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Influence of eating patterns on weight status, and academic performance of a Nigerian undergraduate population

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ABSTRACT

Background: Unhealthy diets have been linked to undesired weight gain and poor cognitive development in adulthood. However, the link between eating pattern, weight status, and academic performance have received much less attention in the young adult population.

Objective: This study seeks to understand the influence of eating patterns on weight status and academic performance.

Methods: A structured self-administered questionnaire was completed by a representative sample of 399 undergraduates. The questionnaire explored socio-demographic characteristics, dietary diversity, food frequency pattern, and meal pattern of respondents. The resulting data were analyzed using descriptive and inferential statistics.

Result: The mean age (SD) of the respondents was 21.8 (±2.52) years and were mostly (35.3%) in their third year of study. Most (58.6%) of the students had good dietary diversity and were mostly females (53.0%). The prevalence of unhealthy food frequency pattern (FFP) was high (80.7%) among the respondents, especially among males (53.1%). There were no statistically significant relationships between FFP, weight status, and academic performance ($p > 0.05$). The majority (62.7%) had an unhealthy meal pattern, and this was higher in males (55.6%). There were no statistically significant relationships between the meal pattern, weight status, and academic performance ($p > 0.05$). However, a higher proportion of respondents with healthy eating patterns had good academic performances.

Conclusions: Unhealthy eating patterns were common among undergraduates, especially among males. There was no statistically significant relationship between eating patterns, weight status, and academic performance. It is recommended that policies that will promote healthy eating patterns among students be implemented in the university environment.

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Background

Nutrition is one of the most important modifiable environmental factors that affect brain development, and therefore, cognition and academic performance [1]. Consumption of a healthy diet from conception to birth and beyond is the foundation of a well-developed brain [2,3]. Unfortunately, the nutrition transition era in the developing countries has replaced healthy diets with unhealthful ones [4]. These diets are often characterized by high intake of low-quality foods, such as sweets, fried foods, saturated fats, salts, refined grains, and low intake of high-quality foods, such as dairy, fruits, vegetables, whole grains, and dietary fiber [5,6]. While everybody is facing the scourge of this transition, adolescents are most at risk [4]. This is a unique period of growth spurt characterized by physiological, psychological, and cognitive development, all of which affect their nutritional needs. Most undergraduates in Nigeria are youths, and the rigours of campus life often predispose them to unbalanced lifestyles, which ultimately lead to irregular eating pattern and poor weight status.

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The link between dietary pattern and weight status of an individual had been well documented. Unhealthy eating pattern has been linked to the pathogenesis of most chronic non-communicable diseases, such as cardiovascular diseases, coronary heart diseases, and even emotional disorder [7–10]. Poor diet quality, resulting from low dietary diversity for fruits and vegetables, was closely associated with obesity and abdominal adiposity [8]. The 2018 global nutrition report shows that overweight and obesity are increasing globally, most especially among adolescents [4]. This increased burden of malnutrition observed globally has been linked to what we eat. Also, the link between diet and academic performance is well-established. For instance, higher dietary intake of western diets have been shown to reduce cognitive performance [1]. Evidence has also shown that regular breakfast consumption improves cognitive performance [11]. Due to the importance of good academic performance at all the levels of learning, studies have been done to reveal factors that influence academic performance, such as intellectual ability, study habit, achievement, motivation, and socioeconomic factors [12,13]. Also, the effects of a range of health behaviour and indicators on academic achievement of university students have been previously established, for example, excessive alcohol consumption, sleep deprivation, and poor mental health status have all been shown to be detrimental to academic achievement [14,15]. However, the link between eating pattern and academic achievement has received much less attention in this population group, especially in Nigeria as most of the research works focused on school-aged children [6,16]. This study focused on undergraduates to determine the influence of eating patterns on their weight status and academic performance.

Methods

This study was carried out at Obafemi Awolowo University Campus, Ile-Ife, Osun State, Nigeria. Obafemi Awolowo University (OAU) is a federal government-owned and operated Nigerian university situated on a vast expanse of land totaling 11,681 hectares in Ile Ife, Osun State, south-west, Nigeria. The OAU campus is built on about 5,000 acres (20 km^2) and comprises of academic, administrative units and service centres. The University comprises central campus, the student residential area, the staff quarters, and a teaching research farm. The student residential area is made up of eight undergraduate hostels and a postgraduate hall of residence. It has a population of 35,000 students with 13 faculties, 82 departments, and two colleges. OAU has a centralized eating arena with many restaurants that serve both local and westernized diets. They enjoy good patronage by students with a reported surge during examination periods. Each hall of residence has a buttery where snacks and soft drinks are sold, and there are other outlets around that provide similar services.

This study was a descriptive cross-sectional survey. The study population was undergraduates of Obafemi Awolowo University, Ile Ife. All the healthy respondents in the chosen departments from 200 level and above with a preformed cumulative grade point average (CGPA) were eligible. A sample size of 423 was calculated using the appropriate statistical formula for estimating minimum sample size in descriptive health studies ($n = Z^2p(1-p)/d^2$) and prevalence of skipping breakfast among undergraduates as 52% [17]. Multi-stage sampling technique was used in selecting participants. In the first stage, six faculties out of thirteen were selected by simple random sampling (balloting method) which included Technology, Law, Administration, Social Sciences, Arts, and Agriculture. In stage two, simple random sampling was also used to select three departments from each of the six faculties (besides Faculty of Law which has only one department) totaling 16 departments. In stage three, students from the respective departments were chosen by simple random sampling method giving a total of 423 respondents.

A semi-structured self-administered questionnaire was used to collect the data. The questionnaire had two main sections which assessed the respondents' socio-demographic characteristics, 24-hour dietary recall, food frequency, and meal pattern. The questionnaire was pretested in another faculty outside the chosen faculties and ambiguous questions were adjusted accordingly.

Statistical analysis was done using the IBM—Statistical Product and Service Solutions (SPSS) version 20. Univariate analysis was done to analyze descriptive data and the results are presented as frequencies and percentages for categorical variables, and as means and standard deviation for continuous variables. Bivariate analysis was done using chi-square to determine the difference in eating patterns between gender, and associations between eating patterns, weight status and academic performance of the respondents. The level of significance was set at $p < 0.05$. Written informed consent was obtained from the study participants

while they were reassured of the confidentiality of their information. Ethical clearance was obtained (IPH/OAU/12/1011) from the Institute of Public Health Research and Ethics Committee, Obafemi Awolowo University, Ile-Ife, Nigeria.

Eating pattern

Questions were asked on dietary diversity, habitual food intake, and meal pattern of the respondents. The 24-hour dietary recall was used to assess dietary diversity. The diet was classified according to nine food groups as recommended by FAO [18], which included: (1) cereals, roots and tubers; (2) vitamin-A-rich fruits and vegetables; (3) other fruit; (4) other vegetables; (5) legumes and nuts; (6) meat, poultry and fish; (7) fats and oils; (8) dairy; and (9) eggs. Whoever consumed <3 food groups has low dietary diversity, 4–5 food groups have medium, while >5 food groups have high dietary diversity. This was further re-categorized into poor (≤3) and good (≥4) DD.

Habitual food intake was assessed with food frequency questions. The food frequency question has nine items (Adapted from Food and Agriculture Organization [19]) which was scored 0–4 from "never" to "daily" for questions on healthy foods and 4–0 from "never" to "daily" for questions on unhealthy foods (Sugary drinks/Excess Salt intake). The scoring was further dichotomized to 1 for consuming healthy foods, namely; Fruits, vegetables, cereals, root and tubers, meat and meat product, dairy products more than 3 times/week and 0 for consuming unhealthy foods, namely; Sugary drinks and excess salt more than 3 times/week. This gave a maximum score of 9 and a minimum of 0. A score below the mean score was classified as unhealthy food frequency pattern and vice versa.

Meal pattern was assessed with nine questions designed after careful consideration of the literature [20–23]. These questions were not captured in the 24-hour dietary recall and food frequency questionnaire. Questions like "how many times they eat per day; meal skipping habits; how often they visit the restaurant; water intake habit and unhealthy snack consumption habit." Each question was scored accordingly with a maximum score of 13 and a minimum of 2. A score below the mean was classified as unhealthy meal pattern.

Weight status

Anthropometric measurements of respondents were taken. Bodyweight was obtained with a weighing scale to the nearest 0.1 kg with the respondents' shoes taken off. Height was measured to the nearest 0.1 cm by the use of stadiometer. All the measurements were taken twice by the researchers and the mean value calculated and recorded. The weight status of the respondents was grouped using body mass index (BMI) classification into Underweight (<18.5), normal weight (18.5–24.99), Overweight (25.0–29.99), and Obese (≥30) [24].

Academic performance

CGPA of the students for the last semester were self-reported. It was classified according to the university standard. The points between 4.50 and 5.00 are classified as First class, 4.49–3.50 as Second Class Upper, 3.49–2.50 as Second Class Lower, 2.49–1.5 as Third Class while points below 1.49 as Pass. For ease of analysis, the academic performance was further dichotomized into good and poor based on the mean CGPA of the respondents (2.48 ± 0.88).

Results

Table 1 shows the sociodemographic characteristics of the respondents. The majority (85.7%) of the respondents belonged to the age group 18–24 years, and there was a fair representation of both sexes (Male 51.4%; Female 48.6%). A large proportion (97%) of the participants were singles and belonged to Yoruba (75.9%) ethnic group. Most

Table 1. Socio demographic characteristics of the respondents *N* = 399.

Variables	Frequency (*n*)	Percentage (%)
Age group		
18–24 years	342	85.7
25–31 years	57	14.3
Mean (SD)	21.8 (2.52)	
Sex		
Male	205	51.4
Female	194	48.6
Marital status		
Single	387	97.0
Married	12	3.0
Ethnicity		
Yoruba	303	75.9
Others (Igbo & Hausa)	96	24.1
Religion		
Christianity	286	71.7
Islam	113	28.3
Level of study		
200	130	32.6
300	141	35.3
400	100	25.1
500	28	7.0

(71.7%) of the respondents were Christians and in their third year of study (35.3%).

Table 2 shows the 24-hour dietary recall of the respondents by gender. The foods mostly consumed 24 hours before the study were from fat and oils group (86.5%), and cereals, roots and tubers group (85.7%). The least consumed foods were from vitamin A-rich fruits and vegetable group (18.8%), other fruits group (10.8%), and dairy group (9.3%). The males consumed more foods from vegetables group (55.8%), vitamin A-rich fruits and vegetables group (56.0%), and fruits group (53.5%), whereas the females consumed more foods from the legumes and nuts group (59.5%), eggs group (54.9%), and meat, poultry, and fish group (63.0%). The dietary diversity score (DDS) shows that the majority (58.6%) of the respondents had good dietary diversity and were mostly the females (53.0%). The difference in the DDSs between the males and the females was statistically significant ($p = 0.038$).

Table 2. 24-hour dietary recall of the respondents by gender $N = 399$.

Food groups	Male *n* (%)	Female *n* (%)	Total *n* (%)
Fats and oils	172 (49.9)	173 (50.1)	345 (86.5)
Cereals, roots, and tubers	179 (52.3)	163 (47.7)	342 (85.7)
Legumes and nuts	106 (40.5)	156 (59.5)	262 (65.7)
Other vegetables	82 (55.8)	65 (44.2)	147 (36.8)
Eggs	65 (45.1)	79 (54.9)	144 (36.1)
Meat, poultry, and fish	34 (37.0)	58 (63.0)	92 (23.1)
Vitamin A rich fruits and vegetables	42 (56.0)	33 (44.0)	75 (18.8)
Other fruits	23 (53.5)	20 (46.5)	43 (10.8)
Dairy	19 (51.4)	18 (48.6)	37 (9.3)
DDS			
Poor	95 (57.6)	70 (42.4)	165 (41.4)
Good	110 (47.0)	124 (53.0)	234 (58.6)

$\chi^2 = 4.326$; p-value = 0.038*

Table 3 shows the food frequency pattern of the respondents. About two out of five (38.3%) of the respondents consumed foods from cereal group daily, whereas less than one-quarter (23.3%) consumed foods from meat and meat product group daily. Also, less than 10% of the respondents consumed foods from legumes and nuts group, roots and tubers group, vegetable group, fruits group, and dairy group daily. On the aggregate score, the majority (80.7%) of the respondents' exhibited unhealthy food frequency pattern and this were mostly (53.1%) the males. The difference in the food frequency pattern between sexes was not statistically significant ($p = 0.158$).

Table 4 shows the meal pattern of the respondents by gender. The majority (52.1%) of the respondents eat three squared meal and were mostly female (54.3%). The most skipped meal of the day was lunch (68.4%), and this was higher in males (51.6%). Most (42.6%) of the respondents take 4–8 cups of water daily, and this was common in males

Table 3. Food frequency pattern of the respondents $N = 399$.

Food groups consumed	Never *n* (%)	Rarely *n* (%)	1–3 times /wk *n* (%)	4–6 times /wk *n* (%)	Daily *n* (%)
Cereals	0 (0)	17 (4.3)	56 (14.0)	173 (43.4)	153 (38.3)
Meat and meat products	3 (0.8)	46 (11.5)	105 (26.3)	152 (38.1)	93 (23.3)
Legumes and nuts	3 (0.8)	63 (15.8)	197 (49.4)	99 (24.8)	37 (9.3)
Roots and tubers	10 (2.5)	139 (34.8)	119 (29.8)	97 (24.3)	34 (8.5)
Vegetables	19 (4.8)	159 (39.8)	131 (32.8)	58 (14.5)	32 (8.0)
Fruits	10 (2.5)	119 (29.8)	178 (44.6)	65 (16.3)	27 (6.8)
Dairy products	17 (4.3)	132 (33.1)	162 (40.6)	65 (16.3)	23 (5.8)
Canned/bottled drinks	56 (14.0)	103 (25.8)	130 (32.6)	105 (26.3)	5 (1.3)
Salts	75 (18.8)	107 (26.8)	117 (29.3)	96 (24.1)	4 (1.0)
FF pattern	Male *n* (%)	Female *n* (%)	Total *n* (%)	χ^2	*p*-value
Healthy	34 (44.2)	43 (55.8)	77 (19.3)	1.992	0.158
Unhealthy	171 (53.1)	151 (46.9)	322 (80.7)		

Table 4. Meal pattern of the respondents by gender
N = 399.

Meal pattern	Male *n* (%)	Female *n* (%)	Total *n* (%)
No of meals per day			
Once	12 (75.0)	4 (25.0)	16 (4.0)
Twice	98 (56.0)	77 (44.0)	175 (43.9)
Thrice	95 (45.7)	113 (54.3)	208 (52.1)
Breakfast			
Daily	99 (50.3)	98 (49.7)	197 (49.4)
Skipped	106 (52.5)	96 (47.5)	202 (50.6)
Lunch			
Daily	64 (50.8)	62 (49.2)	126 (31.6)
Skipped	141 (51.6)	132 (48.4)	273 (68.4)
Dinner			
Daily	118 (53.4)	103 (46.6)	221 (55.4)
Skipped	87 (48.9)	91 (51.1)	178 (44.6)
Water intake/day			
<4 cups	37 (51.4)	35 (48.6)	72 (18.0)
4–8 cups	90 (52.9)	80 (47.1)	170 (42.6)
>8 cups	78 (49.7)	79 (50.3)	157 (39.4)
Fried foods			
Healthy intake	40 (46.5)	46 (53.5)	86 (21.6)
Unhealthy intake	165 (52.7)	148 (47.3)	313 (78.4)
Fast foods			
Healthy intake	77 (47.2)	86 (52.8)	163 (40.9)
Unhealthy intake	128 (54.2)	108 (45.8)	236 (59.1)
Snacking			
Healthy intake	32 (39.5)	49 (60.5)	81 (20.3)
Unhealthy intake	173 (54.4)	145 (45.6)	318 (79.7)
Sugary drinks			
Healthy intake	36 (42.9)	48 (57.1)	84 (21.1)
Unhealthy intake	169 (53.7)	146 (46.3)	315 (78.9)
Meal pattern category	Male *n* (%)	Female *n* (%)	Total *n* (%)
Healthy	66 (44.3)	83 (55.7)	149 (37.3)
Unhealthy	139 (55.6)	111 (44.4)	250 (62.7)

χ^2 = 4.776; *p*-value = 0.029*

*Significant.
The difference in the academic performance between both sexes was statistically significant (*p* = 0.031)

(52.9%). The majority (78.4%) take fried foods, eat fast foods (59.1%), engage in unhealthy snacking (79.7%) and take sugary drinks (78.9%) every day. The aggregate score showed that majority (62.7%) of the respondents had an unhealthy meal pattern, and this was higher in the males (55.6%). The difference in the meal pattern between the sexes was statistically significant (*p* = 0.029).

Table 5 shows the weight status of the respondents by gender. The majority (78.7%) of the

Table 5. Weight status of the respondents by gender.

BMI classification	Male *n* (%)	Female *n* (%)	Total *n* (%)
Underweight	16 (47.1)	18 (52.9)	34 (8.5)
Normal weight	169 (53.8)	145 (46.2)	314 (78.7)
Overweight/Obese	20 (39.2)	31 (60.8)	51 (12.8)

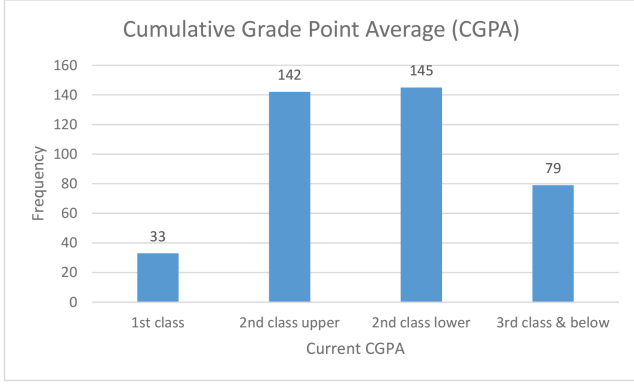

Figure 1. Cumulative grade point average.

participants had a good body weight. Underweight (52.9%) and overweight/obesity (60.8%) were found to be higher in females compared to males.

Figure 1 shows the CGPA point average of the respondents. One hundred and forty-five (36.3%) of the respondents had second class lower, while less than 10% had first class. The CGPA was further dichotomized into good and poor academic performance using the mean score of 2.48 (±0.88). The majority (80.2%) had good academic grades and were mostly males (54.1%).

Table 6 shows the association between eating patterns, weight status. and academic performance, There was no statistically significant relationship between food frequency patterns and academic performance of the respondents (*p* = 0.301). However, a higher proportion (84.4%) of respondents with healthy food frequency pattern had good academic grades. Also, there was no statistically significant relationship between meal pattern and academic performance (*p* = 0.363), but a higher proportion (82.6%) of the respondents with a healthy meal pattern, had good academic grade. There was no statistically significant relationship between food frequency patterns and weight status of the respondents (*p* = 0.777). Also, no statistically significant relationship exists between the meal pattern and weight status of the respondents (*p* = 0.061).

Table 6. Associations between eating patterns, weight status, and academic performance.

Eating patterns	Weight status			Total *n* (%)	χ^2/*p* value
	Underweight *n* (%)	Normal *n* (%)	Overweight/ Obese *n* (%)		
FF pattern					
Unhealthy	27 (8.4)	252 (78.3)	43 (13.4)	322 (80.7)	0.504/0.777
Healthy	7 (9.1)	62 (80.5)	8 (10.4)	77 (19.3)	
Meal pattern					
Unhealthy	15 (6.0)	201 (80.4)	34 (13.6)	250 (62.7)	5.592/0.061
Healthy	19 (12.8)	113(75.8)	17 (11.4)	149 (37.3)	
	Academic performance		Total *n* (%)	χ2	*p* value
	Poor *n* (%)	Good (%)			
FF pattern					
Unhealthy	67 (20.8)	255 (79.2)	322 (80.7)	1.068	0.301
Healthy	12 (15.6)	65 (84.4)	77 (19.3)		
Meal pattern					
Unhealthy	53 (21.2)	197 (78.8)	250 (62.7)	0.827	0.363
Healthy	26 (17.4)	123 (82.6)	149 (37.3)		

Discussion

This study assessed the influence of eating patterns on weight status and academic performance of undergraduates at Obafemi Awolowo University, Ile-Ife. The prevalence of unhealthy food frequency pattern (FFP) was high (80.7%) among respondents. There was no statistically significant relationship between FFP and weight status ($p > 0.05$). Also, the relationship between FFP and academic performance was not statistically significant ($p > 0.05$). In this study, the majority (62.7%) had an unhealthy meal pattern, and the relationship between meal pattern and weight status was not statistically significant ($p > 0.05$). Also, the relationship between meal pattern and academic performance was not statistically significant ($p > 0.05$). Although there were no statistically significant relationships between eating patterns and weight status, as well as the academic performance of the respondents, a higher proportion with healthy eating patterns had good academic performance.

In this study, the total DDS of the respondents was good (58.6%), and the females have a higher score (53.0%) compared to the males. This finding is similar to some other studies conducted among females [25,26] but contrary to the study of Nupo et al. [27] who reported low DDS among undergraduates. This good DDS observed among the students could be attributed to the fact that students are not restricted as to their food choices, purchase, preparation as well as their quest for nutrition information from multiple sources [28].

With regards to FFP of students and as reported in the literature [20,29–32], we found that the prevalence of unhealthy FFP was high among respondents. For instance, the consumption of fruits and vegetables daily was low. This was in agreement with some other studies conducted among undergraduates [33–37]. The reason for this low intake could be as a result of the lack of accessibility to these foods or poor knowledge with regards to the health benefits of their consumption [38]. Also, the males (53.1%) have a higher proportion of unhealthy food frequency pattern compared to their counterparts. A similar study was carried out among university students in Lebanon by Salameh et al. [39] who reported that the males consumed more of unhealthy foods compared to the females. The reason for this could be that males generally, give little attention to their body image [40,41], and were less conscious of their diet [34]. Furthermore, a statistically significant association was not found between FFP and weight status. Similar results have been reported by other studies conducted among undergraduates [39,42,43]. Also, the relationship between FFP and academic performance was not statistically significant ($p > 0.05$). However, a higher proportion of respondents with healthy FFP had good academic performance.

Consistent with previous research works [23,30,44,45], our study found that meal pattern was an issue of concern among university students. For instance, the majority of the students skipped breakfast (50.6%) and lunch (68.4%) daily. This was in agreement with previous works carried out among university students [21,37,46,47]. Most respondents (78.9%) have a strong desire for sugary drinks. This was more prevalent in males (53.7%) than in females (46.3%). This harmonized

with other studies among university students [22,32,47,48] but contrary to the study of Likus et al. [21] on dietary habits among first-year university students. The reason for such disparity in result could be attributed to the year of study of the participants. Fried foods consumption was high (78.4%) among respondents, especially among males (52.7%). However, this was contrary to the finding of Feitosa et al. [49] who reported high consumption of deep-fried foods among the females. Fast food intake among the respondents was above average (59%), and this was higher compared to the finding of Ramalho et al. [50] who reported low intake of fast foods among university students. In this study, a higher proportion (79.7%) of students engaged in unhealthy snacking. This agrees with many studies carried out among university students showing that unhealthful snacking habit is prevalent [37,44,51]. This unhealthful snacking habit was most common with the males (54.4%), and this was in consonant with the finding of Ansari et al. [52] who reported that males consumed more snacks than female students. On aggregate, the relationship between meal pattern and weight status was not statistically significant ($p > 0.05$). A similar result has been documented by previous research works [39,42,43]. Also, the relationship between meal pattern and academic performance was not statistically significant ($p > 0.05$). However, a higher proportion of respondents with a healthy meal pattern had good academic performance. A similar finding has been documented in the literature [53,54]. These unhealthy eating patterns of university students have been attributed to a number of factors, such as, life-styles of the students, poor accessibility to these foods [33], lack of time to prepare meal [36,55], financial instability [56], lack of cooking skills [57], and easy access to unhealthy foods [58].

This present study had limitations. First, the sample size was drawn from a single institution. Therefore, there is a need to exercise caution when generalizing the results. Second, the responses were self-reported, hence, is subjected to recall bias, and the actual portion size of the food consumed was not measured. Third, a non-validated questionnaire was used to assess meal pattern. Lastly, assessing academic performance using GPA for all class level can also be considered a limitation.

Based on our findings, it is recommended that policies that will promote healthy eating patterns among students and increase their access to healthy foods at the university environment be put in place and implemented. Nutrition education and behavioral change programs should be encouraged in the university community. Any barriers to healthy food selection should be examined thoroughly within the context of the broader university community and dealt with accordingly. The intervention during this youthful stage would be an effective method of improving the overall academic performance and achieving future overweight and obesity reduction in society.

Conclusion

The majority of the male respondents in this study had unhealthy eating patterns. There was no statistically significant relationship between eating patterns and weight status. Also, there was no statistically significant relationship between eating patterns and academic performance. However, a higher proportion of respondents with healthy eating patterns showed good academic performances. This suggests a relationship between these variables, though not statistically significant. We, therefore, encourage future research to look at the influence of portion sizes on the academic performance of university students and also consider a more robust sample.

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