Dietary patterns, behaviours, and their associated factors among university students in coastal Kenya

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Abstract: Unhealthy dietary habits are common among university students and are associated with increased incidence of lifestyle and chronic illnesses. There are few studies, if any, on university students’ dietary habits and patterns from the Kenyan setting. This study seeks to describe the dietary patterns, behaviours and knowledge/lifestyle choices among undergraduate university students in a university setting in coastal Kenya. We employed a cross-sectional study design with a sample of 72 undergraduate students at Pwani university, Kenya. Data was collected using a semi-structured food frequency questionnaire that also provided lifestyle and sociodemographic information and dietary patterns. All statistical analyses including descriptive analyses, inferential statistics using Z-tests, t-tests, chi-square tests and univariate and multivariable logistic regression. This study included students aged 18–26 years, most of whom were aged 21–24 years (59.7%), with a higher representation of females (67.6%). Most students reported having balanced diet (72.2%), embraced healthy lifestyle choices including no smoking (97.2%), no alcohol (84.7%), regular exercise (70.8%), own preparation of meals (57.0%), regularity in eating (45.8%), and had normal BMI status (69.4%). Most students reported being aware of what entails healthy nutrition (62.5%). There were notable

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PUBLIC INTEREST STATEMENT

Unhealthy dietary habits and patterns are common among young people and are a major risk factor of lifestyle and chronic illness among this population. For most young people, the transition into university is associated with increased autonomy including dietary choices. These dietary habits are linked to limited availability of proper dietary advice during their period of study, challenges within their academic frontiers, the stress associated with navigating through food selection, purchasing and meal preparation. The dietary patterns they choose could either lead to favourable or unfavourable nutritional outcomes.

Assessing the university students’ dietary patterns and nutrition status is crucial in guiding the development of nutrition intervention and education. Whilst enhancing understanding of students’ dietary practices to promote healthy dietary behaviour and dietary intake an area that needs multilevel nutrition intervention by concerned stakeholders.
differences in specific dietary behaviours including fruit and vegetable consumption, regularity in eating, consumption of balanced diet and dietary diversity. Such differences were associated with at least one of the following: BMI (OR = 0.72, \( p = 0.01 \)), own meal preparation (OR = 4.60, \( p = 0.04 \)) and snacking behaviours (OR = 11.4, \( p < 0.0001 \)) after accounting for other variables in a logistic regression model. University students have a fair knowledge of nutritional requirements for diet and health; however, this does not necessarily translate to healthy food choices and dietary behaviours.

**Subjects:** Nutrition and Dietetics; Clinical Nutrition; Dietetics

**Keywords:** dietary behaviour; university students; nutrition status; dietary choice; nutrition knowledge; Kenya

1. **Introduction**

The transition to college is associated with significant changes in dietary options among university students (Abraham et al., 2018; Sagari et al., 2018; Tanton et al., 2015) and puts them at risk of making poor dietary choices that can lead to health problems (Brown et al., 2014). Dietary choices and related behaviour within this subgroup are defined by a heterogeneous set of factors. Several factors have previously been identified to influence their dietary choices including time constraints; nutrition and health concerns; stressful events, parents training, culture, taste; food prices, convenience, family/peer eating habits, environmental issues, food preparation skills and food accessibility and availability (Amirabdollahian, 2018; Demory-Luce et al., 2004; Kabir et al., 2018; Pelletier et al., 2014). Consequently, favourable or unfavourable nutritional outcomes have been reported (Mehio Sibai et al., 2011; Nasreddine et al., 2012).

For most young people, the transition into university is associated with increased autonomy including dietary choices and is often characterised by a shift in composition and quality of the diet (Lupi et al., 2015). Studies among university students in developing countries show increased consumption of high caloric and fatty foods and low consumption of fruits and vegetables (Al-retaiaa et al., 2010; El-Mouty, 2016; Haidar & Cosman, 2011). University students often report consuming less than the recommended amounts of primary food groups including cereals, tubers, fruits, vegetables, dairy, poultry, meat, nuts and seeds while increasing the consumption of fatty foods and beverages (Pengpid & Peltzer, 2015a; Tanton et al., 2015; Zakeri & Berenson, 2004). Moreover, dietary modifications relative to variety, frequency and timing of intake is common among this sub-population (Beasley et al., 2004; Lupi et al., 2015).

Recently, unhealthy dietary habits among students are of increasing concern owing to the public health implications. The rising prevalence and increased incidence of lifestyle and chronic illnesses including diabetes, obesity and cardiovascular diseases (Nasreddine et al., 2020; Tanton et al., 2015) are now closely linked to poor nutritional status and unhealthy dietary/eating habits. These dietary behaviours among students are linked to limited support among peers towards healthy eating habits, high costs and limited access to healthy food (Kabir et al., 2018; O'Sullivan & Amirabdollahian, 2016). The limited availability of proper dietary advice during their study is not uncommon. In addition to challenges within their academic frontiers, the stress associated with navigating through food selection, purchasing and meal preparation can be unbearable for most students (O'Sullivan & Amirabdollahian, 2016).

In sub-Saharan Africa (SSA), few studies have been undertaken on the dietary patterns among university students. In a recent study, consumption of high-calorie diets, snacks, the pattern of skipping breakfast, and the high prevalence of obesity and being overweight was reported among undergraduate students in a private University in southern Nigeria (Omage & Omuemu, 2018;
Pengpid & Peltzer, 2015a). It was found among university students in 26 low- and middle-income countries (including seven SSA countries) a high prevalence of poor dietary healthy behaviours. The unhealthy dietary behaviours often results in unfavourable increase in bodyweight and obesity, or even undernutrition (Peltzer et al., 2014; Wilson et al., 2017).

There is a paucity of literature on university students’ dietary patterns in several countries in SSA. From the Kenyan setting, there are no published studies to the best of our knowledge with a focus on university students’ dietary habits and nutrition status, but which is important for addressing nutrition-related issues of public health concern within this subgroup. The need to focus on this subpopulation relates to previous reports by the World Health organisation (WHO) that the adult disease burden is largely attributed to healthy risk behaviours that start in young people (WHO, 2014). Several studies have established physical inactivity and unhealthy dietary habits in young adulthood as triggers of adverse effects on the weight status and future health of adults (Allom & Mullan, 2014; Hutchesson et al., 2016), for example, leading to high incidence of obesity in adults (Ogden et al., 2015). Bednarek et al.

This study seeks to describe the dietary patterns, behaviours and knowledge/lifestyle choices among undergraduate university students in a university setting in coastal Kenya. We further seek to explore how such patterns and behaviours are associated with lifestyle choice and sociodemographic characteristics. This study aims to contribute to the gap of knowledge in dietary patterns of undergraduate students in Kenya.

2. Methods

2.1. Study design and participants
This cross-sectional study was conducted between January to September 2018 at Pwani University, Kilifi county, Kenya. This public institution is situated along the Kenyan north coast, in a rural setting strategically placed in the heart of the coastal region of Kenya. The respondents were drawn from seven faculties in the institution. The sample size for this study was drawn from the population of undergraduate students (approximately 7000). Given a margin of error of 10% and a proportion of 70% being at the university during the study duration and equally likely to respond, the approach by Daniel and Cross (Daniel & Cross, 2018) leads to a sample size of 80 respondents. However, a feasible sample size within the budgetary constraints and which did not impact the was in the range of 70–75.

A sample of 72 students aged 18–25 years, approached, and randomly recruited participated in this study. The inclusion criteria consisted of: students enrolled in the institution and belonged to either of the faculties within the institution; Undergraduate students undertaking any bachelor’s program, and in any year of study, and those who gave informed consent. The exclusion criteria included students enrolled for postgraduate studies (MSc and PhD) because these programs are offered on a part-time basis they are not in regular contact with students’ life. The enrolment was voluntary and anonymous. Those who agreed to participate in this study were asked for their written consent. A self-administered questionnaire was used to collect data and it was collected upon completion of filling. No incentives were provided.

The students were sampled from all the six colleges at the institution: school of education—38.9%, school of humanities & social sciences-12.5%, school of agricultural sciences & agribusiness-5.6%, school of business & economics-8.3%, from environmental & earth sciences-11.1%, school of pure & applied sciences-11.1%, and school of health & human sciences-12.5%. Recruitment of participants was done by visiting the lecture halls of different faculties where students are mainly located during the day. Interested students were enrolled into the study once they provided an informed consent.
2.2. Data collection & measurements
Both dietary intake assessment and anthropometric measurements were undertaken. A semi-structured previously pretested food frequency questionnaire (FFQ) was self-administered. This questionnaire was pretested in 10 randomly selected undergraduate students within the university to ascertain its appropriateness. The questionnaire gathered information on socio-demographic characteristics, dietary practices and anthropometric measurements from the recruited students. Research Participants were asked to report the frequency of consumption of different food groups. The FFQ questionnaire is provided in the supplementary material.

Anthropometric measures and physical activity were self-reported in the questionnaire by the participant. For comparison purposes, electronic scales with 100 g precision were used to assess participants weight, and a tape measure graduated in centimeters was used for height measurement. For the analysis, the actual measurement was used from whom it was obtained, otherwise the self-reported measure was used. Body Mass Index (BMI) was calculated in kg/m² and BMI status classified according to the World Health Organization classifications (Weir & Jan, 2021). The BMI values were classified into four categories underweight ≤ 18.5 kg/m², normal weight 18.5–24.9 kg/m², overweight 25–29.9 kg/m² and obese ≥ 30 kg/m².

2.3. Ethical considerations
Ethical approval for the study was sought from the Pwani University Ethics Committee. Consent was sought from each study participant following a detailed explanation of the aims of the study, information to be collected and any potential risks. Participants were made aware they were free to withdraw from the study at any point and confidentiality, anonymity and privacy of all information was guaranteed. Administrative authorization from the chair of department was sought.

2.4. Statistical analysis
EpiData Software (version 3.0.2, The EpiData Association, Odense, Denmark), and SPSS (version 25.0) were used for data entry and data management. All statistical analysis was undertaken using STATA version 15.0 (StataCorp, College Station, TX, USA). The weight, height and BMI were analysed using descriptive statistics. Results were presented as means ± standard deviations, frequencies and percentages. We performed a descriptive analysis of the variables, using means ± standard deviations (or medians ± IQR where relevant) for continuous variables and frequencies and percentages, for binary variables. Tests of association were performed using chi-square tests (or Fisher’s exact test for infrequent observations). Comparisons of proportions was done using Z-tests while comparison of means using t-tests (or Mann-Whitney tests for non-parametric data). Any tests for normality were done using the Shapiro-Wilk test. Univariate (adjusted) and multi-variable (adjusted) logistic regression models were fitted to establish which factors were associated with specific dietary patterns and behaviours. The potential confounders included in the model were sociodemographic variables and lifestyle behaviours. All statistical tests were performed at the 5% level of significance. All participant data were used in the final analysis as there were no outlier observations.

3. Results
3.1. Socio-demographic characteristics, anthropometric measurements and student lifestyle characteristics and behaviours
Table 1 provides the summary statistics of the socio-demographic variables, anthropometric measurements and student lifestyle characteristics and behaviours. A total of 72 undergraduate students participated in the study, with a near-equal representation of males and females (females—51.39%, n = 37/72 vs males—48.61%, n = 35/72).

Most of the students involved in this study were 21 years and above, with more than half of the students aged between 21 and 24 years (59.7%) and all years of study (year 1—year 4) were near equally represented. On anthropometric measures, the was no evidence of a statistically
Table 1. Descriptive statistics of sociodemographic variables, anthropometric measurements and student lifestyle characteristics and behaviours of the university students

| Variables                      | Females (n = 37) | Males (n = 35) | Total (N = 72) | P-value* |
|--------------------------------|------------------|----------------|----------------|----------|
| **Age (years)**                |                  |                |                |          |
| ≤20                            | 8 (21.6%)        | 16 (45.7%)     | 24 (33.3%)     | 0.0035   |
| 21–24 years                    | 25 (67.6%)       | 18 (51.4%)     | 43 (59.7%)     |          |
| 25 years and above             | 4 (10.8%)        | 1 (3.0%)       | 5 (6.9%)       |          |
| **Year of study**              |                  |                |                |          |
| Year 1                         | 10 (27.0%)       | 7 (20.0%)      | 17 (23.6%)     | 0.5726   |
| Year 2                         | 7 (18.9%)        | 9 (25.7%)      | 16 (22.2%)     |          |
| Year 3                         | 8 (21.6%)        | 11 (31.4%)     | 19 (26.4%)     |          |
| Year 4                         | 12 (32.4%)       | 8 (22.9%)      | 20 (27.8%)     |          |
| **Anthropometric measures, mean (SD)** |                  |                |                |          |
| Weight (Kg)                    | 64.3 (6.7)       | 62.4 (9.6)     | 63.4 (8.3)     | 0.3313   |
| Height (cm)                    | 168.2 (9.9)      | 162.3 (8.3)    | 165.4 (9.6)    | 0.0080   |
| BMI (kg/m²)                    | 2.2 (0.5)        | 2.4 (0.5)      | 2.3 (0.5)      | 0.0943   |
| **BMI categories**             |                  |                |                |          |
| Underweight (<18.5 kg/m²)      | 2 (5.4%)         | -              | 2 (2.8%)       | 0.2908   |
| Normal (18.5–24.9 kg/m²)       | 27 (73.0%)       | 23 (65.7%)     | 50 (69.4%)     |          |
| Overweight(25–29.9 kg/m²)      | 8 (21.6%)        | 11 (31.4%)     | 19 (26.4%)     |          |
| Obese (≥ 30 kg/m²)             | -                | 1 (2.9%)       | 1 (1.4%)       |          |
| **Lifestyle characteristics & behaviours** |                  |                |                |          |
| Regular exercise               | 28 (75.7%)       | 23 (65.7%)     | 51 (70.8%)     | 0.5028   |
| Weight loss regime             | 12 (32.4%)       | 16 (45.7%)     | 28 (38.9%)     | 0.3609   |
| Eating balanced diet           | 28 (75.7%)       | 24 (68.6%)     | 52 (72.2%)     | 0.6822   |
| Having a diet regime           | 20 (54.1%)       | 13 (37.1%)     | 33 (45.8%)     | 0.2291   |
| Variables                              | Females (n = 37) | Males (n = 35) | Total (N = 72) | P-value* |
|----------------------------------------|------------------|----------------|----------------|----------|
| **Awareness of healthy nutrition**     |                  |                |                |          |
| High                                   | 25 (67.6%)       | 20 (57.1%)     | 45 (62.5%)     | 0.5087   |
| Low                                    | 12 (32.4%)       | 15 (42.3%)     | 27 (37.5%)     |          |
| **Received information on diet and health** |                  |                |                |          |
| Very much                              | 23 (62.1%)       | 27 (77.1%)     | 50 (69.4%)     | 0.1678   |
| Little                                 | 14 (37.8%)       | 8 (22.8%)      | 22 (30.6%)     |          |
| **Desire to change current dietary habits** |                  |                |                |          |
|                                        |                  |                |                |          |
| **Smoker**                             |                  |                |                |          |
|                                        |                  |                |                |          |
| **Alcohol consumption**                |                  |                |                |          |
|                                        |                  |                |                |          |

Data are n (crude percentage), unless where specified means (SD). The denominator used to compute the proportions is the n provided at the top pf the respective column.

*P-values are from statistical tests for sex-specific differences in the variables in the left column. Z-tests used for comparison of proportions. Chi-square/Fisher’s test used for comparison of proportions. T-test used for comparison of means.
significant difference in the weight and BMI of the students surveyed. However, there was evidence of a different in the height of males and females; females were slightly taller compared to their male colleagues (168.2 cm vs 162.3 cm, p-value = 0.008).

The BMI status classifications in Table 1 indicate that while most students were classified in the normal category (n = 50/72, 69%), a considerable proportion of students were overweight, and a minority were either underweight or obese. The prevalence of overweight and obesity was more common among male students (31.4% vs 21.6%), although overall there was no evidence of association between BMI status and gender.

The results further reveal that although a majority of students surveyed were highly aware of what is meant by healthy nutrition (n = 45/72, 62.5%), we observed disproportionate levels between male and female students. Male students were overwhelmingly reported being knowledgeable about healthy nutrition compared to females (67.6% vs 80%). Furthermore, 69.4% of the students (62.1% of females and 77.1% of males) acknowledged receiving a lot of information on diet and health. Most of the students (83.3%) reported that at the time of the survey they had the desire to change their current dietary habits (81.1% of females and 85.7% of males).

We note that most of the students (n = 51/72, 70.8%) reported undertaking regular exercise, which was reportedly common in females compared to males (75% vs 65%). However, there was no statistically significant association between regular exercise and gender (p = 0.5028). Besides, a very high proportion of the students surveyed (n = 60/72, 83.3%) were reported they had concern about their dietary habits and felt the need to change. Moreover, in this student population less than half (45.8%) followed a diet and weight loss regime, 15.3% of the respondents reported drinking alcohol and 2.8% were smokers. Notably, females reported drinking alcohol more frequently than men.

3.2. Nutrition behaviour and eating habits of the university students

3.2.1. Food consumption behaviour/ patterns
The meal and snack patterns of university students are shown in Table 2. Most of the students prepared their own meals (n = 41/72, 57%), with comparable statistics between males and females (p-value = 0.9736). Similarly, the number of meals consumed in a day was comparable between male and female students (p-value = 0.8917), although a majority (75%) reported taking at least 3 meals per day. Daily breakfast, lunch and dinner consumption was fairly common among all students (59.7%, 31.1% and 72.2% respectively).

Snacking was less common among the students surveyed, with at least 85% (n = 56/72) of the students reporting they either never snacked or snacked sometimes only. Majority of the university students reported eating vegetables and fruits more than thrice a week (87.5% and 69.4% respectively). This behaviour that was common in both males and females, although females appeared to have higher consumption of fruits and vegetables per week (80% vs 65%).

3.2.2. Food group consumption and BMI status
The diversity of food intake among the university students according to BMI status is reported in Table 3. The diversity reported here is a measure of the frequency of the different food types (legumes & nuts, cereal-based foods & tubers, meat & poultry products, milk & milk products, fruits & vegetables) per week reported by the student. If a student reported consuming all the different food groups at a frequency of more than 5 times per week for each of the five food groups, they were considered to have a high diversity. Similarly, those who reported consumption of 3–4 times/ week and less than twice/week were classified into medium and low groups respectively.

Of the five different food groups reported in Table 3, the most consumed food category was legumes and nuts (37.5%), followed by fruits and vegetables (26.4%) and cereal based foods
Animal products (meat, milk and related) were the least consumed foods among the students, with only 5.6% of the students reporting a nearly daily consumption (i.e., >5 times/week) of these foods. The low dietary intake of the two animal products was the least reported among those with a normal BMI (69.4% and 67.9% respectively) in contrast with those who were overweight who reported 28.6% and 28.3%, respectively.

Table 2. Food consumption patterns among the university students

| Food consumption behaviour/pattern | Females n = 37 (%) | Males n = 35 (%) | TotalN = 72 (%) | P-value |
|-----------------------------------|-------------------|-----------------|-----------------|---------|
| The main source of meals          |                   |                 |                 |         |
| Ready meals/take-aways            | 16(43.2%)         | 15(42.8%)       | 31(43.1%)       | 0.9736  |
| Own preparation/cooking           | 21(56.8%)         | 20(57.1%)       | 41(57.0%)       |         |
| Meals in a day                    |                   |                 |                 |         |
| 1–2 times                         | 9(24.3%)          | 9(25.7%)        | 18(25.0%)       | 0.8917  |
| 3 or more                         | 28(75.7%)         | 26(74.3%)       | 54(75.0%)       |         |
| Breakfast consumption             |                   |                 |                 |         |
| Everyday                          | 23(62.2%)         | 20(57.1%)       | 43(59.7%)       | 0.1517  |
| Sometimes                         | 11(29.7%)         | 15(42.9%)       | 26(36.1%)       |         |
| None                              | 3(8.1%)           | -               | 3(4.2%)         |         |
| Lunch consumption                 |                   |                 |                 |         |
| Everyday                          | 22(59.5%)         | 22(62.3%)       | 44(61.1%)       | 0.6119  |
| Sometimes                         | 14(37.8%)         | 13(37.1%)       | 27(37.5%)       |         |
| None                              | 1(2.7%)           | -               | 1(1.4%)         |         |
| Dinner consumption                |                   |                 |                 |         |
| Everyday                          | 27(73.0%)         | 25(71.4%)       | 52(72.2%)       | 0.5843  |
| Sometimes                         | 9(24.3%)          | 10(28.6%)       | 19(26.4%)       |         |
| None                              | 1(2.7%)           | -               | 1(1.4%)         |         |
| Snacking                          |                   |                 |                 |         |
| Everyday                          | 4(10.8%)          | 7(20.0%)        | 11(15.3%)       | 0.5527  |
| Sometimes                         | 24(64.9%)         | 20(57.1%)       | 44(61.1%)       |         |
| None                              | 9(24.3%)          | 8(22.9%)        | 17(23.6%)       |         |
| Fried foods consumption           |                   |                 |                 |         |
| None                              | 8(21.6%)          | 5(14.3%)        | 13(18.1%)       | 0.672   |
| 1–2 times                         | 13 (35.1%)        | 12(34.3%)       | 25(34.7%)       |         |
| 3 or more                         | 16(43.2%)         | 18(51.4%)       | 34(47.2%)       |         |
| Vegetable consumption             |                   |                 |                 |         |
| 1–2 times                         | 4(10.8%)          | 5(14.3%)        | 9(12.5%)        | 0.6559  |
| 3 or more                         | 33(89.2%)         | 30(85.7%)       | 63(87.5%)       |         |
| Fruit consumption                 |                   |                 |                 |         |
| None                              | 1(2.7%)           | 1(2.9%)         | 2(2.8%)         | 0.7926  |
| 1–2 times                         | 9(24.3%)          | 11(31.4%)       | 20(27.8%)       |         |
| 3 or more                         | 27(80.0%)         | 23(65.7%)       | 50(69.4%)       |         |
| Meals away from home              |                   |                 |                 |         |
| None                              | 3(8.1%)           | 4(11.4%)        | 7(9.7%)         | 0.5696  |
| 1–2 times                         | 12(32.4%)         | 7(20.0%)        | 19(26.4%)       |         |
| 3 or more                         | 22(59.5%)         | 21(60.0%)       | 43(59.7%)       |         |
| Food category consumed | BMI STATUS | P-value |
|------------------------|------------|---------|
|                        | Underweight | Normal | Overweight | Obese | Overall |
| **Legumes & nuts**     |            |        |            |       |         |
| High                   | 1 (3.7%)    | 15 (55.6%) | 11 (40.7%) | 0 (0%) | 27 (100%) |
| Moderate               | 0 (0%)      | 17 (77.3%) | 5 (22.7%)  | 0 (0%) | 22 (100%) |
| Low                    | 0 (0%)      | 16 (69.6%) | 6 (26.1%)  | 1 (4.4%) | 23 (100%) |
| **Cereal based foods & Tubers** |            |        |            |       |         |
| High                   | 0 (0%)      | 10 (58.8%) | 7 (41.2%)  | 0 (0%) | 17 (100%) |
| Moderate               | 1 (2.2%)    | 32 (69.6%) | 12 (26.1%) | 1 (2.2%) | 46 (100%) |
| Low                    | 0 (0%)      | 6 (66.7%)  | 3 (33.3%)  | 0 (0%) | 9 (100%)  |
| **Meat & poultry products** |            |        |            |       |         |
| High                   | 1 (25%)     | 0 (0%)   | 3 (75%)    | 0 (0%) | 4 (100%)  |
| Moderate               | 0 (0%)      | 14 (73.7%) | 5 (26.3%)  | 0 (0%) | 19 (100%) |
| Low                    | 0 (0%)      | 34 (69.4%) | 14 (28.6%) | 1 (2.0%) | 49 (100%) |
| **Milk & milk products** |            |        |            |       |         |
| High                   | 0 (0%)      | 2 (50%)  | 2 (50%)    | 0 (0%) | 4 (100%)  |
| Moderate               | 0 (0%)      | 10 (66.7%) | 5 (33.3%)  | 0 (0%) | 15 (100%) |
| Low                    | 1 (1.9%)    | 36 (67.9%) | 15 (28.3%) | 1 (1.9%) | 53 (100%) |
| **Fruits & Vegetables** |            |        |            |       |         |
| High                   | 1 (5.26%)   | 13 (68.4%) | 5 (26.3%)  | 0 (0%) | 19 (100%) |
| Moderate               | 0 (0%)      | 16 (72.7%) | 5 (22.7%)  | 1 (4.6%) | 22 (100%) |
| Low                    | 0 (0%)      | 19 (61.3%) | 12 (38.7%) | 0 (0%) | 31 (100%) |
Table 4. Factors associated with regularity in eating among the university students surveyed

| Regular meal patterns | Adjusted | Unadjusted |
|-----------------------|----------|------------|
|                       | Odds Ratio | P-value | Odds Ratio | P-value |
| Age                   | 0.45      | 0.29      | 0.84      | 0.74    |
| Female                | 2.12      | 0.23      | 1.39      | 0.49    |
| BMI                   | 1.10      | 0.33      | 1.05      | 0.55    |
| Own cooking food preparation | 0.84 | 0.80 | 0.66 | 0.40 |
| Knowledge on healthy diet | 1.26 | 0.75 | 0.62 | 0.33 |
| Awareness on health and nutrition | 0.53 | 0.42 | 0.79 | 0.62 |
| Regular exercise     | 0.76      | 0.74      | 0.91      | 0.86    |
| Followed a diet regime | 1.89   | 0.40      | 1.16      | 0.75    |
| Weight loss regime   | 0.58      | 0.38      | 0.69      | 0.45    |
| Alcohol intake       | 0.58      | 0.58      | 0.62      | 0.47    |
| Embracing balance diet | 0.32 | 0.13 | 0.78 | 0.64 |
| Snacking             | 11.04     | <0.001**  | 4.20      | 0.02**  |

There was evidence of association between BMI status and consumption of different classes of foods, namely legumes and nuts (p-value = 0.0012) and meat and meat products (p-value = 0.0008). For these two food groups, it is evident, for example, that most of the obese participants had higher consumption of legumes and nuts (n = 11/19, 58%) and low consumption of meat and meat products (n = 12/19, 63.1%). Although there was no evidence of association between fruit and vegetable consumption and BMI status (p-value = 0.364), it was evident that the obese group were less likely to consume fruit and vegetables.

3.3. Factors associated with student’s dietary patterns

Table 4 presents results on factors associated with regularity in eating among the university students surveyed. We fitted a multivariable logistic regression model to establish which factors had a statistically significant association with regularity in eating. Regularity was defined as a binary variable. The results show that of all variables included in the model, only snacking had a statistically significant relationship with regularity in eating (OR = 4.2, p-value <0.001). Students who had snacks had eleven times higher odds of having regular meals after adjusting for other variables.

3.3.1. Fruit and vegetable consumption

Table 5 shows the results of a logistic regression model assessing factors associated with regularity in eating fruits and vegetables among university students. The results show that BMI and own meal preparation were the most important factors associated with regularity in eating fruits and vegetables. In this study, we define regularity as those having the minimum required consumption of fruits and vegetables per week. Students who prepared their meals had 4.6 times higher odds of having regular consumption of fruits and vegetables compared to their counterparts who did not prepare their meals. Own meal preparation is a likely indicator that such students were more cognisant of healthier eating habits and hence even more likely to be better consumers of fruits and vegetables compared to those who had ready meals.

3.3.2. Balanced diet consumption

The results in Table 6 show factors associated with the consumption of a balanced diet among the students surveyed. We adopted a broad working definition of a balanced diet as consumption of foods from all the major food groups included in the FFQ (see, Table 3). Only three factors in the
unadjusted logistic regression model were associated with balanced diet consumption: knowledge of healthy diet (p-value = 0.07), awareness of health and nutrition (p-value = 0.07), and engagement in regular exercise (p-value<0.001). This highlights a major role of the knowledge gaps in the adoption of healthy dietary habits among young people. In the adjusted model, none of the variables was significant at the 5% level of significance.
3.4. Dietary diversity

Dietary diversity was deduced from the frequency of consumption of the different food groups, and a dietary diversity score (DDS) (low, moderate, and high) was constructed; the DDS was classified as low DDS if consumption of a variety of foods in the food frequency questionnaire was no more than once a week, medium if relevant foods were only consumed two–four times a week, and high if consumption was more than five times a week. We note that the DDS score computed here is not a validated metric but is computed specifically to enable comparative analysis in this study.

We established that involvement in exercise was significantly associated with dietary diversity (chi-square statistic = 6.2374; p-value = 0.044). Those who were involved in regular exercise seemed to be more aware of the health benefits and therefore embraced dietary diversity in their eating habits. Further, we observed that those who followed a diet regime were also associated with dietary diversity (chi-square statistic = 8.3461; p-value = 0.015). There were also gender differences in dietary diversity (chi-square statistic = 6.7417; p-value = 0.034). Females embraced greater dietary diversity in their eating habits compared to males. We did not observe any association between dietary knowledge and dietary diversity score.

4. Discussion

This study sought to report the dietary patterns, behaviours, and their associated factors, in a university student population in Coastal Kenya. Eating habits were identified which aided in the characterization of dietary patterns including snacking frequencies, practices associated with skipping meals/irregular meals intake, alcohol consumption, smoking, low consumption of fruits and vegetables, and a high intake of cereal-based foods.

Our study revealed that although there was a high level of awareness of healthy nutrition and being in receipt of information on diet and health, this did not necessarily translate to healthy food choices and dietary behaviours. This further brings to question what kind of information students receive and its effectiveness in leading to healthy dietary behaviour (Worsley, 2002). We observed disproportionate levels of consumption of the different food groups; animal products were less consumed but there were neither a high consumption of fruits & vegetables, and legumes and nuts. Poor healthy dietary habits among undergraduate students have similarly been reported in many high-income countries (Sogari et al., 2018; Yahia et al., 2016; Lupi et al., 2015) and developing countries (Nakhooda & Wiles, 2018; Peltzer et al., 2014; Tok et al., 2018), including sub-Saharan Africa countries such as Rwanda, Nigeria and Namibia (Omage & Omuem, 2018; Pengpid & Peltzer, 2015b; Waweru & Marete, 2016). One factor that maybe associated with certain unhealthy dietary habits is that convenience is known to be a major factor in deciding when, what and how to eat among students (Deshpande et al., 2009; Sogari et al., 2018).

We observed gendered food differences and dietary behaviours, especially in relation to dietary diversity, balanced diet consumption and regularity in eating. This is unsurprising because it has been suggested in the literature that the dietary intake of male and female students is influenced by different factors; females are significantly motivated by price, convenience, pleasure concerns more than their male counterparts (Deshpande et al., 2009). It has also been reported elsewhere that females are more cautious about their weight status than their males counterparts (Ferguson et al., 2011; Lindmark et al., 2005). Females embraced more regularity in eating (e.g., less likely to skip breakfast which is a common practice among university students (Seedat & Pillay, 2019; Tok et al., 2018)), balanced diet, eating fruits and vegetables compared to their males counterparts. Such differences have previously been reported in student populations in other African settings (Omage & Omuem, 2018) and outside of Africa (Cluskey & Grobe, 2009; Stok et al., 2018; Tok et al., 2018). O mage et al. for instance, reported a statistically significant association between gender and regularity in eating while Cluskey and colleagues established that female participants were more concerned about physical appearance and weight and therefore adopted dieting and specific dietary behaviours. Although the gendered differences on one front could be surprising given that more males compared
to females reported they received information related to diet and health, it maybe that females are better adapters of certain dietary habits that has been reported in the literature (El Ansari et al., 2012).

Our study showed a low prevalence of selected healthy dietary habits. For example, regular intake of fruits and vegetables was not a common practice, and irregularity in eating (for example, skipping breakfast), moderate dietary diversity, snacking and fast-food consumption were frequently reported among university students in this study. These poor dietary practices have been reported among university students in countries such as Lebanon (Salameh et al., 2014) and several other high-income countries (Pengpid & Peltzer, 2015b) and even African settings such as Cameroon and Nigerian universities (Bede et al., 2020; Pengpid & Peltzer, 2015b). This aforesaid results indicate that the students do not take a balanced diet and may likely fall short of the recommended daily nutrient intake; Westat contends that daily fruits and vegetable intake coupled with eating at least three main meals in a day is recommended to meet the daily nutrient and energy requirements (Westat, 2007). The observed low consumption of healthy food options such as fruit and vegetables in our study could be partly explained by the high consumption of fried food and snacking behaviours. A study in Turkish universities showed that fast food consumption is negatively correlated with fruits and vegetable intake (Lupi et al., 2015). Some studies have also suggested that stress can be an important barrier of fruit and vegetable intake (Unusan, 2006) but our study did not collect data on such psychosocial factors.

We further observed that both awareness of healthy nutrition and receiving information on diet and health sometimes played a key role in whether a student adopted certain dietary behaviours such as consuming a balanced diet. Several previous studies agree that sound dietary knowledge can lead students to adopt healthy dietary and lifestyle behaviours (Vadeboncoeur et al., 2015; Yahia et al., 2016). This observation underscores the fact that nutrition education is a potential tool in promoting healthy eating, although some authors argue that awareness creation by itself may not be an effective technique (Deshpande et al., 2009) and students need to be consulted when developing interventions to promote healthy eating behaviour (Sogari et al., 2018).

Whilst high rates of drinking and smoking have been reported in several student populations (Tanton et al., 2015), we did not observe this in our study. This can partly be associated with the fact that majority of the students receiving information on diet and health. However, we also acknowledge that this observation can be influenced by some factors. First, this study relies on a small sample size. Secondly, certain students maybe be less likely to divulge such information. For example, it is well established in the literature that female students are more likely than male students to accurately report their actual dietary behaviours (Pengpid & Peltzer, 2015b). As such larger studies are need for reliable inference on these prevalence estimates.

There are some limitations to this study. First, we acknowledge that this is a small cross-sectional study and therefore does not provide robust evidence about dietary behaviors and for the entire student population. As such there is need for larger multi-institutional studies to provide robust findings. Secondly, the FFQ used in this questionnaire was not validated. However, we pre-tested this tool to ensure it would collect requisite information for which it was intended. Third, no quantitative data such as daily food portions and calorie intake was collected in the questionnaire thus limiting further analysis to infer nutritional status. Longitudinal studies are therefore necessary. Fourth, dietary intake and anthropometric measures were self-reported by the students. However, some previous studies have shown that self-reported data would still enable correct classification of most of the population into their corresponding (right) BMI categories (Bowring et al., 2012; Yoong et al., 2013). We also acknowledge that there are methodological limitations to the use of BMI that have been widely reported in the literature, for instance, when populations contain different proportions of athletic subjects (Carey, 2019; Himes, 2009; Nevill et al., 2006). Lastly, we did not consider psychological factors that are known to be associated with dietary patterns and behaviors among students(Ganasegeran et al., 2012).
5. Conclusion

This study highlights the need for multilevel nutrition intervention and strategies to promote healthy eating behaviour, lifestyle, and dietary intake among university students. Nutrition education interventions can be an important tool to encourage healthy food choices and improved dietary habits among university/college students.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

Data availability

Study data are available from the corresponding author upon reasonable request.

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