will be addressed in the discussion.

Table 1: Respondents' socioeconomic characteristics by their dietary diversity (food security status)

Variables	Pool	Poor food consumption	Borderline food consumption	Acceptable food consumption	X² (P Value)
Age	n=392	n=32 (8.16%)	n=202(51.53%)	n=158 (40.31%)	
16-20	30.0% (n=118)	28.13%(n=9)	32.67%(n=66)	27.22%(n=43)	41.594
21-25	40.0% (n=157)	46.88%(n=15)	40.59%(n=82)	37.97%(n=60)	
26-30	20.0% (n=78)	15.63%(n=5)	24.26%(n=49)	15.19%(n=24)	
>30	10.0% (n=39)	9.38%(n=3)	2.48%(n=5)	19.62%(n=31)	
Gender	n=392	n=32	n=202	n=158	
Male	57.8%(n=207)	43.75%(n=14)	51.98%(n=105)	55.70%(n=88)	1.638
Female	47.2(n=185)	56.25%(n=18)	48.02%(n=97)	44.30%(n=70)	0.441
Level	n=392	n=32	n=202	n=158	
100	25.77%(n=101)	21.88%(n=7)	27.23%(n=55)	24.68%(n=39)	18.339
200	22.70%(n=89)	28.12%(n=9)	20.30%(n=41)	24.68%(n=39)	0.019
300	19.13%(n=75)	25.0%(n=8)	22.77%(n=46)	13.29%(n=21)	
400	18..37%(n=72)	15.63%(n=5)	20.79%(n=42)	15.82%(n=25)	
500	14.03%(n=55)	9.38%(n=3)	8.91%(n=18)	21.52%(n=34)	
Poverty Status	n=392	n=32	n=202	n=158	
Poor	17.35%(n=248)	75.0%(n=24)	63.86%(n=129)	60.13%(n=95)	2.596
Non-Poor	8.16%(n=144)	25.0%(n=8)	36.14%(n=73)	39.87%(n=63)	0.273
Location of Accommodation/Living Arrangement	n=392	n=32	n=202	n=158	
Off-Campus	81.1%(n=318)	65.6%(n=21)	86.1%(n=174)	77.8%(n=123)	9.443
On-Campus	18.9%(n=74)	34.4%(n=11)	13.9%(n=28)	22.2%(n=35)	0.009
Distance (km)	n=318	n=24	n=182	n=112	
< 1.00	32.08%(n=102)	25.0%(n=6)	32.97%(n=60)	32.14%(n=36)	11.779
1.00 – 2.00	26.73%(n=85)	20.83%(n=5)	25.82%(n=47)	29.46%(n=33)	0.161
3.00 - 4.00	21.38%(n=68)	16.67%(n=4)	21.98%(n=40)	21.43%(n=24)	
5.00 - 6.00	11.01%(n=35)	20.83%(n=5)	13.19%(n=24)	5.36%(n=6)	
> 6.00	8.81%(n=28)	16.67%(n=4)	6.04%(n=11)	11.61%(n=13)	
Healthy/Unhealthy Habits	n=392	n=32	n=202	n=158	
Healthier than Unhealthy Habits	27.81%(n=109)	62.5%(n=20)	19.8%(n=40)	31.01%(n=49)	60.98
Unhealthier than	72.19%(n=283)	37.5%(n=12)	18.2%(n=162)	68.99%(n=109)	

Source: Data Analysis, 2024

Healthy habits (Yes=1

Earning Income (Work & Study)	n=392	n=32	n=202	n=158	
Yes	18.90%(n=78)	43.75%(n=14)	16.34%(n=33)	19.62%(n=31)	13.037
No	80.10%(n=314)	56.25%(n=18)	83.66%(n=169)	80.38%(n=127)	0.001
Sponsors' Monthly Income (N)	n=392	n=32	n=202	n=158	
≤ 30,000	20.92%(n=82)	37.5%(n=12)	29.21%(n=59)	6.96%(n=11)	93.202
30,001 – 60,000	39.97%(n=141)	46.88%(n=15)	43.56%(n=88)	25.05%(n=38)	0.000
60,001 – 90,000	26.02%(n=102)	12.5%(n=4)	10.39(n=21)	48.73%(n=77)	
> 90,000	17.09%(n=67)	3.13%(n=1)	16.83%(n=34)	20.25%(n=32)	
%Average Weekly Hour Often Spent in Attending Lectures					
(Physical Interaction) 0% – 25%	n=392 24.74%(n=97)	n=32 25.00%(n=8)	n=202 23.76%(n=48)	n=158 25.95%(n=41)	n=392 125.601
26% – 50%	26.53%(n=104)	28.13%(n=9)	25.74%(n=52)	27.22%(n=43)	0.8041
51% - 75%	30.10%(n=118)	34.38%(n=11)	28.71%(n=58)	31.01%(n=49)	
76% - 100%	18.62%(n=73)	12.50%(n=4)	21.78%(n=44)	15.82%(n=25)	
Perceived Mental Stress	n=392	n=32	n=202	n=158	
Low or No Stress	18.36%(n=72)	25.0%(n=8)	22.77%(n=46)	11.39%(n=18)	18.566
Moderately High Stress	54.84%(n=215)	43.75%(n=14)	46.53%(n=94)	67.72%(n=107	
Very High Stress	26.78%(n=105)	31.25%(n=10)	30.69%(n=62)	20.89%(n=33)	
Does Your State of Mental Health Influence You to Violate School Rules and Regulations?	n=392	n=32	n=202	n=158	
Yes	32.40%(n=127)	87.5%(n=28)	40.1%(n=81)	11.39%(n=18)	81.662
No	67.6%(n=265)	12.5%(n=4)	59.9%(n=121)	88.6%(n=140)	
Students' Academic Performance	n=392	n=32	n=202	n=158	
1.00 – 1.49	13.54%(n=57)	25.00%(n=8)	15.84%(n=32)	10.76%(n=17)	23.478
1.50 – 2.49	26.02%(n=102)	18.75%(n=6)	27.73%(n=54)	26.58%(n=42)	0.003
2.50 – 3.49	33.67(n=132)	25.00%(n=8)	39.11%(n=79)	28.48%(n=45)	
3.50 – 4.49	20.41%(n=80)	18.75%(n=6)	13.86%(n=28)	29.11%(n=46)	
4.50 – 5.00	5.36%(n=21)	12.5%(n=4)	4.46%(n=9)	5.06%(n=8)	

Table 2 presents the results of a multiple regression analysis aimed at assessing the effects of food insecurity, students' perceived mental stability (high stress perception), and various sociodemographic factors on students' academic performance. The dependent variable is academic performance, and the coefficients, standard errors, t-statistics, and p values are reported for each independent variable. The findings indicate that food insecurity (poor food

consumption score [FCS] = yes) and high perceived mental stress have statistically significant negative effects on academic performance, with coefficients of -
15.311 and -22.108, respectively. Other influential factors include age (positive effect), class status/level (> 400 level), and earning income (yes=1), which all have statistically significant effects on academic performance. The distance of school from one's residence also plays a significant role, with a negative effect on academic performance. Specifically, the coefficient for "Average Weekly Hour Often Spent in Attending Lectures" is 8.025, suggesting that, on average, a one-unit increase in weekly hours spent in physical interaction during lectures corresponds to an 8.025-unit increase in academic performance. The standard error (3.307) reflects the precision of this estimate. The t-statistic (2.4267) indicates that the coefficient is statistically significant, and the low p value (0.0157) reinforces this, suggesting that the variable significantly influences students' academic performance.

Conversely, variables such as gender, poverty status, students' unhealthy habits, sponsor's income, and earning income do not show statistically significant effects on academic performance based on the provided p values. Overall, these results highlight the importance of addressing food insecurity, mental well-being, and other sociodemographic factors in interventions aimed at improving students' academic performance.

Table 2: Multiple Regression to Test the Effects of Food Insecurity and Students' Perceived Mental Stability (highly stressed) on Students' Academic Performance

Variables	Coefficients	Standard Error	T Statistics	P Value
Food Insecure (Poor FCS [Yes=1])	-15.311	8.014	-5.0799	**0.000**
State of Mental Health (Perception of High Stress [Yes=1])	-22.108	10.271	-2.1524	**0.0320**
Age	5.005	2.119	2.3619	**0.0187**
Gender	12.812	11.944	1.0726	**0.2841**
Poverty Status (Poor)	-14.609	13.881	-1.0524	**0.2933**
Class Status/Level (> 400 level)	2.225	1.062	2.0951	**0.0368**
Students' Habit (Unhealthy Habits)	-3.102	2.188	-1.4177	**0.1571**
Sponsor's Income	9.477	112.051	0.0845	0.9327
Distance of School from Residence	-3.891	1.404	-2.771	0.0059
Earning Income (Yes=1)	-6.332	2.995	-2.1141	**0.0351**
Average Weekly Hour Often Spent in Attending Lectures (Physical Interaction)	8.025	3.307	2.4267	**0.0157**

R-squared=0.64
Adjusted R-Squared=0.58

Source: Data Analysis, 2024.

Table 3 presents the results of a mediation analysis examining the mediating effects of mental stress (perception of stress) on the impact of food insecurity on the academic performance of undergraduate students. The coefficients, standard errors, and p values are reported for each relationship. The results are presented for poor and nonpoor students.

For poor students, the findings suggest a significant direct effect of food insecurity on mental stress (0.271, p=0.0001), indicating that experiencing food insecurity contributes to an increase in mental stress. Additionally, there was a significant direct effect of mental stress on academic performance (-0.116, p=0.0496), suggesting that higher levels of perceived stress are

associated with lower academic performance.

The direct effect of food insecurity on academic performance is also significant (-0.424, p=0.0001), indicating that food insecurity negatively impacts academic performance. Importantly, the mediating effect

of mental stress in the relationship between food insecurity and academic performance was substantial (- 0.733, p=0.0001). This finding implies that mental stress significantly mediates the impact of food insecurity on academic performance.

For the nonpoor students, the presented results in this table indicate the coefficients, standard errors, and p values for a mediation analysis assessing the relationships between food insecurity, mental stress, and academic performance among undergraduate students.

The findings revealed a significant direct effect of food insecurity on mental stress (0.513, p=0.0001), suggesting that experiencing food insecurity contributes to an increase in mental stress. However, the direct effect of mental stress on academic performance was not statistically significant (-0.208, p=0.0792), indicating that perceived mental stress may not independently impact academic performance.

Interestingly, there is a significant direct effect of food insecurity on academic performance (-0.223, p=0.0143), suggesting that food insecurity independently influences academic performance. The mediating effect of mental stress on the relationship between food insecurity and academic performance is substantial (-0.405, p=0.0001), indicating that mental stress significantly mediates the impact of food insecurity on academic performance.

Table 3: Mediating Effects of Mental Stress (Perception of Stress) on the Impact of Food Insecurity on the Academic Performance of Undergraduate Students

Variables	Coefficients	Standard Errors	P Value
Poor			
Food Insecurity → Mental Stress	0.271***	0.0344	**0.0001**
Mental Stress → Academic Performance	-0.116**	0.0589	**0.0496**
Food Insecurity → Academic Performance	-0.424***	0.0193	**0.0001**
Mediating Effect			
Food Insecurity → Mental Stress → Academic Performance	-0.733***	0.0511	**0.0001**
Non-Poor			
Food Insecurity → Mental Stress	0.513***	0.0826	**0.0001**
Mental Stress → Academic Performance	-0.208*	0.1182	**0.0792**
Food Insecurity → Academic Performance	-0.223**	0.0906	**0.0143**
Mediating Effect			
Food Insecurity → Mental Stress → Academic Performance	**-0.405*****	**0.0553**	**0.0001**

Source: Data Analysis, 2024

3.2 DISCUSSION

The present study examined the associations among food insecurity, mental stress and academic performance among students at Nigerian universities. The average age of the respondents (students) was 22.8 years, similar to the finding of Ahmad et al. (2021), who reported that the average age of respondents was 22 years in a similar study. However, in contrast to this study, this study revealed that the majority of the participants were male (58%), which is different from the findings of Ahmad et al. (2021). Eighty-one percent of the respondents lived off campus because of limited accommodation on campus, and among those students who lived off campus, only approximately 32% lived within a radius of 1 km from the school main entrance because they were able to afford more expensive accommodations near their school area. Others (67%) have to walk longer distances to be in school and/or incur more cost on transportation to school for lectures. This additional cost affects the academic performance of students, especially distressed students. Providing suitable living arrangements for students living on campus and ensuring efficient transport logistics for staff and students who are staying off campus are major challenges that most universities in Nigeria are still struggling to resolve. The study revealed that 72% of the students had more unhealthy habits than healthy habits, which was strongly associated with their food insecurity status (x^2=60.980; p value= 0.000). According to Ahmad et al. (2021), unhealthy habits are precursors of mental stress. The study also revealed that approximately 80% of the undergraduate students in Nigeria do not engage in income-based economic activities to obtain additional income to support their education, that only approximately 40% of their sponsors have monthly incomes within the bracket, N30,001-N60,000 (USD20 - USD40), and that 17% of their sponsors earn monthly income above N90,000 (>USD60). For a country that is strongly import dependent, this income is just too low to sustain quality living standards and pay for quality education. Coupled with the fact that there are minimal opportunities for financial support, such as bursary and scholarships, the burden of financial provisions falls solely on the parents and guardians whose wards are studying in Nigerian universities. The pressure of how to source funding for their tuition and other life needs are sufficient factors to cause poor academic performance for students (Sulaiman et al., 2021), and there is evidence that sponsors' level of income is directly linked to their children's food security (Ukegbu et al., 2019). Fifty-five percent and 27% of the respondents also experienced "moderately high stress" and "very high stress", respectively, in school. Similar to the findings of Wattick et al. (2018), Debate et al. (2021) and Ahmad et al. (2021), the majority (34%) of the students who were not food insecure fell within the CGPA (2.50-3.49%).

Approximately 60% of respondents were food insecure and at risk of food insecurity (borderline of food consumption score and below). The findings in this study support and extend the growing evidence that the majority of students in Nigerian universities are at risk of becoming food insecure, and the findings corroborate the findings in the literature (Raskind et al., 2019; Bruening et al., 2017; and Ahmad et al., 2021). With a p value of less than 0.05, the study confidently rejected the null hypothesis and concluded that there was a significant relationship between the socioeconomic characteristics of the students and their food security status. Therefore, there is statistical evidence that there is a significant relationship between students' food security status and their socioeconomic characteristics, such as age (X^2=41.594; p value= 0.010), education level (X^2=18.339; p value= 0.019), location of accommodation (X^2=9.443; p value= 0.009), health-related habits (x^2=60.980; p value= 0.000), and engagement in economic activities (earning income).

X^2=13.037; p value= 0.000), parents' monthly income (x^2=93.202; p value=0.000), students' perception of their mental stress (X^2=93.202; p value=0.000), mental stress (x^2=18.566; p value=0.000) and students' academic performance (X^2=23.478; p value=0.002). The chi-square statistic further reinforces the strength of this relationship, indicating a substantial difference in the observed distribution compared to what would be expected if there were no association between

socioeconomic characteristics and the food security status of students. These findings are similar to the findings of Raskind et al. (2019), Patton-Lopez et al. (2014), and Ahmad et al. (2021).

Food insecurity, defined as inadequate access to sufficient and nutritious food to sustain an active and healthy lifestyle (Coleman-Jensen, Gregory, & Singh, 2018), has historically been a prevalent concern for vulnerable populations such as women, children, and elderly people. However, there is a growing recognition of food insecurity among students, which has been described as a nascent issue often overlooked within university settings, akin to a hidden problem (Van den Berg & Raubenheimer, 2015). The results of the multiple regression analysis that examined the impact of food insecurity, students' perceived mental stress, and various sociodemographic factors on academic performance revealed several significant factors that influence students' academic performance. Food insecurity, as indicated by a poor food consumption score, has a statistically significant negative effect on academic performance, which is similar to the findings of Crutchfield & Maguire (2018) and Eisenberg et al. (2016). This suggests that students who experience food insecurity are more likely to have lower academic performance. The coefficient of -15.311 further emphasizes the magnitude of this negative effect. High perceived mental stress also has a statistically significant negative effect on academic performance. Students who perceive high levels of stress are likely to experience a decline in their academic performance. The coefficient of -22.108 highlights the substantial impact of mental stress on academic performance.

On the other hand, age, class status/level (> 400 level), and earning income are identified as influential factors that have statistically significant positive effects on academic performance. Age has a positive effect, as shown by Momanyi et al. (2015), implying that older students tend to perform better academically. Similarly, higher class status/level and earning income are associated with improved academic performance. Despite the fact that Ahmad et al. (2021) found no significant association between the living arrangement of students and academic performance, this study found that the distance of the school from students' residence outside the school has a significant negative effect on academic performance. This suggests that students who must travel long distances to attend school may face challenges that negatively impact their academic performance. One specific variable, "Average Weekly Hour Often Spent in Attending Lectures," is found to have a statistically significant positive effect on academic performance. The coefficient of 8.025 suggests that for every one-unit increase in weekly hours spent in physical interaction during lectures, there is an 8.025-unit increase in academic performance. This finding emphasizes the importance of regular attendance and active engagement in lectures for students' academic success. On the other hand, variables such as gender, poverty status, students' unhealthy habits, sponsor's income, and earning income do not show statistically significant effects on academic performance based on the provided p values. This finding implies that these factors may not have a significant influence on students' academic performance in the context of this study.

Similar to the findings of Bruening et al. (2018) and Coffino et al. (2021), this study revealed that the significant direct effect of food insecurity on mental stress indicates that providing support and resources to alleviate food insecurity can potentially reduce the mental stress experienced by these students. By addressing food insecurity, policymakers can indirectly mitigate the negative impact of mental stress on academic performance. The substantial mediating effect of mental stress on the relationship between food insecurity and academic performance emphasizes the importance of addressing mental health concerns among students, in line with the findings of Reeder et al. (2020) and Payne-Sturges et al. (2018). For nonpoor students, the findings suggest that food insecurity still has a significant direct effect on mental stress, emphasizing the importance of addressing this issue across different socioeconomic backgrounds. However, the lack of a statistically significant direct effect of mental stress on academic performance among nonpoor students indicates that other factors may be more influential in determining academic outcomes for this group.

4.0. CONCLUSION

This study investigated the mediating effects of mental stress on the impact of students' food insecurity status on students' academic performance. The study revealed that mental stress significantly mediates the impact of food insecurity on students' academic performance. The findings of this study suggest that policies aimed at addressing food insecurity, mental stress, and their mediating effects on academic performance can be effective in improving educational outcomes for undergraduate students. Providing support for students experiencing food insecurity, promoting mental health services, and implementing strategies to mitigate the impact of these factors can contribute to creating a supportive academic environment that fosters student success.

Therefore, policies should focus on providing mental health support services, such as counselling or workshops on stress management, to help students cope with the challenges associated with food insecurity. By addressing mental stress, policymakers can potentially improve academic performance among students who experience food insecurity. Additionally, the significant direct effect of food insecurity on academic performance highlights the need for policies that address the underlying causes of food insecurity. This could include improving access to affordable and nutritious food options on campuses, implementing programmes to support students in financial need, and raising awareness about available resources such as food banks or meal assistance programmes.

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