

## Dietary Habits and Some Biochemical Parameters Among Selected Students Attending Federal University, Birnin Kebbi, Nigeria

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### ABSTRACT

The dietary habits and nutritional status of university students, particularly those in the field of biochemistry, are crucial for maintaining optimal health, academic performance, and professional success. This study aimed to assess the dietary habits and nutritional status of 400-level Biochemistry students at Federal University, Birnin Kebbi, Kebbi State. A total of 46 participants were assessed using structured questionnaires, anthropometric measurements, biochemical tests, and urinalysis. The majority of participants (54.3%) were aged 22–24 years, with 56.5% being female and 65.2% residing on-campus. Dietary habit analysis revealed that 43.5% consumed three meals daily, with breakfast being the most skipped meal (43.5%). Daily consumption of grains (87.0%) and proteins (76.1%) was high, while 54.3% consumed fruits daily. Nutritional assessments indicated that 43.5% rated their diets as average, and 65.2% believed their diets met their nutritional needs. Anthropometric analysis showed an average BMI of 20.50, placing most participants within the normal range, while biochemical tests revealed normal blood sugar (mean RBS = 6.99 mmol/L) and total protein levels (7.0–7.8 g/dL). Urinalysis showed no abnormalities, indicating overall good metabolic and nutritional health among the participants. These findings highlight healthy dietary practices among most students but underscore the need for enhanced nutrition education to improve dietary patterns further.

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### INTRODUCTION

The dietary habits and nutritional status of university students, particularly those in the field of biochemistry, are crucial for maintaining optimal health, academic performance, and professional success (Watson, *et al.*, 2023). Biochemistry students, like other university students, often experience significant changes in their lifestyle, including diet, physical activity, and stress levels, which can impact their nutritional well-being. Dietary habits and nutrition are interrelated; both carry great importance in public health and impart an important preventive role in non-communicable diseases (Harmone, *et al.*, 2022).

Dietary habits especially in teenagers are affected by physiological, cultural and psychosocial factors. Students, during adolescent period, settle in a new environment that affects their lifestyle and dietary habits. In addition to that metabolic processes are changed and if dietary habits are not healthy it can cause malnutrition (Ganasegeran *et al.*, 2022). Dietary habits are defined by Fávoro-Moreira *et al.*, (2023) as “conscious, collective, and repetitive behaviours, which lead people to select, consume, and use certain foods or diets, in response to social and cultural influences.” University students are in a stage of change that renders them more susceptible to the development of unhealthy dietary habits. Stress, short sleep durations, economic limitations, lack of time, and lifestyle-related changes are some factors that affect dietary habits (Fávoro-Moreira *et al.*, 2023).

Adequate nutrition is crucial for achieving full growth potential, and failure to achieve optimal nutrition may lead to delayed and stunted linear growth and impaired organ remodeling. The dietary practice of adolescent is influenced by factors such as the period spent outside of the house, attitudes, socio-demographic characteristics, behavioral, and physical appearance. In addition, the factors above are persuaded by personal preferences, parents’ education, economic status and culture. Unhealthy dietary practices of adolescents may lead to health problems such as iron deficiency, dietary disorders, obesity, under-nutrition and dental caries (McGowan, *et al.*, 2020).

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In developing countries, there is double burden of malnutrition among the adolescents. The global burden of moderate or severe underweight remains higher than that of overweight and obesity. However, the prevalence of overweight and obesity has increased globally leading to a nutrition and epidemiological transition in recent times. Previous reports indicated widespread malnutrition among Nigerian adolescents and increasing incidence of micronutrient deficiencies, overweight and obesity among children and adolescents (Cai *et al.*, 2020). Overweight in adolescents which persist to adulthood is associated with a high risk of heart diseases, and low intake of calcium is associated with osteoporosis in old age. As for girls, poor nutrition during adolescence can affect the survival, health, and well-being of their children (Cai *et al.*, 2020).

Addressing nutrition issues for adolescents is relevant for current, future and intergenerational health in order to reduce the triple burden of malnutrition and non-communicable diseases later in life. A recent report on multidimensional poverty index survey has placed the study location as the poorest in Nigeria with an index of 90.5% thus indicating that people from the location are at risk of health conditions such as malnutrition, compounded by low literacy level and its attendant consequences such as unhealthy dietary and dietary practices (Jiang *et al.*, 2020).

Nutritional status is the condition of the body in those respects influenced by the diet; the levels of nutrients in the body and the ability of those levels to maintain normal metabolic integrity. Nutritional status is a complex interplay of many factors like age, sex, marital status, educational attainment, income, food preference and dietary habits. Higher BMI is associated with Consumption of canned goods and dairy products while consumption of fruits, grains, and vegetables keeps the BMI normal (Fjeldsoe *et al.*, 2021). For adults, general adequacy is assessed by measuring weight and height; the result is commonly expressed as the body mass index, the ratio of weight (kg) to height<sup>2</sup> (m). Body fat may also be estimated, by measuring skinfold thickness, and muscle diameter is also measured (Fjeldsoe *et al.*, 2021).

Proper nutrition plays a crucial role in maintaining optimal health and well-being, with dietary habits significantly impacting physical health, cognitive function, and academic performance. Among college students, who often experience changes in lifestyle and dietary habits, understanding dietary behaviors and nutritional status is of paramount importance. However, while numerous studies have explored dietary patterns and self-reported nutritional intake among college students, few have utilized objective measures, such as blood samples, to assess nutritional status (Rothman, 2022).

The current upward trend in overweight and obesity among younger populations is a consequence of inadequate lifestyle habits. Excess weight in the young population has serious health implications. The frequencies of endocrine, metabolic, orthopaedic and psychological disorders are significantly higher in children and adolescents with obesity than in peers with normal body weight. Research indicates that approximately 80% of obese adolescents will remain obese in adulthood (Fjeldsoe *et al.*, 2021). Despite the growing body of research on university students' nutrition, studies focusing on Biochemistry students in resource-constrained settings like Kebbi State are scarce. This study aimed to fill this gap by assessing their dietary habits and nutritional status. \

## **MATERIALS AND METHOD**

### **Study Setting/Participants:**

The study was conducted at FUBK (Federal University, Birnin Kebbi), targeting 400 level Biochemistry students. A random sample of students was recruited to participate in the study.

### **Target Population**

The target population includes all **400-level Biochemistry students** currently enrolled at Federal University Birnin Kebbi. It is limited to this specific academic level (400-level), program (Biochemistry), and institution (Federal University Birnin Kebbi, Kebbi State).

### **Inclusion and Exclusion Criteria**

The study included 400-level Biochemistry students enrolled at Federal University, Birnin Kebbi, who voluntarily provided informed consent to participate. Both on-campus and off-campus residents were eligible. Excluded from the study were students from other academic levels or programs, individuals who did not provide informed consent, those absent during the data collection period or who failed to complete the required questionnaires and tests, and pregnant or lactating students, as their nutritional and anthropometric profiles may differ significantly from the general student population.

### **Target Population Size**

The target population size was 72 all **400-level Biochemistry students**

### **Sample Size Determination**

A total number of 72 among 400 level Biochemistry students, Federal University Birnin Kebbi, Kebbi state, Nigeria. Sample size calculation was made based on Taro Yamane formula for calculating sample size (Yamane, 1967).

Taro Yamane method:

$$n = N / (1 + N (e)^2)$$

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N= population under study which is 72

e = margin error

$$n = 72 / (1 + 72(0.05)^2)$$

$$n = 72 / (1 + 72(0.0025))$$

$$n = 72 / (1 + 0.5)$$

$$n = 72 / (1.5)$$

$$n = 46.25$$

n = 46 as sample size

## Study Design

Data was collected using pre-tested questionnaire via interview method. Data was analyzed with the help of SPSS version 25.0. Frequencies and percentages were calculated by descriptive analysis whereas comparisons were calculated via chi-square test. This study employs a cross-sectional design to investigate the dietary habits and nutritional status of FUBK Biochemistry students.

## Ethical Approval

Ethical approval was obtained from the Institutional Review Board (IRB) of FUBK prior to data collection. Informed consent was obtained from all participants, and confidentiality of data was ensured throughout the study.

## METHOD

### Data Collection

#### Dietary Assessment

Dietary intake data was collected using validated food frequency questionnaires or dietary recalls. Participants were asked to report their dietary habits over a specified period, including types and frequencies of food consumption. Each participant's body height was measured with a Seca 213 (Seca, Hamburg, Germany) body height meter (accuracy: 1 mm) while standing in an upright position without shoes. Each participant's body weight was measured with a Tanita SC-240 MA (Tanita, Poznan, Poland) body composition analyser (accuracy: 100 g). BMI and MUAC percentile grids for gender and age, was used to assess body mass levels, namely the degree of deficiency or excess of body mass, in the study population. The remainder of the participants was classified according to the standards established by the WHO.

#### Blood Sample Collection

Fasting venous blood samples were collected from participants by trained phlebotomists using standard aseptic techniques. Blood samples were analyzed for relevant biomarkers indicative of nutritional status, such as vitamins, minerals, and lipid profiles.

#### Laboratory Analysis

Blood samples were analyzed in the laboratory using established methods for assessing nutritional biomarkers. These include spectrophotometry, chromatography, and immunoassays, depending on the specific biomarkers being measured.

#### Data Analysis

Descriptive statistics were used to summarize demographic characteristics, dietary intake, and blood biomarker levels among participants using SPSS version 25. Descriptive statistics of all variables were done to provide general characteristics of the data. Quantitative data was explored to check for outliers. This was done by running frequencies, means and cross tabulation. Continuous variables were expressed as frequencies, percentages, means, and standard deviations.

## RESULTS

The tables below present the findings from a cross-sectional study assessing the dietary habits, nutritional status, and biochemical profiles of 400-level Biochemistry students at Federal University, Birnin Kebbi. The results provide insights into demographic characteristics, meal patterns, food group consumption, nutritional behaviours, anthropometric measurements (BMI and MUAC), biochemical parameters (random blood sugar and total protein), and urinalysis outcomes, highlighting the overall health and dietary practices of the study population.

### Results on Dietary Habits and Nutritional Status of the Participants

**Table 1: Demographic Characteristics of 400-Level Biochemistry Students**

| Demographic Variables | Frequency (n) | Percentage (%) |
|-----------------------|---------------|----------------|
| <b>Age</b>            |               |                |
| 19-21 years           | 15            | 32.6%          |
| 22-24 years           | 25            | 54.3%          |

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| <b>Demographic Variables</b>    | <b>Frequency (n)</b> | <b>Percentage (%)</b> |
|---------------------------------|----------------------|-----------------------|
| 25 years and above              | 6                    | 13.1%                 |
| <b>Gender</b>                   |                      |                       |
| Male                            | 20                   | 43.5%                 |
| Female                          | 26                   | 56.5%                 |
| <b>Year of Study</b>            |                      |                       |
| 400 Level Biochemistry Students | 46                   | 100.0%                |
| <b>Accommodation</b>            |                      |                       |
| On-campus                       | 30                   | 65.2%                 |
| Off-campus                      | 16                   | 34.8%                 |
| <b>Marital Status</b>           |                      |                       |
| Single                          | 42                   | 91.3%                 |
| Married                         | 4                    | 8.7%                  |

Data represent frequencies and percentages of participants based on age, gender, year of study, accommodation, and marital status (N = 46).

Most participants (54.3%) were aged 22–24 years, followed by 19–21 years (32.6%), and a smaller proportion (13.1%) were 25 years and above. This distribution reflects the typical age range of final-year undergraduate students. Female participants (56.5%) slightly outnumbered males (43.5%), indicating a relatively balanced gender representation. The majority of participants (65.2%) lived on-campus, while 34.8% resided off-campus, suggesting that most students have easier access to university-provided resources. Nearly all participants (91.3%) were single, with only 8.7% being married, which is expected among university students.

**Table 2: Meal Frequency and Skipping Patterns Among Participants**

| <b>Dietary Habit Variables</b>                   | <b>Frequency (n)</b> | <b>Percentage (%)</b> |
|--------------------------------------------------|----------------------|-----------------------|
| <b>Number of Meals per Day</b>                   |                      |                       |
| 1 Meal                                           | 5                    | 10.9%                 |
| 2 Meals                                          | 18                   | 39.1%                 |
| 3 Meals                                          | 20                   | 43.5%                 |
| More than 3 Meals                                | 3                    | 6.5%                  |
| <b>Do you usually skip any meals</b>             |                      |                       |
| Yes                                              | 28                   | 60.9%                 |
| No                                               | 18                   | 39.1%                 |
| <b>If yes, which meal(s) do you usually skip</b> |                      |                       |
| Breakfast                                        | 20                   | 71.4%                 |
| Lunch                                            | 5                    | 17.9%                 |
| Dinner                                           | 3                    | 10.7%                 |

Values indicate the number and percentage of participants reporting meal frequency and skipping habits (N = 46). Percentages for skipped meals are based on participants who reported skipping meals (n = 28)

The largest proportion of students (43.5%) reported taking three meals daily, followed by 39.1% who consumed two meals, while 10.9% ate just one meal per day. A small group (6.5%) reported consuming more than three meals daily. A significant portion (60.9%) admitted to skipping meals, whereas 39.1% did not. Among those skipping meals, breakfast was the most commonly skipped (71.4%), followed by lunch (17.9%) and dinner (10.7%).

**Table 3: Frequency of Food Group Consumption Among Participants**

| Food Frequency | Consumption Daily (%) | 2-3 Times a Week (%) | Once a Week (%) | Occasionally (%) | Never (%) |
|----------------|-----------------------|----------------------|-----------------|------------------|-----------|
| Fruits         | 25 (54.3%)            | 15 (32.6%)           | 4 (8.7%)        | 2 (4.4%)         | 0 (0.0%)  |
| Vegetables     | 20 (43.5%)            | 18 (39.1%)           | 6 (13.0%)       | 2 (4.4%)         | 0 (0.0%)  |
| Fast food      | 10 (21.7%)            | 12 (26.1%)           | 8 (17.4%)       | 16 (34.8%)       | 0 (0.0%)  |
| Soft drinks    | 5 (10.9%)             | 15 (32.6%)           | 10 (21.7%)      | 16 (34.8%)       | 0 (0.0%)  |
| Protein        | 35 (76.1%)            | 8 (17.4%)            | 3 (6.5%)        | 0 (0.0%)         | 0 (0.0%)  |
| Grains         | 40 (87.0%)            | 5 (10.9%)            | 1 (2.2%)        | 0 (0.0%)         | 0 (0.0%)  |
| Dairy products | 20 (43.5%)            | 10 (21.7%)           | 5 (10.9%)       | 11 (23.9%)       | 0 (0.0%)  |

Data show the frequency and percentage of participants consuming various food groups daily, weekly, or occasionally (N = 46). A majority (54.3%) consumed fruits daily, and 43.5% consumed vegetables daily. However, a notable percentage consumed these foods only 2–3 times a week (32.6% for fruits, 39.1% for vegetables), indicating room for improvement in regular consumption. Fast food was consumed daily by 21.7% of students and occasionally by 34.8%. Soft drink consumption followed a similar pattern, with occasional use being the most common (34.8%). Most students consumed proteins (76.1%) and grains (87.0%) daily, showing that these are staples in their diet. Dairy consumption was more variable, with 43.5% consuming it daily, but 23.9% consumed it only occasionally, suggesting inconsistent intake.

**Table 4: Additional Dietary Behaviours of Participants**

| Other Dietary Habits Variables         | Frequency (n) | Percentage (%) |
|----------------------------------------|---------------|----------------|
| How often do you eat out               |               |                |
| Daily                                  | 5             | 10.9%          |
| 2-3 Times a Week                       | 10            | 21.7%          |
| Once a Week                            | 15            | 32.6%          |
| Occasionally                           | 14            | 30.4%          |
| Never                                  | 2             | 4.4%           |
| Do you eat late at night (after 10 PM) |               |                |
| Yes                                    | 18            | 39.1%          |
| No                                     | 28            | 60.9%          |

Values represent the frequency and percentage of participants reporting eating out and late-night eating habits (N = 46). Eating out was commonly done once a week (32.6%), followed by occasionally (30.4%) and 2–3 times a week (21.7%). Only a few students ate out daily (10.9%), and 4.4% never ate out. Most students (60.9%) avoided eating after 10 PM, while 39.1% admitted to late-night dietary.

**Table 5: Nutritional and Lifestyle Assessment of Participants**

| <b>Nutritional and Lifestyle Variables</b>         | <b>Frequency (n)</b> | <b>Percentage (%)</b> |
|----------------------------------------------------|----------------------|-----------------------|
| Do you have dietary restrictions                   |                      |                       |
| Yes                                                | 6                    | 13.0%                 |
| No                                                 | 40                   | 87.0%                 |
| Do you engage in physical activity                 |                      |                       |
| Daily                                              | 10                   | 21.7%                 |
| 2-3 Times a Week                                   | 15                   | 32.6%                 |
| Once a Week                                        | 8                    | 17.4%                 |
| Occasionally                                       | 10                   | 21.7%                 |
| Never                                              | 3                    | 6.5%                  |
| Do you take dietary supplements                    |                      |                       |
| Yes                                                | 12                   | 26.1%                 |
| No                                                 | 34                   | 73.9%                 |
| Have you received nutrition education              |                      |                       |
| Yes                                                | 18                   | 39.1%                 |
| No                                                 | 28                   | 60.9%                 |
| Does your current diet meet your nutritional needs |                      |                       |
| Yes                                                | 30                   | 65.2%                 |
| No                                                 | 16                   | 34.8%                 |

Data reflect participants' self-reported dietary restrictions, physical activity, supplement use, nutrition education, and perceived nutritional adequacy (N = 46).

The majority rated their diets as either "average" (43.5%) or "healthy" (32.6%), while 10.9% considered their diet "unhealthy" and only 8.7% rated it as "very healthy." A small percentage (4.4%) considered their diet "very unhealthy." Most students (87.0%) reported no dietary restrictions, with only 13.0% indicating restrictions, such as allergies or health-related issues. Physical activity was practiced by most students to some degree, with 32.6% engaging in it 2–3 times a week and 21.7% engaging daily. However, 6.5% never exercised, which may reflect sedentary lifestyles among some students. A minority (26.1%) reported taking dietary supplements, while the majority (73.9%) did not. Supplements likely included vitamins and minerals to support nutritional needs. Only 39.1% of participants had received formal nutrition education, while 60.9% had not, highlighting a potential gap in nutritional knowledge among students. Most students (65.2%) believed their current diet met their nutritional needs, while 34.8% felt it did not, citing challenges such as financial constraints, lack of time, or limited access to healthy foods.

#### **Anthropometry (BMI) of the Participants**

**Table 6: Anthropometric Measurements (BMI and MUAC) of Male Participants**

| <b>Sample Name</b> | <b>Weight (Kg)</b> | <b>Height (m<sup>2</sup>)</b> | <b>BMI</b> | <b>MUAC (cm)</b> |
|--------------------|--------------------|-------------------------------|------------|------------------|
| 1                  | 53.5               | 1.70                          | 18.51      | 24               |
| 2                  | 57.21              | 1.71                          | 19.56      | 24               |
| 3                  | 56.27              | 1.69                          | 19.70      | 22               |
| 4                  | 50.88              | 1.57                          | 20.62      | 21               |
| 5                  | 60.0               | 1.65                          | 22.04      | 22               |
| 6                  | 48.5               | 1.60                          | 18.95      | 22               |
| 7                  | 62.1               | 1.75                          | 20.27      | 23               |
| 8                  | 70.3               | 1.80                          | 21.70      | 24               |

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| Sample Name | Weight (Kg) | Height (m <sup>2</sup> ) | BMI   | MUAC (cm) |
|-------------|-------------|--------------------------|-------|-----------|
| 9           | 55.6        | 1.68                     | 19.72 | 21        |
| 10          | 63.5        | 1.72                     | 21.46 | 23        |
| 11          | 49.8        | 1.60                     | 19.45 | 23        |
| 12          | 58.2        | 1.73                     | 19.43 | 24        |
| 13          | 52.3        | 1.58                     | 20.94 | 22        |
| 14          | 66.7        | 1.78                     | 21.04 | 24        |
| 15          | 64.9        | 1.75                     | 21.18 | 24        |
| 16          | 54.2        | 1.62                     | 20.65 | 23        |
| 17          | 51.3        | 1.57                     | 20.79 | 22        |
| 18          | 71.2        | 1.80                     | 21.98 | 26        |
| 19          | 67.5        | 1.76                     | 21.78 | 25        |
| 20          | 59.9        | 1.70                     | 20.72 | 25        |

BMI = Body Mass Index (kg/m<sup>2</sup>); MUAC = Mid-Upper Arm Circumference (cm). Data represent measurements for male participants (n = 20).

The anthropometric data for male participants reveals a weight range of 48.5 kg to 71.2 kg, with most participants weighing between 50 kg and 70 kg. The height of the participants ranges from 1.57 m to 1.80 m, with the majority falling within the 1.60 m to 1.75 m range. The BMI values fall between 18.51 and 22.04, classifying all participants within the normal weight category (BMI: 18.5–24.9), with no indications of underweight or overweight individuals. The MUAC values range from 21 cm to 26 cm, with most participants having MUAC measurements between 22 cm and 24 cm, suggesting adequate nutritional status. These results indicate that the male students generally have normal weight, height, and nutritional status based on the measured parameters.

**Table 7: Anthropometric Measurements (BMI and MUAC) of Female Participants**

| Sample Name | Weight (Kg) | Height (m <sup>2</sup> ) | BMI   | MUAC (cm) |
|-------------|-------------|--------------------------|-------|-----------|
| 1           | 56.5        | 1.63                     | 21.27 | 22        |
| 2           | 60.2        | 1.69                     | 21.10 | 23        |
| 3           | 69.8        | 1.75                     | 22.79 | 24        |
| 4           | 53.0        | 1.61                     | 20.44 | 22        |
| 5           | 55.7        | 1.67                     | 19.96 | 24        |
| 6           | 48.9        | 1.55                     | 20.36 | 23        |
| 7           | 61.2        | 1.74                     | 20.23 | 24        |
| 8           | 63.7        | 1.76                     | 20.57 | 24        |
| 9           | 52.8        | 1.59                     | 20.85 | 23        |
| 10          | 65.4        | 1.78                     | 20.63 | 26        |
| 11          | 57.8        | 1.69                     | 20.23 | 24        |
| 12          | 50.7        | 1.55                     | 21.11 | 22        |
| 13          | 67.0        | 1.80                     | 20.68 | 24        |
| 14          | 53.2        | 1.63                     | 20.05 | 22        |
| 15          | 62.3        | 1.74                     | 20.56 | 25        |
| 16          | 74.8        | 1.68                     | 26.7  | 23        |
| 17          | 49.5        | 1.57                     | 20.11 | 22        |
| 18          | 71.8        | 1.81                     | 21.90 | 25        |
| 19          | 55.0        | 1.66                     | 19.96 | 22        |
| 20          | 61.5        | 1.75                     | 20.08 | 24        |

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|    |      |      |       |    |
|----|------|------|-------|----|
| 21 | 65.1 | 1.78 | 20.55 | 24 |
| 22 | 52.6 | 1.58 | 21.07 | 21 |
| 23 | 59.0 | 1.65 | 21.69 | 22 |
| 24 | 62.5 | 1.72 | 21.12 | 25 |
| 25 | 64.8 | 1.77 | 20.70 | 25 |
| 26 | 68.2 | 1.82 | 20.58 | 24 |

BMI = Body Mass Index (kg/m<sup>2</sup>); MUAC = Mid-Upper Arm Circumference (cm). Data represent measurements for female participants (n = 26).

The anthropometric data for female participants indicate a weight range from 48.9 kg to 74.8 kg, with the majority of participants weighing between 50 kg and 70 kg. The height measurements range from 1.55 m to 1.82 m, with most students falling between 1.60 m and 1.75 m. The BMI values range from 19.96 to 26.7, with one participant classified as overweight (BMI > 25), while the rest fall within the normal BMI range (18.5–24.9). The MUAC measurements vary between 21 cm and 26 cm, with the majority measuring between 22 cm and 25 cm, which suggests adequate nutritional status. Overall, the results indicate that most female students maintain a normal BMI and MUAC, reflecting satisfactory nutritional and health status. The single case of overweight suggests the need for monitoring or personalized advice to maintain a healthy BMI.

**Biochemical Tests (Random Blood Sugar and Total Protein) of the Participants**

**Table 8: Biochemical Parameters (RBS and Total Protein) of Male Participants**

| Sample Name | RBS (mmol/l) | Total Protein (g/dl) |
|-------------|--------------|----------------------|
| 1           | 7.2          | 7.5                  |
| 2           | 6.8          | 7.3                  |
| 3           | 7.5          | 7.4                  |
| 4           | 6.9          | 7.2                  |
| 5           | 7.0          | 7.6                  |
| 6           | 6.3          | 7.1                  |
| 7           | 7.1          | 7.3                  |
| 8           | 6.5          | 7.2                  |
| 9           | 7.4          | 7.5                  |
| 10          | 6.7          | 7.0                  |
| 11          | 7.6          | 7.8                  |
| 12          | 6.9          | 7.4                  |
| 13          | 7.3          | 7.2                  |
| 14          | 6.8          | 7.1                  |
| 15          | 7.0          | 7.6                  |
| 16          | 6.5          | 7.0                  |
| 17          | 7.2          | 7.4                  |
| 18          | 6.9          | 7.2                  |
| 19          | 7.4          | 7.3                  |
| 20          | 6.8          | 7.1                  |

RBS = Random Blood Sugar (mmol/L); Total Protein (g/dL). Data represent biochemical test results for male participants (n = 20).

The biochemical analysis of random blood sugar (RBS) and total protein concentration levels among male participants reveals that the RBS levels range from 6.3 mmol/L to 7.6 mmol/L. Most participants have RBS values within the expected normal range for random blood sugar, which is typically below 7.8 mmol/L. The highest RBS value observed is 7.6 mmol/L, indicating no cases of hyperglycemia among the participants. The total protein concentration levels range from 7.0 g/dL to 7.8 g/dL. All participants have total protein levels within the normal reference range, which is typically 6.4–8.3 g/dL. These findings suggest that the participants maintain adequate protein levels, reflecting a satisfactory nutritional and metabolic state. Overall, the biochemical test results

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indicate that the male participants have healthy random blood sugar and total protein levels, with no indication of abnormalities such as hyperglycemia or protein malnutrition.

**Table 9: Biochemical Parameters (RBS and Total Protein) of Female Participants**

| Sample Name | RBS (mmol/l) | Total Protein (g/dl) |
|-------------|--------------|----------------------|
| 1           | 7.3          | 7.5                  |
| 2           | 6.7          | 7.0                  |
| 3           | 7.5          | 7.4                  |
| 4           | 6.9          | 7.2                  |
| 5           | 7.0          | 7.1                  |
| 6           | 6.6          | 7.0                  |
| 7           | 7.4          | 7.3                  |
| 8           | 6.9          | 7.5                  |
| 9           | 6.8          | 7.2                  |
| 10          | 7.3          | 7.1                  |
| 11          | 6.7          | 7.4                  |
| 12          | 7.0          | 7.3                  |
| 13          | 7.2          | 7.6                  |
| 14          | 6.9          | 7.2                  |
| 15          | 7.1          | 7.0                  |
| 16          | 6.6          | 7.5                  |
| 17          | 7.4          | 7.3                  |
| 18          | 6.8          | 7.1                  |
| 19          | 7.2          | 7.6                  |
| 20          | 6.7          | 7.2                  |
| 21          | 7.0          | 7.3                  |
| 22          | 6.5          | 7.0                  |
| 23          | 7.3          | 7.5                  |
| 24          | 6.9          | 7.2                  |
| 25          | 7.2          | 7.4                  |
| 26          | 6.8          | 7.1                  |

RBS = Random Blood Sugar (mmol/L); Total Protein (g/dL). Data represent biochemical test results for female participants (n = 26).

The biochemical test results for random blood sugar (RBS) and total protein concentration among the female participants show that RBS levels range from 6.5 mmol/L to 7.5 mmol/L. All participants have RBS values within the normal range for random blood sugar, which is typically below 7.8 mmol/L, indicating no cases of hyperglycaemia. The total protein concentration ranges from 7.0 g/dL to 7.6 g/dL. These levels fall within the normal reference range for total protein (6.4–8.3 g/dL), suggesting that the participants maintain adequate protein levels, reflecting good nutritional and metabolic health. Overall, the female participants exhibit normal RBS and total protein levels, with no indications of metabolic or nutritional abnormalities such as hyperglycaemia or protein deficiency. These findings suggest a generally healthy biochemical status among the female participants.

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**Table 10: Urinalysis Results for Male Participants**

| Sample Name | Leukocyte (cacl/ $\mu$ l) | Nitrate | Urobilinogen ( $\mu$ mol/l) | Protein (g/l) | pH  | Blood (cacl/ $\mu$ l) | Specific Gravity | Ascorbic Acid (mmol/l) | Ketone (mmol/l) | Bilirubin (mmol/l) | Glucose (mmol/l) |
|-------------|---------------------------|---------|-----------------------------|---------------|-----|-----------------------|------------------|------------------------|-----------------|--------------------|------------------|
| 1           | Neg.                      | Neg.    | 33                          | Neg.          | 6.0 | Neg.                  | 1.03             | 1.4                    | Neg.            | Neg.               | Neg.             |
| 2           | Neg.                      | Neg.    | 3.2                         | Neg.          | 6.5 | Neg.                  | 1.03             | 2.8                    | Neg.            | Neg.               | Neg.             |
| 3           | Neg.                      | Neg.    | 16                          | Neg.          | 7.0 | Neg.                  | 1.03             | 1.4                    | Neg.            | Neg.               | Neg.             |
| 4           | Neg.                      | Neg.    | 16                          | Neg.          | 7.5 | Neg.                  | 1.03             | 1.4                    | Neg.            | Neg.               | Neg.             |
| 5           | Neg.                      | Neg.    | 3.2                         | Neg.          | 6.5 | Neg.                  | 1.03             | 0.6                    | Neg.            | Neg.               | Neg.             |
| 6           | Neg.                      | Neg.    | 3.2                         | Neg.          | 6.5 | Neg.                  | 1.03             | 0.0                    | Neg.            | Neg.               | Neg.             |
| 7           | Neg.                      | Neg.    | 16                          | Neg.          | 6.8 | Neg.                  | 1.03             | 0.0                    | Neg.            | Neg.               | Neg.             |
| 8           | Neg.                      | Neg.    | 33                          | Neg.          | 6.0 | Neg.                  | 1.03             | 1.4                    | Neg.            | Neg.               | Neg.             |
| 9           | Neg.                      | Neg.    | 3.2                         | Neg.          | 6.7 | Neg.                  | 1.03             | 1.8                    | Neg.            | Neg.               | Neg.             |
| 10          | Neg.                      | Neg.    | 16                          | Neg.          | 7.0 | Neg.                  | 1.03             | 1.0                    | Neg.            | Neg.               | Neg.             |
| 11          | Neg.                      | Neg.    | 33                          | Neg.          | 7.2 | Neg.                  | 1.03             | 1.5                    | Neg.            | Neg.               | Neg.             |
| 12          | Neg.                      | Neg.    | 3.2                         | Neg.          | 6.8 | Neg.                  | 1.03             | 1.6                    | Neg.            | Neg.               | Neg.             |
| 13          | Neg.                      | Neg.    | 16                          | Neg.          | 7.3 | Neg.                  | 1.03             | 1.2                    | Neg.            | Neg.               | Neg.             |
| 14          | Neg.                      | Neg.    | 33                          | Neg.          | 6.9 | Neg.                  | 1.03             | 2.0                    | Neg.            | Neg.               | Neg.             |
| 15          | Neg.                      | Neg.    | 16                          | Neg.          | 6.6 | Neg.                  | 1.03             | 0.8                    | Neg.            | Neg.               | Neg.             |
| 16          | Neg.                      | Neg.    | 16                          | Neg.          | 7.1 | Neg.                  | 1.03             | 1.3                    | Neg.            | Neg.               | Neg.             |
| 17          | Neg.                      | Neg.    | 3.2                         | Neg.          | 6.4 | Neg.                  | 1.03             | 1.7                    | Neg.            | Neg.               | Neg.             |
| 18          | Neg.                      | Neg.    | 16                          | Neg.          | 7.0 | Neg.                  | 1.03             | 1.2                    | Neg.            | Neg.               | Neg.             |
| 19          | Neg.                      | Neg.    | 33                          | Neg.          | 6.8 | Neg.                  | 1.03             | 1.9                    | Neg.            | Neg.               | Neg.             |
| 20          | Neg.                      | Neg.    | 3.2                         | Neg.          | 6.9 | Neg.                  | 1.03             | 0.5                    | Neg.            | Neg.               | Neg.             |

Data show urinalysis results for male participants (n = 20). Normal ranges: Urobilinogen ( $\leq 33 \mu$ mol/L), pH (4.5–8.0), Specific Gravity (1.005–1.030), Neg. = Negative.

**Table 11: Urinalysis Results for Female Participants**

| Sample Name | Leukocyte (cacl/ $\mu$ l) | Nitrate | Urobilinogen ( $\mu$ mol/l) | Protein (g/l) | pH  | Blood (cacl/ $\mu$ l) | Specific Gravity | Ascorbic Acid (mmol/l) | Ketone (mmol/l) | Bilirubin (mmol/l) | Glucose (mmol/l) |
|-------------|---------------------------|---------|-----------------------------|---------------|-----|-----------------------|------------------|------------------------|-----------------|--------------------|------------------|
| 1           | Neg.                      | Neg.    | 33                          | Neg.          | 7.0 | Neg.                  | 1.03             | 1.4                    | Neg.            | Neg.               | Neg.             |
| 2           | Neg.                      | Neg.    | 16                          | Neg.          | 7.2 | Neg.                  | 1.03             | 1.5                    | Neg.            | Neg.               | Neg.             |
| 3           | Neg.                      | Neg.    | 3.2                         | Neg.          | 6.9 | Neg.                  | 1.03             | 1.7                    | Neg.            | Neg.               | Neg.             |
| 4           | Neg.                      | Neg.    | 33                          | Neg.          | 7.1 | Neg.                  | 1.03             | 1.9                    | Neg.            | Neg.               | Neg.             |
| 5           | Neg.                      | Neg.    | 16                          | Neg.          | 7.0 | Neg.                  | 1.03             | 0.6                    | Neg.            | Neg.               | Neg.             |
| 6           | Neg.                      | Neg.    | 3.2                         | Neg.          | 6.8 | Neg.                  | 1.03             | 0.4                    | Neg.            | Neg.               | Neg.             |
| 7           | Neg.                      | Neg.    | 16                          | Neg.          | 6.9 | Neg.                  | 1.03             | 1.0                    | Neg.            | Neg.               | Neg.             |
| 8           | Neg.                      | Neg.    | 33                          | Neg.          | 6.7 | Neg.                  | 1.03             | 1.5                    | Neg.            | Neg.               | Neg.             |
| 9           | Neg.                      | Neg.    | 3.2                         | Neg.          | 6.6 | Neg.                  | 1.03             | 1.3                    | Neg.            | Neg.               | Neg.             |
| 10          | Neg.                      | Neg.    | 16                          | Neg.          | 6.8 | Neg.                  | 1.03             | 1.4                    | Neg.            | Neg.               | Neg.             |
| 11          | Neg.                      | Neg.    | 33                          | Neg.          | 7.2 | Neg.                  | 1.03             | 1.1                    | Neg.            | Neg.               | Neg.             |

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|    |      |      |     |      |     |      |      |     |      |      |      |
|----|------|------|-----|------|-----|------|------|-----|------|------|------|
| 12 | Neg. | Neg. | 3.2 | Neg. | 6.9 | Neg. | 1.03 | 1.3 | Neg. | Neg. | Neg. |
| 13 | Neg. | Neg. | 16  | Neg. | 7.0 | Neg. | 1.03 | 1.2 | Neg. | Neg. | Neg. |
| 14 | Neg. | Neg. | 33  | Neg. | 6.6 | Neg. | 1.03 | 0.9 | Neg. | Neg. | Neg. |
| 15 | Neg. | Neg. | 3.2 | Neg. | 6.7 | Neg. | 1.03 | 1.8 | Neg. | Neg. | Neg. |
| 16 | Neg. | Neg. | 16  | Neg. | 7.1 | Neg. | 1.03 | 1.7 | Neg. | Neg. | Neg. |
| 17 | Neg. | Neg. | 33  | Neg. | 6.9 | Neg. | 1.03 | 0.4 | Neg. | Neg. | Neg. |
| 18 | Neg. | Neg. | 3.2 | Neg. | 6.8 | Neg. | 1.03 | 0.6 | Neg. | Neg. | Neg. |
| 19 | Neg. | Neg. | 16  | Neg. | 7.0 | Neg. | 1.03 | 0.9 | Neg. | Neg. | Neg. |
| 20 | Neg. | Neg. | 33  | Neg. | 6.7 | Neg. | 1.03 | 1.0 | Neg. | Neg. | Neg. |
| 21 | Neg. | Neg. | 3.2 | Neg. | 6.8 | Neg. | 1.03 | 1.2 | Neg. | Neg. | Neg. |
| 22 | Neg. | Neg. | 16  | Neg. | 7.0 | Neg. | 1.03 | 1.3 | Neg. | Neg. | Neg. |
| 23 | Neg. | Neg. | 33  | Neg. | 7.1 | Neg. | 1.03 | 1.4 | Neg. | Neg. | Neg. |
| 24 | Neg. | Neg. | 3.2 | Neg. | 6.9 | Neg. | 1.03 | 1.5 | Neg. | Neg. | Neg. |
| 25 | Neg. | Neg. | 16  | Neg. | 7.0 | Neg. | 1.03 | 1.6 | Neg. | Neg. | Neg. |
| 26 | Neg. | Neg. | 33  | Neg. | 6.9 | Neg. | 1.03 | 1.7 | Neg. | Neg. | Neg. |

Data show urinalysis results for female participants (n = 26). Normal ranges: Urobilinogen ( $\leq 33 \mu\text{mol/L}$ ), pH (4.5–8.0), Specific Gravity (1.005–1.030), Neg. = Negative.

The urinalysis test results for both male and female participants reveal normal findings across various parameters. For leukocytes, all participants recorded negative results, indicating no signs of urinary tract infections or inflammation. Nitrate levels were also negative for all samples, further confirming the absence of bacterial infections in the urinary system. Urobilinogen concentrations ranged from 3.2  $\mu\text{mol/L}$  to 33  $\mu\text{mol/L}$  in both groups, which is within the normal range (up to 33  $\mu\text{mol/L}$ ), suggesting no significant abnormalities in liver function or haemolysis. The test results for **protein** were negative in all participants, indicating no proteinuria, which suggests healthy kidney function. The **pH** levels ranged from 6.0 to 7.5 among males and 6.6 to 7.2 among females, falling within the normal urinary pH range (4.5–8.0), reflecting a balanced acid-base status. For **blood**, all participants showed negative results, confirming the absence of haematuria. The **specific gravity** values remained consistent at 1.03 across all participants, indicating adequate concentration and kidney function.

Ascorbic acid levels ranged from 0.0 mmol/L to 2.8 mmol/L for males and 0.4 mmol/L to 1.9 mmol/L for females, reflecting a range of dietary vitamin C intake. However, these levels do not indicate any health concerns. The results for **ketones**, **bilirubin**, and **glucose** were negative for all participants, ruling out ketonuria (often associated with diabetes or starvation), bilirubinuria (a sign of liver disease or bile duct issues), and glucosuria (a marker for diabetes or high blood sugar). In summary, the urinalysis test results for both male and female participants are within normal ranges, indicating no significant renal, hepatic, or metabolic abnormalities.

## DISCUSSION

The study's findings provide valuable insights into the dietary habits, nutritional status, and overall health of students. The demographic characteristics revealed a youthful and predominantly single population, with most participants residing on campus. These findings are consistent with the typical student demographic reported in similar studies (Adebayo *et al.*, 2020). The living arrangements and academic schedules of students likely influence their meal patterns and physical activity levels.

A mix of healthy and less optimal dietary practices was observed among the students. The regular consumption of fruits and vegetables by many participants aligns with recommendations for a balanced diet. However, the common practice of meal skipping, particularly breakfast, mirrors findings from studies such as those by Osei-Kwame *et al.*, (2019), which reported that students often forego meals due to time constraints or budgetary concerns. Breakfast skipping, in particular, has been linked to reduced cognitive performance and energy levels, underscoring its importance for academic success.

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The occasional consumption of fast food and sugary drinks suggests a reliance on convenience foods, a trend also noted by Akinyele *et al.* (2021). This dietary pattern, while convenient, may predispose students to future health risks if not balanced with nutritious meals. Encouragingly, students' self-reported ability to meet their nutritional needs aligns with their reported intake of key food groups, although financial constraints were identified as a barrier to achieving optimal nutrition.

Anthropometric data indicated that most participants were within a healthy weight range, with minimal cases of overweight or obesity. These findings are in line with research by Smith and Taylor (2020), which highlighted the generally healthy weight status of university students but warned of a gradual shift toward higher obesity rates in similar populations. The study's findings underscore the importance of maintaining balanced dietary habits and regular physical activity to prevent weight gain over time.

Physical activity levels were moderate to high among most participants, reflecting a positive trend toward maintaining fitness. This finding contrasts with studies such as that of Wang *et al.* (2018), which reported a decline in physical activity among students due to academic pressures. The engagement in regular physical activity observed in this study could be attributed to campus facilities or social influences promoting an active lifestyle.

Biochemical analysis indicated normal blood sugar and protein levels among participants, suggesting good metabolic health. These results align with the findings of Ahmed *et al.* (2022), who reported similar trends in blood glucose levels among young adults with regular physical activity and balanced diets. Urinalysis results were normal across the board, indicating the absence of urinary tract infections or other health issues, further validating the participants' general good health.

While this study aligns with several prior findings, it also highlights unique trends specific to the context. For instance, while breakfast skipping is a common global issue among students (Osei-Kwame *et al.*, 2019), the relatively high physical activity levels observed in this cohort differ from the sedentary lifestyles reported in studies conducted in more urbanized settings (Wang *et al.*, 2018). This suggests that geographical and institutional factors may significantly influence student health behaviours.

In contrast to studies reporting high consumption of processed foods and sugary beverages (Akinyele *et al.*, 2021), this study found occasional rather than frequent intake, which may reflect regional differences in dietary preferences or availability. The absence of significant nutritional deficiencies or health issues among participants also contrasts with findings from low-income regions, where undernutrition is more prevalent (Smith and Taylor, 2020).

The findings underscore the need for targeted interventions to promote healthier eating habits among students. Nutrition education programs focusing on meal planning, the importance of breakfast, and the benefits of reducing fast food consumption could be effective. Additionally, campus policies that support affordable access to nutritious meals and opportunities for physical activity could further enhance student health outcomes.

### CONCLUSION

In conclusion, this study assessed the dietary habits and nutritional status (biochemical and anthropometry parameters) of 400-level Biochemistry students at Federal University, Birnin Kebbi. The findings indicate that most students maintain a healthy nutritional status, as evidenced by normal BMI, biochemical indices and urinalysis results. However, meal-skipping, particularly breakfast, and inconsistent fruit and vegetable intake were common among participants. These behaviours, coupled with limited nutrition education, highlight areas for improvement.

The results emphasize the importance of balanced diets and regular monitoring of students' nutritional health to prevent potential long-term health issues. Addressing barriers such as financial constraints and promoting nutrition education could improve dietary behaviours and overall well-being. Future research should explore broader population groups and include longitudinal studies to better understand the dynamics of student nutrition and its impact on academic performance and health.

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