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Impact of Nutrition on Academic Performance of Boarding Science Students in Selected Secondary Schools in Ilorin Metropolis, Kwara State, Nigeria

[*1]Bello, Z. A., [2]Obebe, S. F., [1]Ayilara, T. T., [4]Sulaiman, M. M., [5]Abdulazeez, B. T-A., & [6]Ambali Rasheed, O.

[1]Department of Biology, Kwara State College of Education, Ilorin, Ilorin, Nigeria
[2]Directorate of Professional Diploma in Education, Kwara State College of Education Ilorin, Ilorin, Nigeria
[3]Department of Science Education, University of Ilorin, Ilorin, Nigeria Ilorin, Nigeria
[4]Department of Science Education, Faculty of Education, Al-Hikmah University, Ilorin, Nigeria.
[5]Physical and Health Education, Kwara State College of Education,

*__Corresponding author email__: zakbay26@gmail.com

Abstract
This study investigates the impact of nutrition on the academic performance of boarding science students in selected secondary schools within the Ilorin metropolis of Kwara State, Nigeria. With growing concerns about failing educational systems and student apathy, the research seeks to understand the role of balanced diets in enhancing academic outcomes. Adopting a descriptive cross-sectional approach, the study collected qualitative data through structured questionnaires administered to a purposively selected sample of 264 boarding students aged 13 to 17. The findings reveal that dietary practices among boarding science students often lack balance, with breakfast being frequently skipped. Such practices lead to reduced concentration, impaired cognitive abilities, and consequently, lower academic performance. Factors influencing these dietary habits encompass hunger, purchasing power, health conditions, family background, school dining menus, peer influence, and religious beliefs. These factors collectively contribute to the nutritional deficiencies observed among the students. The research underscores the importance of addressing these nutritional gaps to improve academic performance. It advocates for compulsory attendance at dining halls to promote healthy eating habits, especially during breakfast, a crucial meal for cognitive function. Furthermore, there's a pressing need for educational initiatives aimed at enlightening students on the benefits of balanced nutrition and its direct impact on academic success. In light of these findings, recommendations include the inclusion of fruits in school meals to boost nutrient intake and the implementation of orientation programs for incoming students. These programs should focus on fostering positive dietary practices from the outset of their boarding school experience. The study highlights a significant relationship between nutrition and academic performance. It emphasizes the urgency of targeted interventions to improve science students' overall well-being, enhance cognitive abilities, and ultimately, elevate scholastic achievement levels among boarding science students in Kwara State.

Keywords*:* Nutrition, Boarding, Boarding Science Students, Academic Performance, and Boarding Schools.

Introduction

Education refers to the process of acquiring knowledge, honing reasoning and judgment skills and preparing oneself or others intellectually for adult life. Academic performance measures the extent to which students, teachers, or institutions achieve their educational objectives over time. No nation can afford to squander its human resources or intellectual capabilities. Yet, this is exactly what happens in contexts where micronutrient deficiencies cause permanent brain damage and where anaemia and short-term hunger impede students' academic performance. In the

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face of struggling schools and disengaged students, educational boards have explored various strategies to improve test scores, enhance exam results, and build school systems that provide all students with high-quality education. One potential approach to boosting academic performance is examining the nutritional quality of the food consumed by school-aged students daily, especially in relation to its impact on their learning capabilities (Bediako, 2011). Poverty is a significant factor affecting the diet and nutrition of boarding students in Ilorin Metropolis, Kwara State, even when parents pay for their meals. Unfortunately, due to the high cost of foodstuffs and ingredients, the funds provided are insufficient to ensure proper nutrition. The students' diets mainly consist of carbohydrate-rich foods such as garri, elubo, eba, fufu, yam, cocoyam, and pap. Additionally, there is a widespread lack of knowledge about proper dietary practices, especially in rural areas where many are illiterate and unaware of nutritional needs. Good digestion, which is linked to overall well-being, is essential for a healthy life. The Federation of African Nutrition Societies (FANUS), in collaboration with the Nigerian Nutrition Society, emphasized the importance of professional training in nutrition education (NEAC) during its 2nd meeting in Abuja, highlighting the need to understand the consequences of poor nutrition.

Nutrition is a cornerstone of human life, health, and development throughout all stages of life. From fetal development to old age, proper nutrition is crucial for survival, physical growth, mental development, productivity, and overall well-being (WHO, 2000). The role of nutrition in academic performance is analogous to the role of fuel in a vehicle. Our cells function like tiny energy-producing machines that require proper maintenance and the right fuel—a balanced diet—to operate effectively. When cells do not receive the necessary nutrients, they become sluggish and inefficient. Some people mistakenly believe that food is merely something to satiate hunger. However, consuming an unbalanced diet can lead to malnutrition-related diseases such as obesity, pellagra, night blindness, rickets, goitre, and anaemia. While the relationship between nutrition and cognition, as well as psychosocial behaviour affecting academic performance, has not been thoroughly explored in past research, some studies have investigated the nutritional benefits of proteins, vitamins, and other essential food substances. Dietary patterns during infancy and their influence on cognitive and neuropsychological function in childhood have also been examined (Gale, 2010). Schools have a critical role in supporting students' learning potential and minimizing the negative effects of poor nutrition on academic performance by providing nutritious meals such as breakfasts, lunches, and dinners. According to the School Nutrition Association (SNA), current guidelines require that students be served a balanced diet daily (SNA, 2008). To address these issues, health education programs should be implemented to counsel students, parents, school cafeteria staff, matrons, food prefects, and vendors within school premises on the importance of balanced nutrition. School administrators should also monitor and ensure compliance with dietary standards. The lack of up-to-date census data in Nigeria has made it challenging to accurately map socio-economic variables, including malnutrition. Nigeria has struggled to address its high levels of malnutrition. Ensuring that students are safe, healthy, and well-nourished is essential for improving academic performance.

Without proper nutrition knowledge and a balanced diet, maintaining good health is impossible. Good health is defined by the World Health Organization (WHO, 1946) as a state of complete physical, mental, and social well-being, not merely the absence of disease. Essential qualities of good health include freedom from disease, proper bodily functions, mental and emotional health, and an adequate diet, which is fundamental to all these qualities. A hungry student is unlikely to be in a state of mental and emotional well-being. Proper nutrition is vital for maintaining a robust immune system, achieving optimal health, and ensuring normal bodily functions such as digestion and excretion. Increasing numbers of students are coming to school hungry, with inadequate nutrition, leading to micronutrient deficiencies. Poor nutrition is linked to various diseases, including intellectual impairment, obesity, extreme weight loss, stunted growth, weakened immunity, pellagra, dermatitis, rickets, diarrhoea, anaemia, beriberi, and scurvy. Unbalanced nutrition can negatively impact students' physical, mental, and emotional well-being, leading to cognitive impairments. Therefore, it is crucial for students to eat healthily to perform well academically.

Recent studies have demonstrated the profound impact of nutrition on students' cognitive abilities, behaviour, and overall health, all of which significantly influence academic performance. Research indicates that diets rich in trans and saturated fats can impair learning and memory, while early nutritional deficiencies can hinder the cognitive development of school-aged children. Conversely, access to nutritious meals has been linked to improved cognition, concentration, and energy levels among students. For instance, studies have shown that 5th-grade students with less

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nutritious diets performed worse on standardized literary assessments, and those consuming more fast food had lower math and reading scores. Furthermore, youth face various food-related concerns such as poor nutrition, obesity, and food insecurity, all of which impact academic outcomes.

Moreover, nutrition indirectly affects school performance by leaving students vulnerable to illness and leading to absences due to headaches and stomachaches. Access to nutrition incorporating protein, carbohydrates, and glucose has been shown to enhance students' cognition, concentration, and energy levels. Conversely, deficiencies in essential nutrients like zinc, B vitamins, Omega-3 fatty acids, and protein can impede cognitive development in school-aged children. Additionally, diets high in trans and saturated fats have been found to negatively impact the brain, affecting learning and memory. Research has also established a clear link between nutrition and behaviour, with access to nutrition, particularly breakfast, enhancing psychosocial well-being, reducing aggression and school suspensions, and decreasing disciplinary problems. Furthermore, dietary habits, including the consumption of fast foods and skipping breakfast, have been associated with poor academic performance. These habits often result in inadequate nutrient intake and metabolic diseases such as insulin resistance and obesity, further highlighting the importance of a balanced diet for academic success. The brain is an intricate organ responsible for coordinating various bodily functions and cognitive processes, including thinking, learning, and memory. It communicates with other organs and cells in the body, ensuring smooth functioning and facilitating both physical and cognitive tasks. Proper nutrition plays a crucial role in supporting optimal brain function, as it provides essential nutrients for neuronal health and overall brain health. Conversely, an unbalanced diet lacking essential nutrients can adversely affect cognitive functions, leading to issues such as inflammation and cognitive impairment.

Omega-3 fatty acids found abundantly in certain foods like fish oils, walnuts, and flax seeds, are particularly vital for brain health. Research indicates that omega-3 fatty acids can improve brain function and reduce the risk of brain disorders such as Alzheimer's disease and depression. These essential nutrients support neuronal health, help regulate inflammation in the brain, and contribute to overall cognitive well-being. However, a deficiency in omega-3 fatty acids due to inadequate dietary intake can lead to cognitive dysfunction and hinder academic performance. Furthermore, the impact of nutritional deficiencies on academic performance extends beyond cognitive function. Individuals experiencing deprivation of basic nutritional needs, such as food insecurity leading to hunger, often struggle to achieve their full potential academically. Nutritional deficiencies can impede physical growth and development, hinder concentration and focus, and affect mood and behaviour. Thus, addressing nutritional needs and promoting a balanced diet is fundamental to supporting academic success and overall well-being among students. A holistic approach that addresses both physical and cognitive aspects of nutrition is essential for nurturing healthy brain function and facilitating optimal academic performance.

Good vision, hearing, and speech are crucial components of academic success for students. However, studies have shown that an unbalanced diet can significantly impact the functions of the eyes, ears, and speech. Excessive consumption of carbohydrates, fats, and cholesterol has been linked to an increased risk of cardiovascular diseases. These mechanisms can also damage the blood flow to the cochlea, affecting auditory sensitivity. Conversely, diets rich in fish and omega-3 polyunsaturated fatty acids have been found to positively impact auditory function by improving blood supply to the cochlea. This suggests that both macronutrients and micronutrients play vital roles in maintaining optimal hearing health. Moreover, poor dietary habits, such as consuming highly processed and high-fat foods, can heighten the risk of eye problems. Conditions like diabetes and dehydration further exacerbate chronic vision and eye issues. Insufficient intake of essential nutrients, such as vitamin E and omega-3 fatty acids, can contribute to vision impairment and conditions like proliferative retinopathy, a leading cause of blindness. Therefore, ensuring a balanced diet rich in essential nutrients is crucial for maintaining healthy vision and preventing vision-related complications among students.

There is a significant relationship between healthy eating habits and academic performance. Research indicates that students who consumed more fast food exhibited slower academic progress, particularly in mathematics, reading, and science, compared to those who did not consume fast food. The importance of school health has been recognized worldwide since the early 20th century. In many developed countries, school health programs emerged after World War II, focusing on nutrition and physical fitness to address the poor nutritional status of lower-middle-

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class and working-class children. These programs typically emphasise nutritional support and clinical assessments (Svokes, 2014).

Studies have shown that students perform better academically when they are well-nourished. Healthy meals are associated with improved grades, better memory, enhanced alertness, and quicker information processing. Foods rich in fibre, protein, and healthy fats, such as eggs, yoghurt, apples, and oatmeal, help sustain energy levels, keeping students focused throughout the day (Options for Youth, 2021). According to the CDC, healthy students tend to be better learners, as poor nutrition, physical inactivity, and unhealthy lifestyles can negatively affect academic performance. Further research has also demonstrated that healthy children generally have better attendance, perform better in class, and display improved behaviour. A study conducted by Revter et al. (2020) found a positive correlation between healthy eating habits, particularly regular breakfast consumption, and academic success. Chen (2020) argued that many foods consumed by students today are high in sugar, chemicals, and sodium, contributing to fatigue, lack of focus, and illness, and negatively influencing academic performance and behaviour. Similarly, Philips (2005) discovered that students who ate breakfast before exams had higher passing rates compared to those who skipped breakfast. Benton and Parker noted that students who did not eat in the morning struggled with recalling items and retaining information from lectures. Poor eating habits were linked to decreased concentration, which often resulted in poor exam performance or withdrawal from subjects. Hungry and malnourished students typically experience difficulty concentrating, reduced energy levels, and low motivation (Massey-Stokes, 2002).

Nutrition education plays a vital role in empowering students with the knowledge and skills necessary to make healthy food choices, thereby promoting wellness and good eating habits. Nutrition knowledge is essential for life and well-being, as stated by Ibukun-Olu (2010), who described nutrition as the science of food, nutrients, and other related substances. Hippocrates, considered the father of medicine, likened the stomach to a stew-pot, where food is cooked or stewed by body heat, and noted that children produce more heat, thus requiring more food than adults. A lack of healthy eating habits and nutritional knowledge can lead to public health issues, especially in developing countries, with significant health consequences (Andere & Kyallo, 2013). Research suggests that nutrition education can enhance students' psychosocial well-being, reduce childhood obesity, and decrease the risk of chronic diseases that may extend from childhood into adulthood (Brown et al., 2008). Childhood obesity, which affects approximately 17% of youth aged 2-19, can persist into adulthood, according to Levi et al.(2012), with further implications reported by Steinbeck (2010) and Boulet (2013). Health professionals in schools are in a unique position to provide nutrition education to large numbers of students, helping to address the growing rates of obesity.

The impact of an unbalanced diet extends beyond physical health to include sensory functions like vision, hearing, and speech. Nutritional deficiencies can compromise these functions, affecting academic performance and overall well-being. Therefore, promoting healthy dietary habits and ensuring adequate intake of essential nutrients is essential for safeguarding students' sensory health and supporting their academic success.

Statement of the Problem

In the current educational landscape, where schools are often underperforming and students are increasingly disengaged, there is ongoing debate among stakeholders—such as teachers, parents, and government officials—about the root causes of these issues. Some argue that improving student nutrition is the responsibility of the government, while others believe that parents and educators also have critical roles to play. This raises the question: "What is the impact of an unbalanced diet on the academic performance of science students?"

Purpose of the Study

The study aims to evaluate the effectiveness of nutrition on the academic performance of boarding science students in selected secondary schools in the Ilorin metropolis. It seeks to investigate the relationship between nutrition and various factors influencing academic performance. The specific objectives of the study are to:

1. Assess the impact of a balanced diet on the academic performance of science students and its role in improving cognitive abilities.

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2. Analyze how nutrition influences brain function, physical development, skeletal growth, body mass index (BMI), and the prevalence of obesity among science students.
3. Examine the effects of nutritional deficiencies, such as lack of essential vitamins and minerals, on the academic performance and overall well-being of science students.
4. Investigate the various factors that affect student nutrition, including the quality and standards of school meals, parental socioeconomic status, advertising, nutritional education, and food availability within the school environment.
5. Explore how knowledge of nutrition among boarding science students affects their dietary choices and academic outcomes.
6. Propose strategies that can be implemented by schools and policymakers to improve the dietary practices of boarding science students, with a focus on enhancing both health and academic performance.

Research Questions

1. What are the dietary practices of boarding science students in selected secondary schools in the Ilorin metropolis?
2. How do the general characteristics of science students relate to their academic performance?
3. What impact does an unbalanced diet have on the academic performance of boarding science students?
4. What factors influence the dietary practices of boarding science students in selected secondary schools in the Ilorin metropolis?
5. How does knowledge of nutrition among science students affect their academic performance?
6. What strategies can be implemented to improve dietary practices among boarding science students?

Hypothesis

$H0_1$: There is no significant relationship between an unbalanced diet and the academic performance of science students.

Methodology

The methodology of this study encompasses the research design, settings, target population, sampling techniques, research instrument, and procedures for data collection and analysis. The research design adopted was a descriptive cross-sectional study, using qualitative methods to investigate the impact of an unbalanced diet on the academic performance of boarding school students in selected secondary schools in Ilorin metropolis, Kwara State. The descriptive survey design was selected because it allowed for the collection of data from a representative sample, which was analyzed to reflect the existing situations regarding students' dietary habits and their academic outcomes.
The sRtudy was carried out in selected secondary schools, focusing on students aged 13 to 17 years. These adolescents, housed in boarding facilities, were part of a homogeneous group undergoing significant growth and developmental changes. The research sought to capture data from students of both genders and various class levels. The total population of interest included 740 boarding students, from which a sample of 264 students (36% of the population) was selected through stratified sampling based on gender and class. This was followed by a simple random sampling method, known as the fishbowl technique, to achieve the desired sample size. Systematic convenience sampling was also employed during the selection process, particularly when gathering students during meals in the dining hall. To determine the sample size, the study applied Yamane Taro's (1967) formula for descriptive studies, which took into account the total population of 740 students and a margin of error of 0.05. This calculation resulted in a sample size of 264 students, which was then used for the study. The research instrument developed was a structured questionnaire that drew upon earlier studies investigating the causes and effects of unbalanced diets among adolescents. The questionnaire was written in English for ease of administration and was divided into five sections. These sections covered demographic information, the relationship between poverty and unbalanced diet, the role of ignorance and socioeconomic factors in poor nutrition, the academic consequences of an unbalanced diet, and the perspectives of parents, teachers, and staff involved in the students' care.

To ensure the validity of the questionnaire, content and face validity were considered. The instrument was reviewed by the researcher's supervisor and other experts in the Department of Science Education at the College of Education, Ilorin, to guarantee that the questions were appropriate and adequately covered the topic under investigation. Their feedback and suggestions were incorporated into the final version of the instrument. The reliability of the instrument

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was tested through a pretest conducted among a sample comprising 10% of the study population. The purpose of the pretest was to assess the clarity, effectiveness, and efficiency of the questionnaire, as well as to identify any challenges the researcher might face during the actual data collection process. The data collection process relied entirely on primary sources, with the questionnaire serving as the main tool for gathering information. It was administered directly to the respondents through face-to-face interactions, with assurances of confidentiality and anonymity to protect the integrity of the responses. The responses provided valuable insights into the relationship between unbalanced diets and the academic performance of boarding school students in Ilorin. The data are analyzed using Stata software Version 15. Descriptive statistics, and binary and multiple linear regression analysis were done. Statistical association of dependent and independent variables was declared at $p\text{-value} < 0.05$. Frequency and Percentage were used to describe the data while Chi-square was used to cross-check whether the hypothesis is accepted or rejected.

Results

Table 1: Shows the responses of students on dietary practices.

Table 1: Number of times the boarding school students eat a main meal in a day

Number of Times	Frequency	%
Once	0	0
Twice	70	27
Thrice	194	73
Total	**264**	**100**

Forty percent (40%) of the students ate twice a day, while 60% of them ate thrice per day but none ate once a day as indicated in Table 1. The students were also asked whether they sometimes skip any of the three main meals of the day and their responses indicated that, 55% (Yes) skipped meals while the remaining 45% (No) did not.

The students who indicated they skipped some of their meals were asked to indicate which meal they skipped.

Table 2: Results of the type of meal skipped by some students

Type of Meal Skipped	Frequency	%	No response
Breakfast	74	53	0
Lunch	48	34	0
Dinner	18	13	0
Total	**140**	**100**	**0**

Table 2 illustrates that among the students who missed meals, 53% skipped breakfast, 34% skipped lunch, and 13% missed dinner. Additionally, students were asked if they occasionally ate meals outside the school dining hall. The findings showed that 76% of the students sometimes ate outside the school dining hall, while 24% did not. For those who reported eating outside the school dining hall, they were further asked to specify their preferred types of meals. The results of this are presented in Table 3.

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Table 3 shows the types of food that students typically consume outside the school dining hall

Preferred Meal	Frequency	Percentage (%)
Fried rice with plantain	74	41
Indomie instant noodles	23	13
Garri and Sugar	27	15
Boiled Yam and egg	24	14
Bread and egg	22	12
White rice with stew	10	5
Total	**180**	**100**

N= 180< 264 due to 84 students indicating not eating outside the school dining hall.

Table 3 shows the types of food that students typically consume outside the school dining hall. Approximately 41% of the students favoured fried rice with plantain, 13% preferred Indomie instant noodles, 15% chose Garri with sugar, 14% opted for boiled yam with egg, 12% selected bread with egg, and the remaining 5% preferred white rice with stew.

The students' responses regarding their preferred breakfast meals are detailed in Table 4 below.

Table 4: The students' preferred meal for breakfast.

Preferred Breakfast Meals	Frequency	Percentage (%)
Pap (Ogi) with bread/ puff loaf	80	36
Beverages such as Bournvita, Milo, milk with bread	71	27
Rice porridge, yam with bread		
Others	57	22
	55	15
Total	**264**	**100**

Table 4 results indicate that 36% of the students preferred Pap (ogi) with bread or puff loaf for breakfast, 27% favoured beverages with bread, 22% opted for rice porridge or yam with bread, while 15% chose other options such as garri with fish, beans, and corn for their morning meal.

In terms of fruit consumption as part of their dietary habits, the students were asked to indicate how frequently they ate fruits, and their responses are summarized in Table 5

Table 5: Rate of fruit intake of the students

Fruits intake	Frequency	Percentage (%)
Seldom	146	55
Weekly	68	26
Daily	50	19
Total	**264**	**100**

Table 5 reveals that 55% of the students rarely consumed fruits, 26% ate fruits on a weekly basis, and only 19% included fruits in their daily diet.

Since water intake is a crucial part of a healthy diet, the researcher asked the students to specify the average amount of water they drank each day. Their responses are detailed in Table 6 below.

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Volume of Water	Frequency	Percentage (%)
4 sachets or less	165	63
5-7 sachets	89	33
8 sachets or more	10	4
Total	**264**	**100**

Table 6 indicates that the majority of students (63%) consumed an average of 4 sachets (2 litres) of water daily. About 33% drank between 5 and 7 sachets (2.5–3.5 litres), while only 10% had a daily water intake of 8 sachets (4 litres) or more.

Additionally, students were asked whether they consumed snacks (small, light foods) to help the researcher determine their snack intake. The responses showed that 98% of the students ate snacks, while only 2% did not. The students who consumed snacks provided further details on their consumption habits. The results are presented in **Table 7** below.

Table 7: The students' responses on the intake of snacks

Consumption Rate	Frequency	Percentage (%)
Not often	30	12
Often	88	34
Very often	140	54
Total	**258**	**100**

N= 258 < 264 due to 6 students indicating not taking in snacks.

The students who ate snacks were 98% (258). The data in Table 7 shows that the rate at which those students ate snacks. 54% of the students ate snacks very often, 34% often ate snacks and 12% of them rarely ate snacks. This result shows that the majority of the students (88%) frequently consumed snacks.

Table 8: The students preferred snack foods

Preferred snack foods	Frequency	Percentage (%)
Biscuits/Pastries/puff-loaf and drinks	130	50
Groundnut and roasted corn	70	28
Sweet potatoes/ fried yam/ spring rolls	10	4
Fruits	16	6
Cassava balls	32	12
Total	**258**	**100**

N= 258< 264 due to 6 students indicating not taking snacks.

Pastries/biscuits/puff-loaf and drinks 50%, sweet potatoes/ Fried yam/spring rolls 4%, Groundnut and Roasted corn 28%, Fruits 6%, Cassava balls 12% Total 100%. N= 258 < 264 due to 6 students indicating not taking in snacks. According to Table 9 half (50%) of the students preferred pastries, biscuits, puffy loaf and drinks for a snack, 4% preferred fried yam, sweet potatoes or spring rolls, while 28% liked groundnut and roasted corn, 12% preferred cassava balls and 6% indicated fruits as their favourite snack.

To address this research question, data were gathered through responses to the questionnaire. The questionnaire sought information on the factors that may influence students' dietary practices. The students were presented with several potential factors and asked to express their agreement or disagreement with each of the following options: health condition, peer influence, religious beliefs, parental or family influence, the school dining menu, food availability, hunger, and purchasing power.

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Table 11: Factors influencing dietary practices of the students

Factors	SA	A	D	SD	TAR in Rank
Hunger	84(32)	165(63)	0(1)	11(4)	1st (95)
Availability of food	220(83)	28(11)	8(3)	8(3)	2nd (94)
Health Conditions	134(51)	82(31)	48(18)	0(0)	3rd (82)
School dinning menu	124(47)	86(33)	50(19)	4(1)	4th(80)
Cultural practices	106(40)	82(31)	46(17)	32(12)	5th (71)
Peer influence	98(37)	70(27)	48(17)	51(19)	6th (64)
Family influence	105(40)	63(24)	42(16)	54(20)	6th (64)
Purchasing power	60(23)	98(37)	64(24)	42(16)	8th(60)
					(n = 264)

Key: SA - Strongly Agree, A - Agree, SD - Strongly Disagree, D - Disagree. TAR - Total Agreed Responses. Note: The percentages are shown in parentheses.

Table 11 provides an overview of the factors influencing students' dietary practices in the study. A substantial majority (95%) identified hunger as a significant influence on their dietary choices, while only 5% disagreed. Similarly, 94% of students indicated that purchasing power affects their dietary practices, with 6% disagreeing. Health was recognized by 82% of students as a factor influencing their dietary habits, compared to 18% who disagreed. Additionally, 80% of students considered the school dining menu to be influential, with 20% holding a different view. Other factors, including cultural practices, food availability, family influence, and purchasing power, were also noted to affect dietary practices, with varying levels of agreement among the students. The data reveals that hunger is the most significant factor influencing students' dietary practices, with 95% agreeing that it impacts their food choices. This suggests that due to their ongoing physiological and physical development, adolescents frequently experience strong hunger, leading them to prioritize satisfying their appetite over making nutritionally sound choices. As a result, students may often opt for snacks and easily accessible foods without considering their nutritional value, which contributes to unbalanced dietary habits. The findings underscore the complexity of the factors shaping students' dietary practices, with hunger being the most dominant influence. Tackling the root causes of hunger and improving access to nutritious meals may help reduce its impact on students' food choices, encouraging healthier eating habits and enhancing their overall well-being. Additionally, addressing other influential factors, such as purchasing power, health education, and family influence, could further support the promotion of balanced and nutritious dietary practices among adolescents.

Discussion

The demographic characteristics are summarized in tables. Reporting higher physical activity, maintaining a healthy weight, living in a large city, feeling subjectively healthy, experiencing lower stress, being at a higher economic level, and having higher parental educational levels were all associated with higher school performance. Dietary habits over the last seven days were surveyed, including the regular consumption of breakfast, lunch, and dinner, as well as the frequency of consuming fruits, soft drinks, fast foods, vegetables, milk, water, etc. Information on physical activity, obesity, subjective health assessments, stress levels, and economic status was also collected from all participants. School performance was classified into five levels (A-E). The adjusted odds ratios (AORs) of dietary habits were analyzed using multinomial logistic regression analysis with complex sampling. Structural equation modelling was employed to analyze the impact of unbalanced dietary factors on school performance while considering the effects of other variables on both dietary habits and students' academic performance. Dietary habits are summarized in tables. Regular consumption of breakfast, lunch, and dinner, as well as frequent intake of fruits, vegetables, and milk, were associated with higher school performance. In contrast, frequent consumption of soft drinks, fast foods, instant noodles, and confections were linked to poorer school performance (each with $p<0.001$). To evaluate possible associations among various dietary habits, a correlation analysis was conducted, and most of the phi coefficients were found to be very small (less than 0.3) (see Table S1, Supplemental Content, which illustrates the Phi correlations among eating behaviours).

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Conclusion

Based on the findings of the study, it is evident that boarding students in selected secondary schools in the Ilorin metropolis have various dietary practices that significantly impact their academic performance. While many students do not skip meals, they often skip breakfast, which affects their concentration in class during teaching and learning sessions. Additionally, students frequently consume energy-dense snacks, while their intake of water and fruit is inadequate. Factors such as hunger, purchasing power, health conditions, family influence, and peer pressure play crucial roles in shaping students' dietary habits. These findings underscore the importance of promoting healthy eating habits among students to enhance their academic performance and overall well-being. Furthermore, the study highlights the profound impact of nutrition on students' academic performance. Adequate nutrition stabilizes energy levels, enhances cognitive function, maintains a healthy weight, and helps prevent mental health conditions among students. Healthy dietary practices, such as regular meals and the consumption of fruits, vegetables, and milk, are associated with better academic performance. Conversely, the consumption of processed foods and excessive sweets negatively relates with academic achievement. It is clear that an unbalanced diet adversely affects students' attendance, behaviour, concentration, and cognitive abilities, emphasizing the crucial link between nutrition and scholastic achievement. Therefore, promoting balanced and nutritious diets is essential for fostering academic success and overall student well-being.

Recommendations

1. Educate students on the importance of eating breakfast to supply essential nutrients and energy for proper organ function, emphasizing its significance for academic performance.
2. Incorporate orientation programs for new students to emphasize the importance of positive dietary practices for overall well-being.
3. Make dining hall attendance compulsory for all boarding students to discourage skipping meals, with strict monitoring by teachers and staff to ensure compliance.
4. Educate students on the importance of consuming meals provided in the school dining hall, involving collaborative efforts from school stakeholders.
5. Ensure the availability of fruits in school dining halls on a daily basis to encourage fruit consumption among students.
6. Organize seminars and symposia by professionals like Home Economics teachers and nutritionists to educate students on healthy eating habits.
7. Encourage parents to set examples of healthy eating at home by preparing nutritious family meals and limiting unhealthy snacks.
8. Incorporate nutrition education into the secondary school curriculum, provide adequate training for teachers, and ensure the provision of necessary cooking utensils and equipment.

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Appendix

What are the general characteristics of the Science students according to their academic performances?

Table 9: General Characteristics of Participants According to Performance at School.

	Students' performance at school						
Factors	Total	A	B	C	D	E	P-Value
Number (n)		264	29	63	72	67	33
%		100	11.0	24.0	27.2	25.4	12.4
Mean age (year, SD)	15.0 (1.7)	14.8 (1.7)	14.9 (1.7)	15.1 (1.8)	15.0 (1.7)	15.0 (1.8)	<0.001
Physical activities (d, SD)	1.69 (2.0)	1.91 (2.0)	1.71 (1.9)	1.65 (1.9)	1.64 (1.9)	1.65 (2.0)	<0.001
Sex %							<0.001
Male	51.4	57.0	52.5	50.5	49.6	53.5	
Female	48.6	43.0	47.5	49.5	50.4	46.5	
Obesity %							<0.001
Underweight	6.6	6.8	6.4	6.7	6.9	7.7	
Healthy	79.9	80.7	80.5	80.5	78.6	77.4	
Overweight	10.5	9.7	10.4	10.0	11.0	11.0	
Obese	3.0	2.8	2.7	2.8	3.4	3.9	
Subjective health %							<0.001
Very good							
Good	18.9	24.9	18.5	18.6	17.5	19.0	
Normal	47.5	48.4	51.3	49.0	45.8	39.5	
Bad	26.2	20.4	23.8	26.3	28.8	30.5	
Very bad	6.9	6.9	6.2	5.8	7.6	10.1	
	0.5	0.4	0.2	0.3	0.3	0.9	
Stress %							<0.001
Severe	12.1	10.7	9.9	10.3	12.8	20.0	
Moderate	30.4	26.0	29.2	30.0	32.5	32.9	
Mild	41.3	41.9	43.6	43.5	40.5	33.7	
A little	13.8	17.2	15.3	14.0	12.3	10.6	
No	2.4	4.1	2 2	2.2	1.9	2.7	
Parents status (education and socio-economic							<0.001
factors) %	17.5	9.8	11.6	16.3	21.5	30.1	
Unknown	5.1	3.	4.3	4.9	5.9	6.9	
Middle	35.2	37.3	33.3	36.9	38.6	36.2	
High	42.2	49.5	50.8	41.9	34.0	41.9	
Low							
Food Availability/ Economic level %							<0.001
Highest	6.3	22.6	6.5	3.4	3.2	3.9	
Middle high	23.1	30.3	34.8	21.6	15.8	12.1	
Middle	47.5	33.3	42.4	56.0	51.7	42.8	
Middle low	17.8	10.6	13.7	16.0	23.7	24.0	
Lowest	5.3	3.1	2.6	2.9	5.6	17.2	

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Appendix II

The impact of unbalanced diet on the Sciences students' academic performance?

Table 10: Diet Habit Rates Of Participants With Their Academic Performance At School.

Factors	Total	A	B	C	D	E	P-Value
Breakfast %							<0.001
6 -7 times a week	21.5	67.8	61.9	36.3	45.3	53.8	
3- 5 times a week							
1 - 2 times a week	53.0	16.1	19.3	23.9	24.3	13.4	
0 time a week							
	13.7	8.4	10.2	20.1	16.6	22.0	
	11.8	7.8	8.6	19.7	13.8	10.7.	
Lunch %							<0.001
6 -7 times a week		86.6	85.7	81.5	5.7	67.6	
3- 5 times a week		6.0	7.0	9.0	6.1	15.1	
1 - 2 times a week		3.3	3.1	4.6	11.7	9.4	
0 time a week		4.1	4.2	4.9	76.4	7.8	
Dinner %							<0.001
6 -7 times a week	72.5	81.8	78.9	74.1	67.4	59.3	
3- 5 times a week							
1 - 2 times a week	16.3	10.7	13.2	15.6	19.5	22.4	
0 time a week							
	6.2	3.6	4.0	5.7	7.8	10.9	
	4.9	3.9	3.9	4.6	5.3	7.4	
Fruits %							<0.001
≥ 7times a week	20.5	28.7	22.6	20.1	17.1	15.9	
3- 5 times a week							
1 - 2 times a week	40.0	41.5	42.9	41.4	38.6	32.9	
0 time a week							
	30.5	23.7	27.6	30.5	33.5	36.4	
	9.0	6.1	6.8	8.0	10.7	14.8	
Soft drink %							<0.001
≥7 times a week	4.4	3.4	2.9	3.8	4.9	8.3	
3- 5 times a week	19.8	16.4	17.1	18.9	22.0	25.4	
1-2 times a week							
0 time a week	45.7	45.5	46.3	46.5	45.7	42.7	
	30.2	34.7	33.7	30.8	27.9	23.7	

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Fast food %							<0.001
≥7 times a week	1.4	1.3	0.8	1.2	1.5	9.6	
3-5 times a week	10.4	8.5	8.6	9.9	11.3	34.8	
1-2 times a week							
0 time a week	52.1	51.6	52.6	52.7	52.2	39.1	
	36.1	38.6	37.9	36.2	34.9	16.5	
Milk,%							<0.001
≥7 times a week	29.3	36.1	31.2	28.8	27.0	25.6	
3-6 times a week	36.0	35.8	37.1	36.7	35.7	32.9	
1-2 times a week							
0 time a week	20.9	17.0	19.4	21.1	22.5	23.8	
	13.8	11.1	12.3	13.5	14.9	17.8	
Vegetables %							<0.001
≥7 times a week	43.0	50.3	46.8	42.9	39.7	35.8	
3-6 times a week	38.8	35.0	38.1	40.2	40.2	37.7	
1-2 times a week							
0 time a week	14.8	11.5	12.5	14.1	16.5	20.3	
	3.4	3.2	2.6	2.8	3.6	6.2	
Instant noodles %							<0.001
≥7 times a week							
3-6 times a week	2.3	1.8	1.4	2.0	2.7	4.6	
1-2 times a week							
0 time a week	21.5	17.0	18.6	20.6	23.9	28.1	
	48.6	49.6	50.4	49.5	47.7	44.1	
	27.6	31.5	29.6	27.9	25.8	23.3	

Chi- square test for the analysis, significance at $p<0.05$.

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