UNIVERSITY FOR DEVELOPMENT STUDIES, TAMALE

NUTRITIONAL STATUS AND NUTRIENT INTAKE ADEQUACY OF STUDENTS OF BOLE NURSING AND MIDWIFERY TRAINING COLLEGE

SALAHUDDIN IDDRISU

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BY

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A DISSERTATION SUBMITTED TO THE DEPARTMENT OF NUTRITIONAL SCIENCES, SCHOOL OF ALLIED HEALTH SCIENCES, UNIVERSITY FOR DEVELOPMENT STUDIES, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF PHILISOPHY DEGREE IN PUBLIC HEALTH NUTRITION

APRIL, 2022

DECLARATION

Student

I hereby declare that this thesis is the result of my original work and that no part of it has been presented for another degree in this University or elsewhere:

Candidate:

Signature:..... Date:.....

Name: .....

Supervisor

I hereby declare that the preparation and presentation of the thesis was supervised following the guidelines on supervision of thesis laid down by the University for Development Studies.

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ABSTRACT

Across the life cycle, energy and nutrient requirements vary depending on age, sex, physiological state, and physical activity levels. Universally, school meals are seen as a way of tackling malnutrition and poor eating behaviours in school children. The provision of meals by colleges of nursing is geared towards meeting the nutrient requirements of students, thereby, improving their nutritional status. The study focused on estimating the nutritional status and nutrient intake adequacy of students in a cross-sectional study consisting of 231 student nurses. Anthropometric measurements were used to determine students' nutritional status while the food frequency questionnaire and weighed food methods were used to assess dietary diversity and nutrient intake. HemoCue1 Hb 201+ was used to determine the haemoglobin concentration of the students. SPSS version 23.0 was used for the data entry and analysis. Nutrient adequacy ratios were calculated for some nutrients and the Mean Adequacy Ratio for all nutrients was determined. Underweight prevalence among students was 4 per cent whilst 27.8% were overweight. Females were highly likely to be overweight than males who stood a higher chance of being underweight when compared to their female colleagues. There was a significant difference in BMI among the program of study where PNNM students were more prone to being overweight and underweight was common among RNAP students. Similarly, the difference in BMI among students' year of study was significant with first-year students having a greater risk of being underweight and obesity. About 18.4% of students had a high waist-to-hip ratio with students in the PNNM program being significantly at a higher risk of having a high waist-to-hip ratio than the other programs. The anaemia prevalence in the study was 21.5% with the risk greater among females than males. The amount of protein and carbohydrates provided by the school meals exceeds 100% of the recommended daily requirements of students. Similarly, the school meals provided more than the recommended daily allowance for vitamin C, vitamin B_6, thiamine and folate, though that of Vitamin B_{12}, Vitamin A, vitamin K, iron, and zinc were inadequate. However, the school meals met the needs of students for all the essential amino acids. The Mean Adequacy Ratio of both micronutrients and macronutrients were adequate. The food categories of Grains, white tubers, and plantain; and other vegetables were consumed each day of the week whilst pulses were consumed 4 times a week. The school meals recorded a dietary diversity score of 28. In conclusion, the study results depict that the college's meals are not diversified and hence inadequately meet the micronutrients need of students. The study recommends that The Health Training Institutions in collaboration with other stakeholders should develop a standard Food-Based Dietary Guideline (FBDG) that could be used by all Nursing and Midwifery Training Colleges (NMTC) in the country. Also, Bole Nursing and Midwifery Training College should re-develop its feeding menu that will promote the intake of a range of foods to step up the quality of meals served to students

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DEDICATION

To my Dad, Iddrisu Ibn Seidu, and my mum, Hafsah Shaibu.

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LIST OF ABBREVIATIONS

BMI	-	Body Mass Index
FBDG	-	Food-Based Dietary Guidelines
FFQ	-	Food Frequency Questionnaire
HTIs	-	Health Training Institutions
MAR	-	Mean Adequacy Ratio
MSFA	-	Monosaturated Fatty Acids
NAC	-	Nurse Assistant Clinical
NAP	-	Nurse Assistant Preventive
NAR	-	Nutrient Adequacy Ratio
NMTC	-	Nursing and Midwifery Training College
PNNM	-	Post NAC/NAP Midwifery
PUFA	-	Poly-unsaturated Fatty Acids
RCN	-	Registered Community Nursing
RDA	-	Recommended Dietary Allowances
RNAP	-	Registered Nurse Assistant Preventive
RNI	-	Recommended Nutrient Intake
SFA	-	Saturated Fatty Acids
WC	-	Waist Circumference
WHR	-	Waist-to-Hip Ratio

CHAPTER ONE
INTRODUCTION

1.0: Introduction

This chapter consists of the study's background, statement of the research problem, study research questions, purpose of study, research objectives, the significance of the study, delimitation of the study, and organisation of the study.

1.1: Background of the study

Nursing is a noble profession devoted to saving lives, and nurses are an integral part of the health delivery system. The nursing profession, asides from ensuring the quality of life of an individual, also promotes the maintenance of the quality of family and community life. Nurses, considered dependable persons in the health system, aspire to make primary health care accessible to every person no matter their socio-economic status (Bhaumik, 2013). Providing sufficient nurses will contribute to achieving the Ghana Ministry of Health's goal of improving the health status of all people living in Ghana. In this sense, nursing students, usually adolescents and young adults (WHO, 2018), are best placed as the future of nursing and health in communities (Darch et al., 2017). Young adults' health is associated with their lifestyle choices (Walter, Aldrian, Stuger, Kiefer, & Ekmekcioglu, 2014), which among other things influences their nutritional outcome, and subsequently, malnutrition, a significant concern of public health in developing countries (Association of Voluntary Agencies for Rural Development (AVARD), 2013).

Throughout the life cycle, energy and nutrient needs differ depending on age, sex, physiological state, and the level of physical movement. During adolescence and adulthood, daily energy between 1,850 kcal and 3,300 kcal (FAO, 2005) is required to maintain normal growth

while the requirement for protein is approximately 46 g. For micronutrients, Recommended Nutrient Intakes (RNIs) for thiamine for persons 10 years and above is 1.1 mg (females) and 1.2 mg (males), whilst that of riboflavin is 1.0 mg for female adolescents and 1.3 mg for males. Adults require 1.1 mg (females) and 1.3 mg (males). Niacin needs of adolescents and adults are between 14 - 16 NE, folic acid, 400 μg, vitamin B_{12}, 2.4 μg, vitamin C, 40-45 mg, vitamin A, 500-600 μg RE, vitamin D, 5 μg, calcium, 1000-1300 mg, iodine, 150 μg, iron, 9.1-27.4 mg (males) and 19.6-58.8 mg (females), and zinc, 4.9-8.6 mg (FAO, 2001).

One of the important things in achieving good health is by meeting these nutritional needs. To meet these nutrients requirements healthy habits need to be promoted among adolescents. Healthy habit promotion demands the appropriate intake of micronutrients and reduced consumption of trans-fat and saturated fat, sugar, salt, and refined foods (Agbozo, Atitto, Jahn, & Abubakari, 2018) with a moderate physical activity level. Osowski et al. (2015) posit that fruits and vegetables, whole grains, low-fat milk, beans, fish, and lean meat should primarily be the diets of school children. However, several pieces of research showed that the content of both energy and nutrient in meals eaten in school usually do not satisfy the nutritional requirements of school children. For example, Flores et al (2009) as cited in Agbozo et al., (2018, p. 2) reported 1501 kcal per day as the average energy contain in meals provided by schools, with 88% of the nutritional requirements being met. In Ghana and many other developing countries, it is not different. The Ghana school feeding programme (GSFP) lunch pack is designed to provide a minimum of 664 kcal energy, 16.3 g protein, 11.1 g fat, 22 mg calcium, 3.7 mg iron, 375 μgRE vitamin A, 0.19 mg thiamine, 0.10 mg riboflavin, 10.4 mg niacin and 4 mg vitamin C (Fisher, 2007). Danquah et al. (2012) in their evaluation of nutrients in meals offered in three GSFP beneficiary schools in 2012 indicated that almost 100% of the RNI values of energy, protein, vitamin A, zinc, iron, and

magnesium were met, and 59%, 25%, and 22% being the values met for vitamin C, riboflavin, and calcium respectively. Private schools provide large portion sizes with higher energy and fat but with similar micronutrients provided in public schools (Owusu et al., 2017).

Universally, meals provided by schools to students are seen as a way of tackling malnutrition and poor eating behaviours among students (Agbozo et al., 2017). The meals provided by colleges of nursing are geared towards meeting the nutrient requirements of students, thereby, improving their nutritional status. School feeding programmes provide an opportunity for higher energy and nutrients intakes (Abizari et al., 2014). Hence, the provision of food with adequate nutrients by Health Training Institutions (HTIs) could have a positive effect on students, especially those disadvantaged. College dining services present most students with inadequate healthy food choices (Abraham et al., 2018). They further stated that students are at risk of a decrease in academic and physical functioning if they eat inadequately daily. That is, without nutritional gains, as stated by Abizari et al. (2014), school feeding programmes (SFP) are unlikely to improve the mental and academic abilities of students.

Impact evaluation of school feeding is mostly on students less than 12 years of age. Little, if any at all, focus is placed on students being fed at various HTIs regarding the meals' quality as well as quantity and whether they meet the nutrient requirement for students. This study will estimate the composition of energy and nutrient in meals served in a selected HTIs that provides their meals to students on-site. The dietary diversity of meals served will also be assessed as well as the nutritional status of students. The study will finally compare the nutrient intake adequacy of meals served and nutrient requirements of trainee nurses.

1.2: Problem statement

School feeding programme (SFP) in schools serves to reduce acute hunger, improve nutritional status, and promote the development of children (Agbozo et al., 2017). Generally, they are geared toward tackling malnutrition and poor eating behaviours among children of school-going age (Agbozo et al., 2017). In Ghana, a lot of studies done concerning SFP targeted primary schools, with little if any at all on Tertiary institutions (Nursing and Teacher training institutions). In some of the Health Training Institutions (HTIs), there are frequent complaints by students concerning the low quality of school meals served, as well as the menu being used. Though, these training institutions, designated as tertiary institutions, provide meals paid for by guardians, the extent to which the meals meet the Recommended Nutrient Intakes (RNIs) of trainees is rarely evaluated. Also, there is no standard Food-based dietary guideline (FBDG) from the Ministry of Health (MOH) that is used by various schools. However, the nutritional status of people within these institutions is significant. This study, thus, seeks to examine the nutritional status and nutrient intake adequacy of students of Bole Nursing and Midwifery Training College.

1.3: Research Questions

1.3.1: Main Research Question

What are the nutritional status and nutrient intake adequacy of students of Bole Nursing and Midwifery Training College?

1.3.2: Specific Research Questions

1. What is the anthropometric status of trainee nurses of Bole Nursing and Midwifery Training College?

2. What is the anaemia status of trainee nurses of Bole Nursing and Midwifery Training College?
3. What is the nutrient intake adequacy of trainee nurses of Bole Nursing and Midwifery Training College?
4. How diversified are the meals served to trainee nurses at Bole Nursing and Midwifery Training College?

1.4: Objectives

1.4.1: General Objective

To examine the nutritional status and nutrient intake adequacy of students of Bole Nursing and Midwifery Training College (BNMTC).

1.4.2: Specific Objectives

1. To assess the anthropometric status of trainee nurses of Bole Nursing and Midwifery Training College
2. To assess the anaemia status of trainee nurses of the Bole Nursing and Midwifery Training College
3. To determine the nutrient intake adequacy of trainee nurses of Bole Nursing and Midwifery Training College
4. To assess the dietary diversity of meals served in Bole Nursing and Midwifery Training College

1.5: Significance of the study

Findings from the study will serve as a basis for HTI to formulate a standard Food-Based Dietary Guideline (FBDG) that could be used by all Nursing and Midwifery Training Colleges (NMTC) in the country. It will also inform guardians and parents regarding the quality of meals served to their wards. School authorities will get to understand the contribution of their meals to the growth and development of students. Finally, students will decide if actually, they are getting the real value of what their parents and guardians are paying for.

1.6: Organisation of study

The study is organised based on the five-chapter model, with references and appendices after the sixth chapter. The introductory chapter, Chapter One, constitutes the background, problem statement, purpose of study, objectives, significance of the study, delimitations, and how the study is organized. The literature review, chapter two, outlines and discusses the theoretical framework organised along three themes derived from the research questions, and a summary of the literature review. Research methodology is chapter three which discusses the design, study area, population, sample and sampling procedure, data collection procedures and tools used in data analysis. Chapter four presents the information obtained from the field and summarizes them via Tables and Figures. Chapter five discusses the results of the study about the literature. Summary of results, conclusions and recommendations form part of chapter Six and summarizes key outcomes of the study and makes appropriate recommendations centred on the findings.

CHAPTER TWO
LITERATURE REVIEW

2.0: Introduction

This chapter is the literature review which outlines and discusses the theoretical framework organised along themes derived from the research questions. The themes are:

1. Nutritional Status of trainee nurses
2. Nutrient intake adequacy of trainee nurses
3. Dietary diversity of college meals

2.1: Nutritional Status of Trainee Nurses

Nutritional status is a consequence of multifaceted factors predisposed by the quality and quantity of food eaten and the physical well-being of the individual (Omage & Omuemu, 2018). Food quality and quantity alone do not determine an individual's nutritional status. An individual's health, as well as behavioural patterns, influences the overall nutritional status. However, in assessing nutritional status various methods can be used. One of which is an anthropometric assessment which is usually employed when assessing the nutritional status of adolescents. Anthropometry provides an extremely useful assessment of adults as well as children's nutritional status (Casadei & Kiel, 2021) and it is much useful when assessing the health, dietary status and future disease risk among adults (Fryar et al., 2012). Many undergraduate trainees, according to Omage and Omuemu (2018), are adolescents and encounter several health threats, including cardiometabolic risks, when transitioning to adulthood. A critical stage for instituting behavioural patterns that affect long-term health and risk of chronic disease is the transition from adolescence to adulthood (Small et al., 2012). Hence, curbing some of these multifaceted factors influencing

nutritional status can be addressed during this transition period since it serves as a crucial stage in establishing behavioural patterns for long-term health benefits. Most of these risks affect the quality of life and life expectancy of these adolescents (Omage & Omuemu, 2018). This shows how critical the transition from adolescence to adulthood is when addressing issues of quality of life and life expectancy. Ensuring adequate nutritional status during this period could contribute to lessening some of the health menaces experienced along with the transition into adulthood.

Waist circumference (WC) and waist-to-hip ratio are linked with the risk of cardiometabolic conditions (De, 2017). Diabetes, dyslipidaemia, hypertension, and metabolic syndrome (MS) are common among individuals with greater waist circumference (central obese persons) (Jacobs et al., 2010). That is, men and women, stand the risk of developing heart disease when their waist circumference exceeds 94 cm and 80 cm respectively (WHO, 2020) because central obesity has a significant effect on chronic heart disease (De, 2017). Alterations in waist circumference replicate changes in risk factors for heart disease and other related persistent diseases (WHO and FAO, 2003), and men with a waist circumference ≥102 cm have a bigger risk of metabolic impediments than women with a waist circumference ≥ 88 cm (WHO and FAO, 2003).

More so, Body Mass Index (BMI) and waist circumference are critical predictors of overweight and obesity among teenagers (Hajian-Tilaki, 2013), although waist circumference, waist-hip ratio and waist-height ratio have been considered superior to BMI when it comes to cardiovascular disease risk predictors (De et al., 2013). In achieving optimal health for the adult population, the median BMI is 21-23 kg/m^2 whereas that of an individual is 18.5-24.9 kg/m^2 (WHO and FAO, 2003).

In Ghana, the prevalence of underweight among school-going adolescents is 25.7 per cent, whereas 8.7 per cent are overweight, 65.6 per cent are with ideal body weight and 1.0 per cent, are obese

(Manyanga et al., 2014). These findings illustrate that about 10 per cent of school-going adolescents in Ghana stand an increased risk of developing cardiovascular diseases including high blood pressure and diabetes. Also, the prevalence of malnutrition among school-going adolescents in Benin is 17.5% (underweight), 11.2% (overweight), 71.3% (normal weight) and 0.6% (obesity) (Manyanga et al., 2014). Similarly, in Morocco according to Manyanga et al. (2014), the prevalence is 24.0 per cent for underweight, 16.6 per cent for overweight, 59.4 per cent for normal weight, and 3.6 per cent for obesity. These show a high overweight (obese inclusive) prevalence in Morocco (20.2%) than in Ghana and Benin (9.7% and 11.8% respectively) which predicts a higher cardiovascular risk among adolescent students in Morocco than in Ghana and Benin.

A descriptive cross-sectional survey conducted in Kumasi, Ghana, among students between the ages of 10 and 20 years, found that 7.4% were underweight, 79.6%, were normal, whilst 12.2% and 0.8% were overweight and obese respectively (Kumah et al., 2015). According to their study prevalence of overweight among males (6.80%) is high than in females (5.40%). In a similar study by Fagaras et al. (2015) the Body Mass Index (BMI) of male students were higher compared to females. More so, in a study conducted by Omage and Omuemu (2018) among undergraduate students of Igbinedion University, Okada, about 71% of students have a normal BMI, whereas 14% and 9.5% are overweight and underweight correspondingly. Nevertheless, in a study carried out in Port Harcourt, Nigeria, among secondary school students between the ages of 10-19, it was realised that 6.4 per cent were underweight, and 1.8% were obese (Adesina et al., 2012). Also, they found the majority (8.9%) of males being underweight to their female counterparts (3.8%) who were more overweight and obese. Among South African students, about 20 per cent of them are overweight or obese with more (22.1%) females in this category than males (12.8%), whilst 8.1% (underweight), 72.1% (normal), and 11.8% have waist circumference above their respective

gender-specific cut-off points (van den Berg et al., 2013). This depicts that about 88 per cent of students have ideal waist circumference reducing their probability of metabolic conditions and obesity-related Non-communicable diseases (NCDs).

Also, the overweight and obesity prevalence among female university undergraduates in Dubai, according to Al Sabbah (2020) is 17.4% and 11.9% respectively using BMI. The underweight prevalence was greater among first-year students, and there was no relationship between overweight, obesity and the year of study (al Sabbah, 2020). Only 5 per cent of undergraduate students are underweight, whilst 8 per cent and 3 per cent are overweight and obese respectively (Sedodo et al., 2014). Also, a study in Pakistan revealed that 65.3% of undergraduate students have a normal BMI and 14.1% are found to be under both overweight and underweight categories, and 6.7 per cent obese (Alam et al., 2021). Most (72%) of the obese persons were males with 28% being females. Also, the overweight or obesity prevalence is greater in males than females (Alkatan et al., 2021). In a cross-sectional survey among undergraduates from Central Michigan University, the majority of the students, especially females, had ideal body weight with the males having more visceral fat and higher waist circumference scores than their female counterparts (Yahia et al., 2016). About 9 per cent of female undergraduates in Dubai have excess abdominal fat and 18.1% are anaemic (al Sabbah, 2020). Abdominal obesity was greater amongst obese students than students who were overweight and normal-weight students. More so, visceral body fat according to Al Sabbah (2020) is common among students with anaemia. Thus, there is an association between total body fat and anaemia. In a study in Yemen to determine the prevalence of anaemia among undergraduates, more than 50% of females were anaemic compared to 46% of their male colleagues (Al-Alimi et al., 2018). The male students were found to have a high (12.00 g/dL) mean haemoglobin level than females (10.82 g/dL).

2.2: Anaemia

Anaemia is a global health concern with the bulk of the over 2 billion persons estimated to be anaemic residing in the developing world (Ramzi et al., 2011; Uddin et al., 2010). The predisposing causes of iron insufficiency among women of reproductive age could be a result of higher demand/loss, poor absorption, or infections of parasites, which could affect cognitive development (Oski, 1993; Shill et al., 2014). Although there are numerous preventive health services meant to address anaemia, its prevalence is still high, especially among pregnant women (Wemakor, 2019). Though women in their reproductive age are more at risk, it is common across the lifespan to have a greater risk of developmental defects (Khaskheli et al., 2016). In the developing world, it is a common micronutrient deficiency from a chronic imbalance of iron (Al-Alimi et al., 2018). Not until its severe form, iron deficiency develops slowly with no visible symptoms (Al-Alimi et al., 2018).

2.3: Nutritional adequacy of college meals

In preventing macronutrient and micronutrient deficiencies, a specific level of dietary intake is required to attain adequacy as incorporated in the Recommended Dietary Allowance (RDA). Currently, dietary guidelines exist for individuals to improve their food intake and influence their dietary choice that will improve their overall health. The college or university setting serves as a prospect in providing students with nutritious dietary behaviours. However, a survey done by Whatnall et al., (2020) disclosed that the food environment provided by universities predisposes students to inadequate food intake and overnutrition risk. Unhealthy eating habits, such as low fruit, vegetable, and fish consumption are common among university students (Hartmann et al., 2021). Furthermore, the majority of students in universities do not meet their recommended dietary requirements (Ouellette et al., 2012). A study among female residential undergraduates in

Bangladesh found that the majority do not meet the recommended nutrient requirements. About 11% of students were found to have a MAR value of more than 0.70 (Sultana et al., 2019). This posits that about 90% of students' MAR is below 1.0 depicting nutrient inadequacy.

Based on the FAO/WHO recommendations, carbohydrate, protein and fat contributions to total energy should be 55-75%, 10-15%, and 15-30% respectively. Though these requirements are met by the diets of some students, others rarely meet their requirements. majority of students' carbohydrate and fat intakes are low compared to their requirements (Fredriksson et al., 2016; van den Berg et al., 2013; Verwey et al., 2021). However, according to Sultana et al., (2019), there is a sufficient contribution of calorie consumption from carbohydrates, protein and fat in students' meals. They further explained that the percentage of fat consumed by students was higher than their requirements. Yet, 36% of students meet their nutrient requirement for vitamin C, and 0%, 0.56%, 1.67%, and 3.33 % of respondents realize their needs for calcium, iron, zinc, and vitamin A correspondingly (Sultana et al., 2019). These show that the calcium, iron, zinc, and vitamin A needs of the utmost students are not met.

Similarly, in South Africa, calcium, iron, Vitamin C, riboflavin, zinc, vitamin B_6, and magnesium were found to be the nutritional gaps among students although intakes of many of the micronutrients were more than the RDA (Verwey et al., 2021). So the chance of students being at risk of micronutrient deficiency still exist since the intake of some of the micronutrients is below what is needed for proper body function. Iron intake among university students is below that recommended (Fredriksson et al., 2016; van der Kruk et al., 2014; Verwey et al., 2021). This further posits that university students' diet is mostly low in iron, thus, making it difficult for students to meet their RDA. This, if persist for long, predisposes students to anaemia and its consequences. Likewise, the mean micronutrient consumption of vitamin C, iron, calcium, and

zinc in a study among boarding secondary schools in Tanzania was less than their RDAs (Nicholaus et al., 2020). They added specifically that 100% and 97% of students' RDAs for calcium and zinc were not met. Hence, this inability to meet the requirements of various nutrients could have consequences for nutrient inadequacy.

2.4: Dietary diversity of college meals

Dietary diversity, a widely recognised way of assessing diet quality, is the number of foods eaten from diverse food groups within a specific time frame (Sedodo et al., 2014). It reflects the idea that consuming foods from different food groups promote the sufficient intake of vital nutrients, as well as ensures the attainment and maintenance of good health. A strong and healthy driver of food intake according to Embling et al. (2021) is variety. Dietary diversity score is undeniably a vital component of the quality of a diet as enough evidence exists especially in the advanced world where any rise in dietary diversity score is related to a conforming surge in nutrient adequacy (Acham et al., 2012; Verger et al., 2021). These indicate that eating different food groups in a day or across days is a strong indicator of an increase in food intake and consequently nutritional adequacy though, it could also raise the risk of over-consumption if foods are dense in energy (Embling et al., 2021).

Food consumption pattern has the same effect on the general populace as it has on the well-being of an individual (Henry-Unaeze & Okonkwo, 2011). Aside from the fact that food choices and habits are deeply personal, they are multifactorial and thus may affect an individual’s needs. According to Bonnie, Mahan, Escott, and Stump, (2004), as cited in Sedodo et al. (2014), young adults turn not to meet their nutrient requirements even though they have a special need for those nutrients for growth and development. Almost 2 billion people experience hidden hunger with all its damaging effects aside from adding to the burden of disease globally (Christofori-khadka,

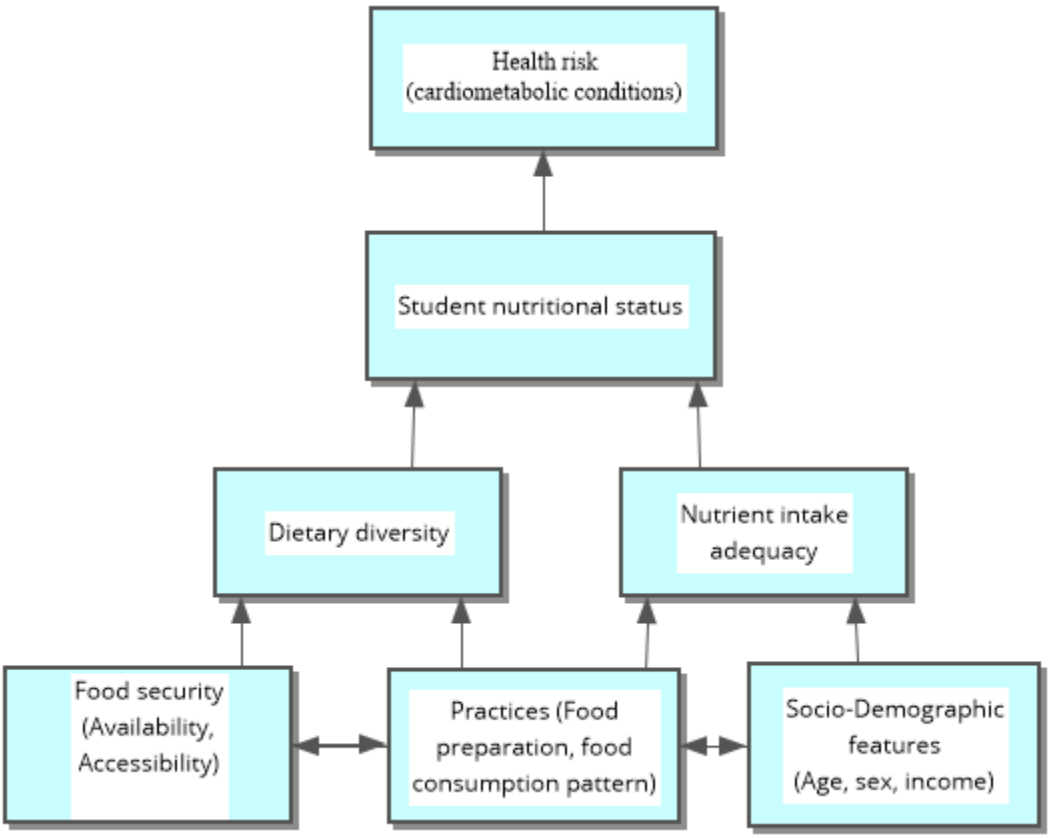
2010). Human well-being and health can be influenced by excessive intake of minerals and vitamins (Habte & Krawinkel, 2016). Over 2 billion of the world's populace of all age and gender groups suffer from micronutrient deficiencies, notably, iodine, iron, vitamin A, and zinc with their respective health consequences (Bailey et al., 2015; Tulchinsky, 2010). According to Van den Berg et al. (2013), in a study to assess the dietary and lifestyle practices of students in South Africa, most students fail to meet their minimum day-to-day needs for vegetables (98.1%), and fruits (58.4%). They further indicated that 60.2% and 30.6% of students do not eat beta-carotene-rich fruit or vegetable daily, and vitamin C-rich fruit or vegetable daily. However, a majority (83.9%) of students consume intake beyond the minimum recommendations (2-3 servings) from meat and meat substitute food groups including legumes and nuts (van den Berg et al., 2013).

Sedodo et al. (2014) found that the dietary diversity score of undergraduate students is poor. According to them, this poor score could have been attributed to the participant's status as they were students. The energy and protein intake among undergraduates is beneath their recommended day-to-day allowance (Sedodo et al., 2014). They further revealed that the dietary diversity score within the meat and meat products category was poor which they attributed to the limited financial status of students.

2.5: Conceptual Framework

The conceptual framework for the study was adopted from the United Nations Children Fund (UNICEF) conceptual framework on the "determinants of maternal and child nutrition" (UNICEF, 2020). It depicts the determinants of students' nutritional status. Nutritional status is greatly affected by nutrient intake adequacy and dietary diversity. Food consumption **patterns**, food preparation, socio-demographic characteristics and food security, as shown in the framework **(Figure 2.1)**, as the underlying determinants.

Figure 2.1: Conceptual framework of the determinants of students' nutritional status



Source: Adapted from UNICEF (2020).

CHAPTER THREE
METHODOLOGY

3.0: Introduction

Methodology, according to Kitchin and Tate (2000), is the logical and consistent set of rules and procedures used to carry out a systematic enquiry about a situation or phenomenon. This study used diverse methods in gathering relevant data. The sampling procedures, data collection instruments and techniques as well as the analysis were carefully considered to ensure the reliability and validity of the data taken.

3.1: Study Design

A cross-sectional design was used to carry out this study. This design is quick and economical and allows one to calculate the prevalence of a condition. The study concentrated on the nutritional status of students and nutrient intake adequacy as well as the dietary diversity of meals consumed. Thus, the study design helped to evaluate the proportion of the study population with malnutrition and anaemia. It also helped in estimating the proportion of the study population's nutrient requirement that was met by the school meals.

3.2: Study Area

The study was carried out in the Nursing and Midwifery Training College in Bole District of Savanna Region, Ghana, located between latitudes 8'10 5 and 09' and longitude 1.50 E and 2.45 W. The school is found in the main town of the district, Bole. The District is bordered to the North by the Sawla-Tuna-Kalba District, to the West by the Republic of Cote D'Ivoire with the Black Volta River being the borderline between the two neighbouring countries, to the East by the West Gonja District, to the south by the Wenchi and Kintampo North Districts in the Brong Ahafo

Region. The District spreads from Bodi to the North and Bamboi to the south. The study area is in the Guinea Savanna vegetation region, with a unimodal rainy season (April-September) and one dry season (December-March) characterised by relatively high temperatures (35-40^{o}C). A broad range of crops is cultivated such as maize, yam, cassava, guinea corn, and groundnuts. The District has a total of 155 schools comprising 1 private vocational institute, 6 primary schools and 6 KGs and 2 public SHS, 28 JHS, 57 primaries, 55 KGS and 1 Nursing and Midwifery Training College (NMTC). The Nursing and Midwifery Training College is one of the three (3) health training schools in the Savanna region but the only school training Registered Nurse Assistant Preventive (RNAP) nurses formally known as Community Health Nurses (CHN). It is located within the same wall as the Bole District Hospital in the Western part of the town, Bole. It is currently offering three main programs: Registered Nurse Assistant Preventive (RNAP), Registered Community Nursing (RCN), and Post-NAP/NAC Midwifery (PNNM). The school has a student population of 424 from diverse ethnic backgrounds and regions across the country, Ghana (UNDP Ghana Office Accra, 2011).

3.3: Study Subjects

The study population included 1st, 2nd and 3rd year Registered Nurse Assistant Preventive (RNAP) students, Post-NAP/NAC (PNNM) midwives, Registered Community Nurse (RCN) students, and the Kitchen staff of the school.

3.4: Sample and sampling procedure

3.4.1: Sample Size Determination

The sample size required was calculated using Yamane's formula (Israel, 2013) for determining sample size as shown below:

$$n = \frac{N}{(1 + Ne^2)}$$

Where

n = sample size,

N = population size = 420

e = margin of error or required precision (5%)= 0.05

Hence sample size, n = $\frac{420}{1+420(0.05^2)}$

$= \frac{420}{1+420(0.0025)}$

$= \frac{420}{2.05}$

= 205

A 10% contingency was added to cater for errors and missing data capture. Therefore, the sample size was rounded to 231 subjects.

3.4.2: Sampling procedure

A probability proportionate to size methodology was deployed, based on the total population of each class, to get the 231 number required for the study. Each class was stratified according to sex, and the respective proportions were estimated (Table 3.1). To get the proportion to be represented in the sample, Microsoft Excel was used to generate random numbers from the sampling frame of each class as shown in Table 3.2.

Table 3.1: Sampling frame of the study population

Class	Male		Female		Total	
	N	%	N	%	N	%
2nd Year RNAP	32	25	94	75	126	30
1st Year RNAP	41	25	126	75	167	40
3rd Year RCN	11	48	12	52	23	5
2nd Year RCN	10	50	10	50	20	5
1st Year RCN	15	32	32	68	47	11
2nd Year PNNM	0	0	17	100	17	4
1st Year PNNM	0	0	20	100	20	5
TOTAL	109		311		420	100

Note. RCN: Registered Community Nursing; RNAP: Registered Nurse Assistant (Preventive); PNNM: Post-NAP/NAC Midwifery

Source: Fieldwork data (2021).

Table 3.2: Proportion of students per class included in the sample

Class	Male	Female	Total
	N	N	N
2nd Year RNAP	17	52	69
1st Year RNAP	23	69	92
3rd Year RCN	6	6	12
2nd Year RCN	6	6	12
1st Year RCN	8	18	26
2nd Year PNNM	0	10	10
1st Year PNNM	0	10	10
TOTAL	60	171	231

Note. RCN: Registered Community Nursing; RNAP: Registered Nurse Assistant (Preventive); PNNM: Post-NAP/NAC Midwifery

Source: Fieldwork data (2021).

3.5: Data Collection and Measurements

Quantitative data were gathered using semi-structured questionnaires for 1 month and 2 weeks (13th March, 2021 to 30th April, 2021). Anthropometry, dietary, and biochemical measurements were done.

3.5.1: Anthropometric measurements

Standard procedures of the World Health Organization (2000) were followed to measure the weight, height, waist, and hip circumferences of students. Height was measured to the nearest 0.1 cm using a microtoise (Bodymetre 208; Seca GmbH), and weight was assessed using an electronic scale (Uniscale; Seca GmbH) to the nearest 0.1 kg. The scale was standardised with a known mass (10 kg) daily on each measurement. The waist and hip circumference was measured to the closest 0.1 cm utilizing a tape measure. An average of two measurements was taken for all measurements. The date of measurement and birth dates were to determine the ages of the students. All physical measurements were done in a secluded area to ensure all participants had adequate privacy. The following procedures were used.

Height measurement using microtoise

Procedures

1. A microtoise was fixed on a levelled wall 2 metres above level ground
2. Every participant was requested to remove his/her:
    - Footwear (shoes, slippers, sandals etc)
    - Headgear (hat, cap, hair bows, comb, ribbons, etc).
3. Each participant was requested to stand against the wall facing the measurer with:
    - Feet together
    - Heels against the wall

- Knees straight

4. The participants were made to stand upright
5. The measurer made sure participants' eyes were at the same level as their ears
6. The measuring arm (microtoise) was then gently moved down onto the head of the participant as they breathed in and stood upright
7. The height was read in centimetres at the precise point
8. The participant was asked to move away from the measuring wall
9. The height measurement in centimetres was then documented on the participant's questionnaire

Weight measurement using a Uniscale

Set up requirements

The scale was positioned on a firm, level surface and turned on to show 0.0.

Procedures

1. The participants were requested to take off their footgear (shoes, slippers, sandals etc) and socks
2. Each member was then requested to step onto the scale ensuring each foot is placed on each side of the scale
3. Each participant under measurement was requested to:
   - stand still
   - face forward
   - place arms on the side and
   - wait until asked to step off
4. The weight was finally documented in kilograms on the participant's Tool

Waist circumference measurement

Procedure

1. Standing to the side of the participant, the inferior margin (lowest point) of the last rib and the crest of the ilium (top of the hip bone) were detected and marked with a fine pen
2. The centre was located and marked using a tape measure
3. A tension tape was applied over the marked midpoint and the participants were asked to wrap it around themselves

   Note: it was ensured that the tape was horizontal across the back and front of the participant
4. The participants were asked to:
   - stand with their feet together
   - place their arms at their side with the palms of their hands facing inwards, and
   - breathe out gently
5. The measurement of the waist circumference was read at a point closest to 0.1 cm and recorded on the participant's Instrument

Hip circumference measurement

Procedure

1. Standing to the side of the participant, they were asked to assist in placing the tape around underneath their hips
2. The measurement tape was positioned around the greatest circumference of the buttocks as the participant:
   - stood with their feet together
   - placed their arms at their side with the palms of their hands facing inwards, and breathed out softly

3. It was ensured that the tape position was level all across the body
4. The waist circumference was measured with reading taken at the level of the tape to the closest 0.1 cm
5. The reading was then recorded on the instrument of the participant

3.5.2: Measurement of haemoglobin concentration

A HemoCue1 Hb 201+ was used to collect venous blood of about 1 ml to determine the haemoglobin concentration of the students. HemoCue1 Hb 201+ is a photometric device with micro cuvettes particularly designed to estimate total blood haemoglobin concentration (Parker et al., 2018). The blood sample was drawn from the fingertip of each participant into a pre-treated cuvette. The haemoglobin concentration value was displayed within 30 seconds on the device's screen.

Procedure

1. The instrument was turned on with the cuvette holder in its loading position. The display showed three flashing dashes and the HemoCue symbol.
2. Made sure the participant's hand was warm and relaxed. The middle or ring finger was used for sampling and fingers with rings on were avoided.
3. The respective finger was cleaned with disinfectant and allowed to dry.
4. Using the thumb, the finger from the top of the knuckle was lightly pressed towards the tip.
5. Whilst pressing lightly towards the fingertip, a lancet was used to prick the finger.
6. The first two or three drops of blood were wiped away. Afterwards, light pressure was re-applied towards the fingertip until another drop of blood appeared.

7. When the drop was large enough, the micro cuvette was filled in one continuous process, filling from the tip of the micro cuvette.
8. Excess blood was wiped off from the outside of the Cuvette. It was made sure that no blood was drawn out of the Cuvette during this procedure.
9. The filled microcuvette was placed in the cuvette holder.
10. The measurement began by pushing the Cuvette holder to its measuring position.
11. After 15-60 seconds the haemoglobin value of the sample was displayed.
12. Once the test was completed, the used microcuvette was discarded in the hazard bin.

3.5.3: Weighed food record

The school provides three main meals to students, that is breakfast, lunch, and supper. Hence, each meal was weighed to determine the amount of food and nutrient it provides. The three (3) main meals were weighed daily for a total of one (1) week, Sunday to Saturday. At each mealtime, five (5) served foods were randomly weighed using a digital electronic scale (MC-1001) and the average was recorded precisely to 1g. In carrying out the weighing, all major constituents making up the meal were separately weighed and recorded along with a description of brand names and details of food preparation. The following procedure was used in weighing:

i. First, the scale was standardized with a known weight of 1kg
ii. An empty plate/bowl was weighed and the scale tarred to zero (0)
iii. The meal component to be weighed was added to the empty plate/bowl on the scale
iv. The weight of the food/various component was read and documented to the nearest 1g

3.5.4: Dietary diversity assessment

The weekly menu for meals from the college was evaluated and a list of food items used for its preparation in a typical week was recorded using a semi-structured Food Frequency Questionnaire (FFQ). The food items were categorised into 10 groups according to the FAO minimum dietary diversity indicator (FAO & FHI 360, 2010). The 10 food groups consisted of grains, tubers and plantain (staple foods); beans, peas and lentils (pulses); nuts and seeds; dairy; meat, poultry and fish; eggs; dark green leafy vegetables; other vitamin A-rich foods; other vegetables; and other fruits. Each food item had eight (8) frequency of intake groupings ranging from none (0) per week to seven (7) times per week.

3.6: Data Analysis

3.6.1: Anthropometry

Data of the students on weight and height were converted into Body Mass Index (BMI) in kg/m^2. The Body Mass Index was computed as weight in kilograms divided by height in metres squared. The nutritional status and risk of metabolic complications were defined as shown in Table 3.3.

Table 3.3: Recommended cut-off points for BMI, waist circumference and waist-hip ratio

Indicator	
Body Mass Index (BMI)	**Nutritional status**
< 18.5	Underweight
≥ 18.5 to < 25.0	Normal nutritional status
≥ 25.0 to < 30.0	Overweight
≥ 30.0	Obesity
Waist circumference	**Risk of metabolic complications**

>94 cm (Males); >80 cm (Females)	Increased
>102 cm (Males); >88 cm (Females)	Substantially increased
Waist-hip ratio	
≥0.90 cm (Males); ≥0.85 cm (Females)	Substantially increased

Source: WHO (2008).

3.6.2: Biochemical analysis

The Hb concentration of the students was determined using HemoCue1 Hb 201+ wick method. Anaemia was well-defined as haemoglobin (Hb) levels <120 g/L for female students and <130 g/L for male students (World Health Organisation (WHO), 2011).

3.6.3: Food composition and nutrient intake calculation

The nutrient database package, devised by the University of Ghana's Department of Nutrition and Food Science, known as RIING (Research to Improve Infant Nutrition and Growth) was used to enter data on the weight of each serving (in grams). It contains foods in Ghana that are locally available and frequently consumed, and as well generates nutrient values of energy, protein, carbohydrate, sugar, fat, cholesterol, fibre, Vitamin A, the B-Vitamins, vitamins C, D, E, calcium, copper, iron, magnesium, manganese, phosphorus, potassium, sodium, zinc, and water. Ingredients used in preparing each meal were matched to the nearest food code in the database. The average weights of each portion size were entered into the RIING software and a code that best described the meal chosen in the database. Energy and nutrient values of each portion size were automatically generated onto an Excel sheet and, exported into SPSS (version 23.0) for analysis. The West African Food Composition Table (WAFCT), Ghana Food Composition Table, and the United

States Department of Agriculture National Nutrient Database for Standard Reference were adopted for respective nutrient values in case of missing foods (Abizari et al., 2014).

3.6.4: Energy and nutrient intake adequacy calculation

Assuming a moderate physical activity level, energy and nutrient requirements were estimated using the age and sex-specific recommended dietary allowances (FAO, 2005; Sugawara & Nikaido, 2014; WHO/FAO/UNU, 2007). The extent to which dietary requirements for each nutrient are met was then assessed by way of calculating the nutrient adequacy ratio for nutrients of interest using the following equations (INDDEX Project, 2018).

Nutrient Adequacy Ratio (NAR) $= \frac{Actual\ nutrient\ intake}{Recommneded\ nutrient\ intake} \times 100$; and

Mean Adequacy Ratio (MAR) $= \frac{\Sigma(Nutrient\ Adequacy\ Ratios)}{Total\ number\ of\ nutrients}$

A nutrient adequacy ratio of less than 66% was considered inadequate, that from 66% – 99.9% was considered fairly adequate, whilst adequate intake was for nutrients with adequacy ratios greater than or equal to 100% (INDDEX Project, 2018). Similarly, the Mean Adequacy Ratio was reported on a scale from 0 to 1, where 1 signifies the needs for all the nutrients were met.

To assess dietary diversity and adequacy, every food item registered in the FFQ was assigned a score of 1 and 0 corresponding to a dichotomous response of 'consumed' and 'not consumed'. A maximum score of 7 was assigned to a food group if a food item from one of the 10 food groups was eaten each day of the week. Therefore, the maximum score that the school was to obtain for the whole week is 70 for the 10 food groups. According to FAO & FHI 360 (2010), consumption of at least five out of the 10 food groups implies dietary diversity and suggests acceptable micronutrient dietary quality. Hence, the school's diet is considered diversified if at minimum half (35) of the overall dietary diversity score was achieved during the week.

3.6.5: Statistical analysis

Data collected first went through cleaning on daily basis during the data collection period by the researcher to check for missing data. In case of missing data, the respective respondent was revisited. Data entry and analysis were done using SPSS version 23.0 (SPSS, Inc.). Continuous data distribution was checked by visual examination of normal-curved fitted histograms. The test of normality was done using the Kolmogorov-Smirnov test. Descriptive statistics were computed for the background characteristics of students. One sample t-test was used to test the differences in the nutrient content of foods served and actual requirements. The mean Adequacy Ratio was determined for some nutrients of interest using their nutrient adequacy ratios. A chi-square test of independence was performed to examine the relation between the background characteristics and nutritional status. An outcome with a $p < 0.05$ was considered statistically significant for all analyses.

3.7: Quality Control

Quality control procedures ensured the gathering and documentation of precise, consistent data. The field interviewers/anthropometrists were graduates of Community Nursing who were thoroughly trained in questionnaire administration, anthropometric assessments, and dietary assessment before data collection. The performance of field staff during data collection was constantly supervised by the Principal researcher who provided checks on the questionnaire at the site, to ensure unfinished questionnaire, and measurement inaccuracies were rectified the same day.

In anthropometrics, the most common mistakes involve body positioning, finding and marking body landmarks, reading measurement results, and recording examination results.

3.7.1: Equipment Calibrations

Regular standardisations of the anthropometry equipment ensured that the equipment produces precise measures. The following pieces of equipment were calibrated at specific points: digital weight scale, and microtoise.

3.7.2: Digital Weight Scale

Complete standardisation of the digital weight scale was done at the start, middle, and end of a session. In addition, a rough standardisation was done every day before the first exam session.

1. Carefully place 5 of the 10-kilogram calibration weights on the scale. To guarantee correct measurement reading, the weights were positioned uniformly over the centre part of the scale.
2. The tolerable standardisation weight range for 5, 10-kilogram calibration weights on the digital weight scale was 49.70 – 50.30 kg (WHO, 2000).

3.7.3: Microtoise

The microtoise was hung on a wall exactly 2 m above the ground with a nail

3.7.4: Physical measurements

Instructions and explanations were given to participants before physical measurements. Privacy was provided with screens, especially, for waist and hip circumference measurements. Measurements of waist circumference were done over light clothing. The measurement was taken:

1. at the end of a normal expiration
2. with the arms relaxed at the sides
3. under the midline of the participant's armpit, at the midpoint between the lower part of the last rib and the top of the hip

Hip circumference measurement was taken over light clothing, and immediately after waist circumference measurement. It was taken:

1. with the arms relaxed at the sides
2. at the minimum circumference over the buttocks

3.7.5: HemoCue1 Hb 201+ wick method

The following were observed as precautionary measures.

1. Before inserting the cuvette, excess blood was wiped off on the outside of the micro cuvette tip using a tissue.
2. At the end of each day's use, the cuvette holder was removed and cleaned with alcohol or a mild soap solution.
3. Once the test was completed, the lancet and the used microcuvette were discarded in the Sharps container.
4. All disposable plastic and paper (gloves, cotton etc.) that were in contact with blood or blood products were placed in a biohazard autoclave bag and kept in appropriate containers.
5. Also, all contaminated work surfaces were wiped with a 10% bleach solution when work was finished.
6. Protective gloves and a laboratory coat were worn during all steps of this method.

3.8: Ethical consideration

Ethical approval was gotten from the Committee on Human Research, Publications and Ethics (CHRPE) of the Kwame Nkrumah University of Science and Technology, Kumasi (Reference: CHRPE/AP/113/21). Permission was also gotten from the management of the Nursing and

Midwifery Training College, Bole. Written consent was attained from each respondent (staff/students) before carrying out any assessment or interview. Each person selected to take part in the study was explained the informed consent and entreated to sign it before taking part. Names of participants were not written on the study document, hence, confidentiality regarding the information collected was ensured. Partaking in the study was voluntary and there were no monetary motivations attached.

CHAPTER FOUR
RESULTS

4.0: Introduction

This part presents and discusses the preliminary data which consists of background information of participants. This information includes the age, sex, religion, and source of funding of participants among others. The primary reason for collecting data under this section was to get background information on the students who partook in the study and how these background characteristics shaped their responses to the items on the instrument. A total of 223 participants (student nurses) completed the questionnaire, and all 223 responses were analysed.

4.1: Socio-Demographic Characteristics of Respondents

4.1.1: Background characteristics of Respondents

The mean age of the respondents was 24.24±3.2 years, whilst the minimum and maximum ages were 19 and 36 years respectively. The findings revealed that about 58% of the respondents were within the 20-24 years age group, and the majority (75.3%) were females. Similarly, most (77%) of the students pursued a Nurse Assistant Preventive program and 59.6% were in their first year of study. Aside from the point that the majority (85.7%) of the students were single, a greater proportion (70.9%) of the students were being catered for by their parents. The Catholic denomination was practised by most (35.4%) of the students, and the Akan ethnic group, the highest among the other ethnic groups, constituted 25.1% of the study population. The details are shown in Table 4.1.

Table 4.1: Socio-demographic Characteristics of Study Participants n=223

Background Characteristics	Frequency	Per cent (%)
Age (years)		
< 19	5	2.2
20-24	129	57.8
25-29	72	32.3
30-34	14	6.3
>34	3	1.3
Sex		
Male	55	24.7
Female	168	75.3
Program of study		
Registered Nurse Assistant Preventive (RNAP)	172	77.1
Registered Community Nursing (RCN)	33	14.8
Post-NAP/NAC Midwifery (PNNM)	18	8.1
Academic level		
1st Year	133	59.6
2nd Year	83	37.2
3rd Year	7	3.1
Marital Status		
Single	191	85.7
Engaged	4	1.8
Married	28	12.6
Main Source of Income		
Parents	158	70.9
Spouse	13	5.8
Self	29	13.0
Partner	1	0.4
Other family members	22	9.9
Religion		
Catholic	79	35.4
Anglican/Methodist/Presbyterian	17	7.6
Pentecostal/Charismatic	38	17.0
Other Christian	30	13.5
Muslim	58	26.0
No religion	1	0.4
Ethnicity		
Akan	56	25.1
Dagomba	9	4.0
Gonja / Safalba	30	13.5
Dagaaba	54	24.2
Waala	6	2.7
Frafra / Kasen	11	4.9
Ewe	9	4.0
Konkomba	10	4.5
Brifor	6	2.7
Others	32	14.3

Source: Fieldwork data (2021).

4.1.2: Background Characteristics of Respondents' Parents

Table 4.2 shows the distribution of students' fathers' occupations and levels of education. It revealed that the majority (45.7%) of parents engaged in agriculture activities, and most (33.2%) of them had no education.

Table 4.2: Respondents Fathers' Background Characteristics *n=223*

Characteristics	Frequency	Per cent
Fathers' occupation		
Professional/Technical or Managerial	38	17.0
Agriculture	102	45.7
Sales and services	17	7.6
Clerical positions	1	0.4
Skilled manual labour	15	6.7
Unskilled manual labour	6	2.7
Others	44	19.7
Fathers' Highest Education Level		
No education	74	33.2
Primary education	16	7.2
Middle/JSS/JHS	55	24.7
Secondary education	29	13.0
Tertiary education	49	22.0

Source: Fieldwork data (2021).

4.2: Nutritional Status Assessment

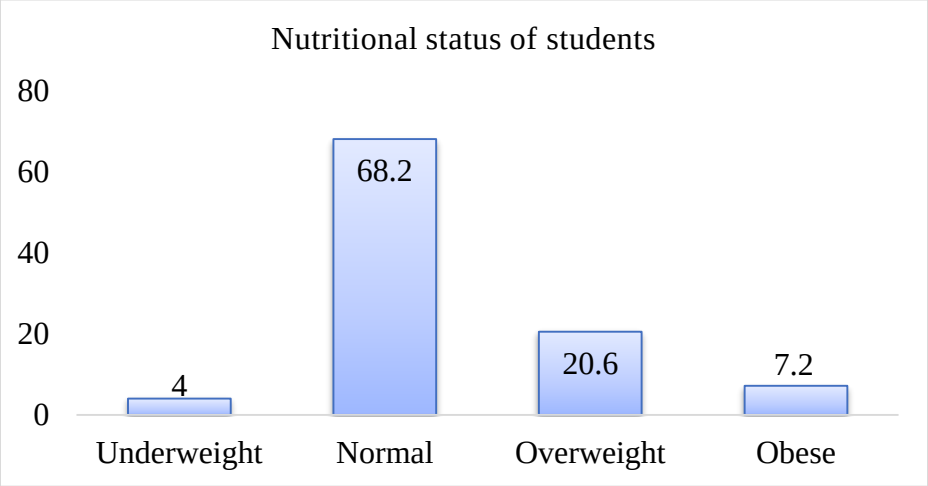
The nutritional status of students was measured using Body Mass Index (BMI), waist-to-hip ratio (WHR), and haemoglobin level.

4.2.1: Body Mass Index

The mean weight, height, and BMI of students were 62.49±11.1 kg, 1.6±0.1 m, and 23.45±4.1 kg/m^2 respectively. Out of the 223 students studied, 152 (68.2%) had their BMIs within the ideal body weight range whereas 4 per cent, and 27.8% were underweight and overweight respectively as displayed in Figure 4.1. There was a significant difference in BMI between male students (M = 21.34, SD = 1.93) and female students (M = 24.15, SD = 4.39), t (203) = 6.59, p < .001. Females were more liable to be overweight, and obese than males (27.4% versus 0.0%, and 9.5% versus 0.0%), whereas males (7.3%) stood a higher chance of being underweight compared to females (3.0%), χ^2 (3, N=223) = 28.66, p < .001, Table 4.3. Furthermore, as shown in Table 4.3, 5.2 per cent of students studying Registered Nurse Assistant Preventive (RNAP) were underweight and the majority had normal body weight as recommended. Among the students offering Registered Community Nursing (RCN), about 82% had ideal body weight whilst half (50%) and 33.3% of students pursuing Post-NAP/NAC Midwifery (PNNM) were overweight and obese respectively. The difference in BMI was significant among the programs of study. Students studying Post-NAP/NAC Midwifery (PNNM) were more prone to be overweight and obese whilst the risk of being underweight was significant among students in the Registered Nurse Assistant Preventive (RNAP) program, χ^2(6, N=223) = 37.98, p < .001. More so, underweight and overweight prevalence among first-year students stood at 4.5 per cent and 18.6% respectively, with about 74% having a normal body weight and 7.5 per cent being obese. Similarly, the majority (56.6%) of second-year students had the recommended ideal body weight whilst 3.6 per cent, 32.5%, and 7.2 per cent were underweight, overweight and obese respectively. Nonetheless, the malnutrition prevalence among third-year students was zero per cent as 100% were having normal body weight. There was a significant relationship between BMI and students' years of study, χ^2(6, N=223)=

13.91, p = .031. The risks of being underweight and obesity were high among first-year students and lower among third-year students.

Figure 4.1: Nutritional Status of Respondents *n=223*



Source: Fieldwork data (2021).

Table 4.3: Nutritional status by Program of Study, Academic Level and Gender *n=223*

		Nutritional status of students								Test statistics
		Underweight		Normal		Overweight		Obese		
		N	%	N	%	N	%	N	%	
Program of study	RNAP	9	5.2	122	70.9	32	18.6	9	5.2	χ^2= 37.978,
	RCN	0	0	27	81.8	5	15.2	1	3	$p <$ .001
	PNNM	0	0	3	16.7	9	50	6	33.3	
Academic level	1st Year	6	4.5	98	73.7	19	14.3	10	7.5	χ^2= 13.912,
	2nd Year	3	3.6	47	56.6	27	32.5	6	7.2	p = .031
	3rd Year	0	0	7	100	0	0	0	0	
Gender	Male	4	7.3	51	92.7	0	0.0	0	0.0	χ^2= 28.657,
	Female	5	3.0	101	60.1	46	27.4	16	9.5	$p <$ .001

Note. RCN: Registered Community Nursing; RNAP: Registered Nurse Assistant (Preventive); PNNM: Post-NAP/NAC Midwifery

Source: Fieldwork data (2021).

4.2.2: Waist-to-hip Ratio

From the study, the minimum and maximum waist circumference among the students was 12 cm and 108 cm respectively, with a mean of 74.9±13.9 cm. It was found that the mean WHR was 0.8±0.9 with 0.3 and 1.1 as the minimum and maximum ratios. Table 4.4 shows that the majority (81.6%) of students had a normal waist-to-hip ratio with 92.7% being males and about 78% being females. However, 22% of the females compared to 7.3 per cent of the males had a higher waist-to-hip ratio. The association between waist-to-hip ratio and sex was significant with females more likely to have an excessive waist-to-hip ratio than males, χ^2 (1, N = 222) = 6.09, p = .014.

Also, 25.3% of second-year students had a high waist-to-hip ratio whilst 15.2% of first-year students had a high waist-to-hip ratio. This difference in waist-to-hip ratio among students in various levels of study was statistically not significant, χ^2(2, N = 222)= 5.12, p = .077. The majority (61.1%) of students in Post NAP/NAC midwifery (PNNM) had a high waist-to-hip ratio compared to 14.6% and 15.2% of students in Registered Nurse Assistant Preventive (RNAP) and Registered Community Nursing (RCN) programmes respectively. A chi-square test of independence revealed a significant relationship between the program of study and waist-to-hip ratio, χ^2 (2, N = 222)= 23.66, p < .001. Post NAP/NAC midwifery students had a greater chance of having a high waist-to-hip ratio than Registered Community Nursing (RCN) students and Registered Nurse Assistant Preventive (RNAP) students (Table 4.4).

Table 4.4: Waist-to-hip ratio by Program of Study, Academic Level and Gender n=222

		Waist-to-hip ratio				Test statistics
		Normal		High		
		N	%	N	%	
Program of study	RNAP	146	85.4	25	14.6	χ^2= 23.660,
	RCN	28	84.8	5	15.2	p < .001
	PNNM	7	38.9	11	61.1	
Academic level	1st Year	112	84.8	20	15.2	χ^2= 5.124,
	2nd Year	62	74.7	21	25.3	p = .077
	3rd Year	7	100.0	0	0.0	
Gender	Male	51	92.7	4	7.3	χ^2= 6.086,
	Female	130	77.8	37	22.2	p = .014

Note. RCN: Registered Community Nursing; RNAP: Registered Nurse Assistant (Preventive); PNNM: Post-NAP/NAC Midwifery

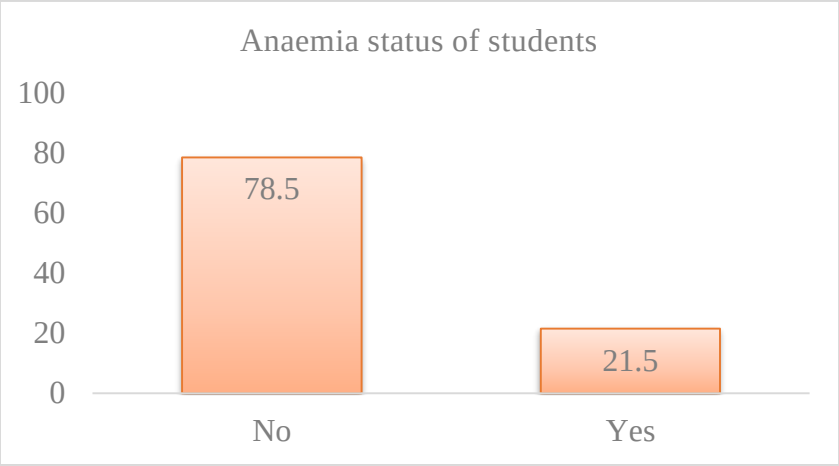
Source: Fieldwork data (2021).

4.2.3: Students' Anaemia Status

The mean haemoglobin level among students in the study was 13.5±2.1 g/dL with a least haemoglobin level of 6.6 g/dL and a maximum of 18.3 g/dL. Out of the 223 students studied, 21.5% of them were anaemic as indicated in Figure 4.2. There was a significant difference in haemoglobin level between male and female students, t (221) = 5.33, p < .001); the average haemoglobin level of male students (M = 14.66, SD = 1.62) was significantly higher than that of female students (M = 13.06, SD = 2.02). Also, there was a significant association between the sex of students and anaemia , χ^2 (1, N = 223) = 8.78, p = .003, (Table 4.5). Furthermore, the prevalence of anaemia among 1st-year students was 17.3% whilst 30.1% was recorded among 2nd-year students. A chi-square test of independence was performed to evaluate the relationship between

academic level and anaemia status. The relation between these two variables was significant, χ^2 (2, N = 223) = 6.96, p = .031, (Table 4.5). Similarly, a significant association was identified between anaemia and the program of study, $\chi^2(2, N = 223) = 15.05$, p = .001. Students in the Registered Nurse Assistant Preventive (RNAP) program were at a higher risk of becoming anaemic (27.3%) compared to 3.0 per cent of students in the Registered Community Nursing (RCN) program and none (0.0%) in the Post NAP/NAC Midwifery (PNNM) program.

Figure 4.2: Prevalence of Anaemia *n=223*



Source: Fieldwork data (2021).

Table 4.5: Anaemia Status by Program of Study, Academic Level and Gender n=223

		Anaemia Status				Test statistics
		Normal		Anaemic		
		N	%	N	%	
Program of study	RNAP	125	72.7	47	27.3	χ^2= 15.046,
	RCN	32	97.0	1	3.0	p = .001
	PNNM	18	100.0	0	0.0	
Academic level	1st Year	110	82.7	23	17.3	χ^2= 6.960,
	2nd Year	58	69.9	25	30.1	p = .031
	3rd Year	7	100.0	0	0.0	
Gender	Male	51	92.7	4	7.3	χ^2= 8.779,
	Female	124	73.8	44	26.2	p = .003

Note. RCN: Registered Community Nursing; RNAP: Registered Nurse Assistant (Preventive); PNNM: Post-NAP/NAC Midwifery

Source: Fieldwork data (2021).

4.3: Nutrient Content of Meals

4.3.1: Macronutrient Contents of Meals

Tables (4.6-4.10) provide the nutrient values of foods served in the school on daily basis. Over the 7 days, (Table 4.6) the meals provided 1951.77±331.1 Cal of energy (mean), a mean protein of 51.06±31.1 g, with 59.20±28.5 g, 310.46±17.1 g, 25.62±7.26 g and 46.41±81.4 mg, being mean values of fat, carbohydrate, fibre, and cholesterol respectively. Wednesday meals provided the highest daily amount of calories (2544.09 Cal), fat (97.73 g), carbohydrate (352.06 g), Mono Saturated Fatty Acid (34.45 g), Saturated Fatty Acids (43.89 g) and cholesterol (228.96 mg) whilst Sunday meals provided the greater portion of protein (72.80 g), and fibre (38.59 g). More so, the largest amount of Poly Unsaturated Fatty Acids (19.90 g) was contained in meals served on

Thursday. Tuesday was the day students obtained the least amount of calories (1535.42 Cal), fat (18.25 g), Saturated Fatty Acids (6.22 g), Mono Saturated Fatty Acid (5.72 g), and Poly Unsaturated Fatty Acids (4.58 g). Also, the least amount of protein (26.90), carbohydrate (262.25), and fibre (18.94) were provided by Saturday meals. Similarly, Saturday (0.00 mg) and Tuesday (0.00 mg) meals provided the least amount of students' daily cholesterol requirements, whereas Friday (8.49 g) meals provided the least amount of sugars for the students and Wednesday (46.05 g) served the highest sugars.

Table 4.6: Daily macronutrient values of food served

Day	**Calories**	**Protein (g)**	**Fat (g)**	**Carbohydrate (g)**	**Fibre (g)**	**Sugars (g)**	**SFA (g)**	**MSFA (g)**	**PUFA (g)**	**Cholesterol (mg)**
Sunday	2115.65	72.80	85.06	281.99	38.59	31.93	29.18	34.12	16.59	16.40
Monday	1902.55	50.76	49.81	319.93	25.25	12.03	11.64	20.80	13.80	27.45
Tuesday	1535.42	34.61	18.25	310.36	20.36	9.62	6.22	5.72	4.58	0.00
Wednesday	2544.09	71.25	97.73	352.06	32.44	46.05	43.89	34.45	12.80	228.96
Thursday	2058.30	53.46	72.83	306.99	22.68	12.41	20.82	27.53	19.90	24.60
Friday	1837.38	47.62	31.79	339.66	21.09	8.49	11.73	11.16	6.40	27.45
Saturday	1669.04	26.90	58.95	262.25	18.94	12.01	26.18	20.71	8.41	0.00
Total	13662.42	357.39	414.41	2173.25	179.36	132.53	149.64	154.49	82.48	324.86
Mean	1951.77 ±331.12	51.06 ± 17.09	59.20 ±28.45	310.46±31.14	25.62 ±7.26	18.93 ± 14.37	21.38 ±12.97	22.07 ± 10.94	11.78 ± 5.57	46.41 ± 81.37

Source: Fieldwork data (2021).

4.3.2: Mineral Contents of Meals

The mineral contents of meals in the school for one week according to the study findings varied (Table 4.7). The mean value for calcium of 284.25±104.55 mg was contributed by the school's meals towards the needs of the students. Mean values of 12.96±5.4 mg, 408.48±110.7 mg, 1103.53±234.4 mg, and 2254.72±895.6 mg were provided by the meals for iron, magnesium, phosphorus, and potassium respectively. Also, 3686.83±935.7 mg of sodium, 8.78±2.4 mg of zinc, and 67.66±22.0 mg of selenium were gotten from the meals served in the school. The largest (492.46 mg) amount of calcium was provided by meals served on Wednesday whilst the least (154.69 mg) amount was contained in Thursday meals. Similarly, Wednesday meals contained the greater (21.91 mg) quantity of iron whilst Saturday meals provided the least (9.18 mg). The larger daily magnesium (593.04 mg) and phosphorus (1399.41 mg) were provided by Sunday meals whiles Saturday meals contributed the least amounts (282.73 mg and 745.55 mg respectively). A greater quantity of Potassium (3776.93 mg), and zinc (11.69 mg), were gotten from meals served on Sunday where as that of sodium (4956.03), and selenium (94.60 mg) were provided by Monday and Wednesday meals respectively. The least amount of zinc (5.50 mg), and selenium (41.95 mg) were provided by Saturday meals whilst Friday and Tuesday meals served the least amounts of potassium (1619.43 mg), and sodium (2220.76 mg) respectively.

Table 4.7: Daily Minerals Values of Foods Serve

Day	**Calcium (mg)**	**Iron (mg)**	**Magnesium (mg)**	**Phosphorus (mg)**	**Potassium (mg)**	**Sodium (mg)**	**Zinc (mg)**	**Selenium (mg)**
Sunday	319.45	19.71	593.04	1399.41	3776.93	3218.25	11.69	42.70
Monday	240.40	9.30	391.48	1188.14	1748.06	4956.03	8.51	90.29
Tuesday	263.72	9.82	321.72	861.17	1748.87	2220.76	6.70	52.70
Wednesday	492.46	21.91	483.55	1316.39	3320.48	4442.39	10.12	94.60
Thursday	154.69	10.11	463.08	1144.57	1806.63	3835.37	11.36	72.21
Friday	277.44	10.68	323.80	1069.38	1619.43	4138.22	7.60	79.17
Saturday	241.57	9.18	282.73	745.55	1762.65	2996.76	5.50	41.95
Total	1989.72	90.70	2859.39	7724.61	15783.04	25807.78	61.47	473.62
Mean	284.25± 104.55	12.96± 5.42	408.48 ± 110.66	1103.52± 234.43	2254.72± 895.55	3686.83± 935.65	8.78± 2.36	67.66± 21.98

Source: Fieldwork data (2021).

4.3.3: Vitamin Content of Meals

An amount of 95.42±57.5 mg of ascorbic acid was provided by the school meals whilst mean amounts of 1.22±0.6 mg, 0.62±0.3 mg, 13.38±4.0 mg, and 484.12±465 µg of thiamine, riboflavin, niacin, and folate respectively were obtained from the meals. More so, 1.66±0.3 mg of vitamin B_6 was found in the meals whereas values of 1.45±1.8 µg for vitamin B_{12}, 151.16±100.4 µg RAE for vitamin A, 9.17±4.5 mg for vitamin E, and 20.43±14.9 µg for vitamin K were gotten from the meals served. The largest amount of ascorbic acid (166.79 mg), thiamine (2.20 mg), and riboflavin (1.30 mg) were obtained from meals served on Wednesday with the least amounts of these vitamins provided by Friday (26.76 mg), Saturday (0.76 mg), and Thursday (0.42 mg) meals respectively. Similarly, Sunday meals recorded the highest (18.45 mg) amount of niacin whilst Saturday provided the least (8.37 mg). Also, a larger portion of vitamin B_6 (2.03 mg) and folate (1205.11 µg) were gotten from Sunday meals whereas Tuesday (1.35 mg) and Monday (156.06 µg) meals provided the least amounts respectively. Monday (4.05 µg) and Friday (4.05 µg) meals provided the largest quantity of vitamin B_{12} for students whiles Tuesday (0.00 µg) and Saturday (0.00 µg) served the least amounts. The greatest quantity of vitamin A was gotten from Thursday (339.66 µg_RAE) meals whiles Friday meals provided the least amount (53.58 µg_RAE). Vitamin E (16.30 mg) and vitamin K (47.41 µg) were gotten more from Wednesday meals than any other day of the week, and the least amounts were recorded on Tuesday (3.43 mg) and Monday (7.63 µg) respectively (Table 4.8).

Table 4.8: Daily Vitamin Content of Foods Served

Day	**Ascorbic acid (mg)**	**Thiamine (mg)**	**Riboflavin (mg)**	**Niacin (mg)**	**Vitamin B_6 (mg)**	**Folate (µg)**	**Vitamin B_{12} (µg)**	**Vitamin A (µg_RAE)**	**Vitamin E (mg)**	**Vitamin K (µg)**
Sunday	136.52	2.07	0.79	18.45	2.03	1205.11	0.58	114.70	13.44	33.94
Monday	39.72	0.81	0.45	15.55	1.74	156.06	4.05	58.48	7.13	7.63
Tuesday	79.01	0.92	0.46	8.60	1.35	286.67	0.00	118.64	3.43	10.49
Wednesday	166.79	2.20	1.30	16.17	1.93	1108.89	0.60	217.23	16.30	47.41
Thursday	61.74	0.79	0.42	15.67	1.72	161.71	0.87	339.66	8.49	10.49
Friday	26.76	0.98	0.52	10.83	1.37	313.96	4.05	53.58	5.37	12.82
Saturday	157.41	0.76	0.44	8.37	1.52	156.40	0.00	155.83	10.06	20.26
Total	667.95	8.54	4.37	93.63	11.65	3388.81	10.15	1058.14	64.21	143.03
Mean	95.42 ± 57.51	1.22 ± 0.63	0.62 ± 0.32	13.38 ± 4.04	1.66 ± 0.26	484.12± 464.95	1.45 ± 1.80	151.16 ± 100.35	9.17 ± 4.51	20.43 ± 14.89

Source: Fieldwork data (2021).

4.3.4: Amino Acid Contents of Meals

Table 4.9 shows the daily amount of essential amino acids provided by the school meals. On average, the amount of Isoleucine provided by the school meals was 1.88±0.6 g with Sunday meals contributing the greatest amount (2.63 g) and Saturday meals providing the minimal quantity of 1.00 g. Similarly, average amounts of 0.51±0.2 g of tryptophan, 1.73±0.5 g of threonine, 4.17±1.0 g of leucine, 2.22±1.1 g of lysine, and 2.53±0.9 g of phenylalanine were provided by the meals consumed in the school. Histidine, Valine, and Methionine values in the school meals were 1.34±0.5 g, 2.39±0.7 g, and 0.91±0.2 g respectively. Sunday meals provided the largest quantities of isoleucine (2.63 g), tryptophan (0.77 g), threonine (2.44 g), leucine (5.60 g), lysine (3.83 g), phenylalanine (3.80 g), histidine (2.02 g), and valine (3.16 g) whilst Saturday meals served the least amounts (1.00 g, 0.26 g, 0.94 g, 2.53 g, 0.86 g, 1.28 g, 0.66 g, and 1.35 g respectively). The highest (1.10 g) amount of methionine was obtained from Wednesday meals whilst the smallest (0.52 g) quantity gotten from meals served on Saturday.

Table 4.9: Daily Amino Acid Values of Foods Serve

Day	Isoleucine (g)	Tryptophan (g)	Threonine (g)	Leucine (g)	Lysine (g)	Phenylalanine (g)	Histidine (g)	Valine (g)	Methionine (g)
Sunday	2.63	0.77	2.44	5.60	3.83	3.80	2.02	3.16	1.06
Monday	1.77	0.45	1.67	4.34	1.90	2.40	1.36	2.34	0.96
Tuesday	1.36	0.36	1.23	3.21	1.33	1.77	0.90	1.81	0.68
Wednesday	2.56	0.76	2.36	4.90	3.47	3.41	1.72	3.11	1.10
Thursday	1.97	0.48	1.76	4.48	2.04	2.69	1.40	2.53	1.06
Friday	1.86	0.47	1.73	4.13	2.12	2.36	1.31	2.45	0.98
Saturday	1.00	0.26	0.94	2.53	0.86	1.28	0.66	1.35	0.52
Total	13.14	3.55	12.13	29.20	15.55	17.72	9.37	16.75	6.34
Mean	1.88 ± 0.59	0.51±0.19	1.73 ± 0.54	4.17 ± 1.03	2.22 ± 1.07	2.53 ± 0.87	1.34 ± 0.46	2.39 ± 0.65	0.91 ± 0.22

Source: Fieldwork data (2021).

4.4: Comparison of Mean Nutrient Intakes with RDAs

Table 4.10 contains the mean daily consumption of various nutrients in seven days matched with the Recommended Dietary Allowance (RDA). The mean energy in the form of calories provided by the school meals was 1951.77 ± 331.12 and those of protein, fat, carbohydrate, and fibre were 51.06 ± 17.09, 59.20 ± 28.45, 310.46 ± 31.14, and 25.62 ± 7.26 respectively. The percentages of two of the macronutrients, protein and carbohydrates provided in the school's meals exceeded 100% of the daily requirements (RDA). The amount of cholesterol (*M* = 46.41, *SD* = 81.37) and fat (*M* = 59.20, *SD* = 28.45) met through the school diet was 15% and 61% respectively, whilst the total energy and fibre provided were 85% and 67% of the Recommended Dietary Allowance.

The school meals provided more than 100% of the Recommended Dietary Allowance (RDA) of Ascorbic acid (212%), Thiamine (102%), Vitamin B_6 (128%), and Folate (121%). However, the percentages for Riboflavin, vitamin B_{12}, vitamin A and vitamin K were below 66% of the RDA, whereas that of Niacin and Vitamin E were 84% and 92% respectively.

More so, the amounts of Calcium (*M* = 248.25, *SD* = 104.55), Iron (*M* = 12.96, *SD* = 5.42), Potassium (*M* = 2254.72, *SD* = 895.55), and Zinc (*M* = 8.78, *SD* = 2.36) gotten from the meals contributed less than 66% of the RDA, whilst that of Magnesium, sodium and selenium provided 157%, 154%, and 199% respectively.

Furthermore, the study revealed that the amount of RDA for all the essential amino acids was above 100%. Mean values of Tryptophan, Threonine, Leucine, Phenylalanine, Histidine, Valine, and Methionine in school meals were higher compared to the 'normal' population means, *t* (6) =

3.158, $p < .05$; t (6) = 3.316, $p < .05$; t (6) = 3.710, $p < .05$; t (6) = 4.998, $p < .005$; t (6) = 3.677, $p < .05$; t (6) = 6.648, $p < .005$; t (6) = 4.478, $p < .005$. The detail is as in Table 4.10.

Table 4.10: Differences in Nutrient Content of Foods Served and Actual Requirements N=7

Nutrient	Mean ± Std. Deviation	RDA	Mean Difference	% of RDA
Macronutrients				
Energy (Cal)	1951.77 ± 331.12	2300	348.23	85
Protein (g)	51.06 ± 17.09	50	1.06	102
Fat (g)	59.20 ± 28.45	97	37.80	61
Carbohydrate (g)	310.46 ± 31.14	130	180.46	239
Fibre (g)	25.62 ± 7.26	38	12.38	67
Cholesterol (mg)	46.41 ± 81.37	300	253.59	15
Vitamins				
Ascorbic acid (mg)	95.42 ± 57.51	45	50.42	212
Thiamine (mg)	1.22 ± 0.63	1.2	0.02	102
Riboflavin (mg)	0.62 ± 0.32	1.3	0.68	48
Niacin (mg)	13.38 ± 4.04	16	2.62	84
Vitamin B_6 (mg)	1.66 ± 0.26	1.3	0.36	128
Folate (µg)	484.12 ± 464.95	400	84.12	121
Vitamin B_{12} (µg)	1.45 ± 1.80	2.4	-0.95	60
Vitamin A (µg RAE)	151.16 ± 100.35	600	448.84	25
Vitamin E (mg)	9.17 ± 4.51	10	0.83	92
Vitamin K (µg)	20.43 ± 14.89	65	44.57	31
Minerals				
Calcium (mg)	284.25 ± 104.55	1000	-715.75	28
Iron (mg)	12.96 ± 5.42	27	-14.04	48
Magnesium (mg)	408.48 ± 110.66	260	148.48	157
Potassium (mg)	2254.72 ± 895.55	3500	1245.28	64
Sodium (mg)	3686.83 ± 935.65	2400	1286.82	154
Zinc (mg)	8.78 ± 2.36	14	5.22	63
Selenium (mg)	67.66 ± 21.98	34	33.66	199
Essential Amino Acids				
Isoleucine (g)	1.88 ± 0.59	1.4	0.48	134
Tryptophan (g)	0.51 ± 0.19	0.28	0.23	181
Threonine (g)	1.73 ± 0.54	1.05	0.68	165
Leucine (g)	4.17 ± 1.03	2.73	1.44	153
Lysine (g)	2.22 ± 1.07	2.1	0.12	106

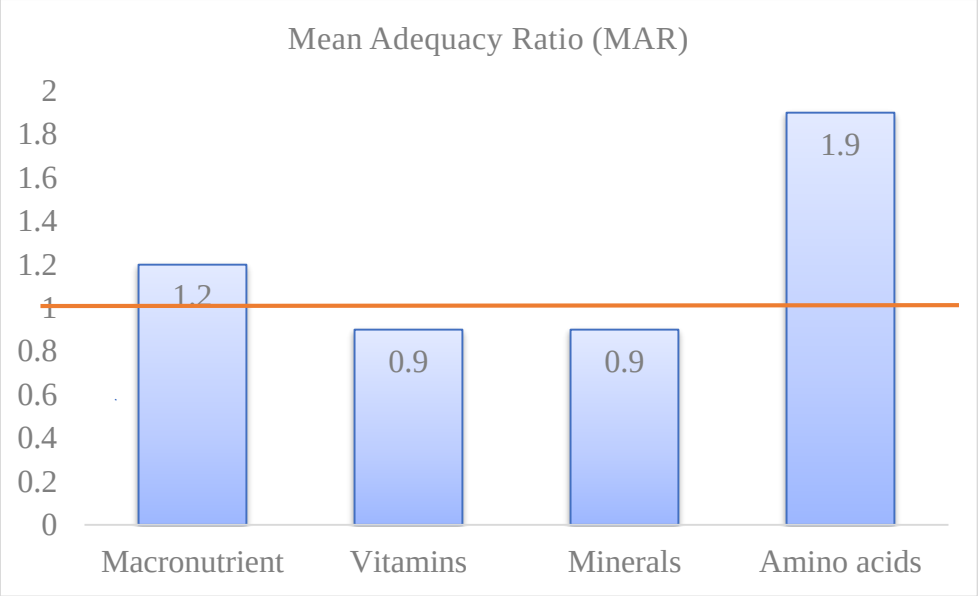
Phenylalanine (g)	2.53 ± 0.87	0.88	1.65	288
Histidine (g)	1.34 ± 0.46	0.7	0.64	191
Valine (g)	2.39 ± 0.65	0.75	1.64	319
Methionine (g)	0.91 ± 0.22	0.53	0.38	172

Source: Fieldwork data (2021).

4.5: Mean Adequacy Ratio (MAR) of Nutrients

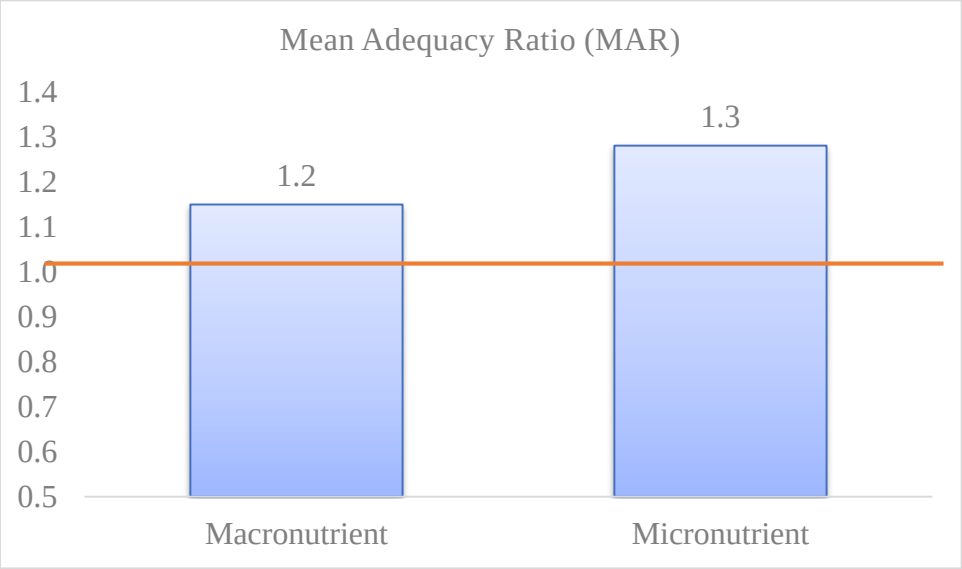
The Mean Adequacy Ratio (MAR) of various nutrients from the study is depicted in Figure 4.3. The MAR of macronutrients and Amino acids were 1.2 and 1.9 respectively, whilst that of vitamins and minerals were both 0.9. However, the combined MAR of the macronutrients was 1.2 and that for the micronutrients was 1.3 (Figure 4.4).

Figure 4.3: Mean Nutrient Adequacy Ratio



Source: Fieldwork data (2021).

Figure 4.4: Mean Nutrient Adequacy Ratio of Macronutrients and Micronutrients



Source: Fieldwork data (2021).

4.6: Dietary Diversity of Meals

Findings from the study disclosed that the food categories, grains, white roots and tubers, and plantains; and other vegetables, were the utmost consumed (every day of the week). Pulses were consumed 4 times a week whereas dairy, meat and fish, and dark green leafy vegetables were eaten twice each week. However, 5 out of the 10 food categories were consumed on Sundays and Thursdays with a dietary diversity score of 5 each whilst 4 of the 10 food categories were eaten on Mondays, Tuesdays, and Wednesdays. Dark green leafy vegetables had a dietary score of 2, and no (0) fruits of any kind were served on any day of the week. The dietary diversity score for meat poultry and fish was 2. A total dietary diversity score of 28 was recorded for the meals in the school. More is shown in Table 4.11.

Table 4.11: Food Frequency Distribution

Food Category	**Sunday**	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Total**
Grains, white roots and tubers, and plantains	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Pulses (beans, peas and lentils)	Yes	No	Yes	Yes	No	Yes	No	4
Nuts and seeds	Yes	Yes	No	No	Yes	No	No	3
Dairy	No	Yes	No	No	Yes	No	No	2
Meat, poultry and fish	Yes	No	No	No	Yes	No	No	2
Eggs	No	No	No	Yes	No	No	No	1
Dark green leafy vegetables	No	No	Yes	No	No	No	Yes	2
Other vitamin A-rich fruits and vegetables	No	No	No	No	No	No	No	0
Other vegetables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Other fruits	No	No	No	No	No	No	No	0
Sub-total	5	4	4	4	5	3	3	28
Condiments and seasonings	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7
Total	6	5	5	5	6	4	4	35

Source: Fieldwork data (2021).

CHAPTER FIVE
DISCUSSION

5.0: Introduction

This chapter emphasises discussing the results of the study. The discussion is done in line with the research questions.

5.1: Prevalence of Malnutrition among Nursing Students

The study revealed a prevalence of 4 per cent for undernutrition, 20.6% for overweight, 7.2% for obesity, and 68.2% for ideal body weight. These findings contradict a study done by Manyanga et al. (2014) which disclosed that about 26% of Ghanaian school-going adolescents are underweight, 8.7 per cent (overweight), 1.0 per cent (obese), and about 66% have ideal body weight. It was also different from Kumah et al. (2015) findings that 7.4% of Ghanaian students are underweight, 79.6%, are normal, whilst 12.2% and 0.8% are overweight and obese respectively. These differences in malnutrition prevalence could be because their study population targeted adolescents, a group at a stage with higher nutritional demand, unlike this present study where the majority of the study participants were early adults in their twenties.

More so, contrarily to Sedodo et al. (2014) findings that male students stand a greater chance of being overweight, this study found female students to be more liable of becoming overweight and obese than their male counterparts, χ^2 (3, N = 223) = 28.66, p < .001. The study findings further contradict the conclusions made by Kumah et al. (2015) and Fagaras et al. (2015) that overweight among male students is higher than among females. It is also different from the conclusion reached by Alkatan et al. (2021) where the overweight and obesity prevalence was greater among males. However, the findings confirm Adesina et al. (2012) conclusion in a study amongst college

students that male students are at a higher risk of becoming underweight than their female colleagues. It is also consistent with findings by van den Berg et al. (2013) among South African students which revealed an overweight prevalence of about 20% with more females than males. Also, the study's high prevalence of underweight among first-year students was in line with that of Al Sabbah's (2020) findings among university students in Dubai where a higher underweight prevalence was found among first-year students. The significant relationship found in the study between body mass index and the year of study was contrary to Al Sabbah's (2020) findings where no association was discovered between overweight, obesity and the year of study. A greater portion of the students in the Registered Nurse Assistant Preventive (RNAP) program was underweight whilst overweight and obesity were greater in the Post-NAP/NAC Midwifery (PNNM) program. The high prevalence among the Post-NAP/NAC Midwifery (PNNM) program could be because students pursuing that program are gainfully employed which might be a contributory factor in determining what they eat.

The study also revealed that 25.1% of students had waist circumferences above their respective gender-specific cut-off points considering the World Health Organisation (WHO) (2008) standards. This is higher than a similar study by Van den Berg et al. (2013) and Al Sabbah (2020) in which about 12% and 9 per cent of students respectively had their waist circumference above their respective gender-specific cut-off points. This depicts that about 25 out of 100 students in this study have an added risk of developing metabolic complications and obesity-related Non-communicable diseases (NCDs). This risk was higher among females than males, χ^2 (1, N = 222) = 24.48, $p < .001$, contradicting Yahia et al. (2016) findings in which males were at a higher risk than females.

Also, the majority of students have a normal waist-to-hip ratio with a greater percentage being males. This is different from Yahia et al. (2016) cross-sectional study where more females had ideal body weight, less visceral fat and lower waist circumference scores. This further contradicts the study findings of the majority of students having a high waist-to-hip ratio being females. The study further revealed that 18.4% of students have a substantially increased risk of developing metabolic complications with females more likely at risk than males, χ^2 (1, N = 222) = 6.009, p < .05. These higher risks of developing metabolic complications among females could be because more females from the study are overweight and obese and these increase their chances of developing metabolic complications than their male counterparts.

The majority of students with a high waist-to-hip ratio were second-year students, females, and students in the Post-NAP/NAC Midwifery (PNNM) program. The reason could be that second-year students in the school do not engage in the daily work and cleaning of the school. So their level of activity reduces with the same quantity of food eaten as they were in the first year. Hence, the likelihood of an increase in body fat due to a reduced level of activity. More so, the high prevalence of waist-to-hip ratio among females could be related to the fact that the Post-NAP/NAC Midwifery (PNNM) program is mainly for females and the program also has a higher prevalence of overweight among all the programs studied.

5.2: Prevalence of anaemia

The anaemia prevalence amongst students was 21.5%, with about 26 per cent of females being anaemic compared to 7.3 per cent of their male colleagues. Males were less likely to be anaemic than females, t (221) = 5.33, p < .001, unlike a study conducted by Al-Alimi et al. (2018) in which more than 50 per cent of females were anaemic. However, the findings that male students had a significant mean haemoglobin level than females conform with Al-Alimi et al. (2018). This could

be because females lose more iron regularly, through menstruation than males, and since most of the females in this study are in their reproductive age their requirement for iron is also higher. It could also be because the bulk of the overweight and obese in the study are females and according to Al Sabbah (2020), total body fat is associated with anaemia. A greater proportion of anaemia was also recorded among students pursuing the Registered Nurse Assistant Preventive (RNAP) program. This might be as a majority of students in the RNAP program are just from senior high school and transitioning from adolescence to early adulthood. Similarly, a larger segment of anaemia was recorded among students in the second year of which the majority were females in their reproductive ages. The higher prevalence as stated by Shill et al. (2014) could also be a result of higher demand or loss, poor absorption, or parasitic infections. It could also be due to other factors such as a poor combination of iron-rich foods with other foods containing inhibiting factors (high calcium, phytates and others).

5.3: Nutrient Adequacy

The nutrient intake of the students (Table 4.10) showed that the mean energy intake (1951.77+331.12) was less than the recommended daily allowance (2300) (FAO, 2005). This was the same for fat and cholesterol as they were both significantly lower than that needed for the students. This finding was contrary to Sultana et al., (2019) study but confirm findings by Fredriksson et al., (2016), van den Berg et al., (2013) and Verwey et al., (2021). However, similar to Sultana et al., (2019) findings, the protein and carbohydrate intake exceed (102% and 239% respectively) the FAO (2005) estimates of the age and sex-specific recommended daily allowance. This implies that the meals in the school adequately meet the recommended daily requirements of students' carbohydrate and protein needs, but their energy needs are inadequately met. This inadequate provision of total energy in the meals could be related to the amount of the three major

macronutrients provided since they are the key sources of energy for the body. However, it is seen from the study that the fat content of the college meals is insufficient to meet the requirements of students. Similarly, the higher protein difference recorded was insignificant to that of the reference population. Hence, the main energy supply for students will be carbohydrates only since the fat and protein contents of the meals are inadequate. Dietary fibre, known for its vital role in digestion and aiding in free bowel movement, was lower than the requirements, meeting 67% of the RDA. This indicates that there is an inadequate supply of fibre in the school meals to students which could be dependent on the number of fruits and vegetables consumed as well as whole grains and cereals.

The requirements of students for Ascorbic acid, (212%), Thiamine (102%), Vitamin B_6 (128%), and Folate (121%) are adequately met by the school's meals which is contrary to Sultana et al., (2019) and Verwey et al. (2021) results. Conversely, and similar to Verwey et al. (2021) findings, the percentages for Riboflavin, vitamin B_{12}, vitamin A and vitamin K are below 66% of the RDA depicting inadequate content of those nutrients in the school's meals. The mean value of Vitamin B_{12} in the meals was also lower than that recommended. There was a fairly adequate content of niacin and vitamin E in the meals consumed by the students, based on INDDEX Project (2018) standards, as they contributed 84% and 92% of the daily requirements respectively.

Similarly, the nutrient adequacy ratios less than 0.66 for calcium, iron, potassium, and zinc meant that the content of these minerals in the meals are inadequate. The highest amount of calcium (492.46 g) and Iron (21.91 mg), for instance, come from Wednesday's meals which are below the daily calcium requirement per WHO/FAO/UNU (2007) standards. Hence, the needs of the students are inadequately met for calcium, iron, potassium, and zinc. However, an adequate supply of magnesium, sodium, and selenium is provided by the school meals. In addition, students will be

able to make enough human protein depending only on the meals the school provides in that the proportion of essential amino acids in the meals exceeds that recommended. This could be because the school meals provide students with animal-source protein 5 times a week, and plant-sourced protein 7 times a week.

Generally, from Figure 4.3 it can be deduced based on the Mean Adequacy Ratios that the macronutrient and Amino acids contents of the school meals are adequate for the students whereas that of minerals and vitamins are inadequate to meet their needs. The micronutrient inadequacy could be ascribed to the limited provision of green leafy vegetables and the lack of fruits in the school's meals supporting the results of van den Berg et al., (2013). However, generally speaking, as Figure 4.4 depicted, the MAR for both macronutrients and micronutrients in the college is adequate. Hence, students meet their requirements contrary to Sultana et al. (2019) study where they found the majority of students with inadequate MAR values.

5.4: Dietary Diversity of Meals

The study findings revealed that the dietary diversity score of the meals served in the school is 28, with Sundays and Thursdays meals having a dietary diversity score of 5 each. Thus, aside from Sundays and Thursdays, that meals provided by the school contain 5 out of the 10 food groups, the rest of the days' meals provides 4 or fewer of the 10 food groups. According to the (FAO & FHI 360, 2010), intake of at least five of the 10 food groups signals dietary diversity and suggests acceptable micronutrient dietary quality. This implies that the school's meals served to students are not diversified considering the FAO and FHI 360 (2010) standards, thus reflecting micronutrient inadequacy as concluded by Acham et al. (2012) and Verger et al. (2021). This is thus not surprising when the study findings found the mineral and vitamin contents of the school's meals to be inadequate. The result is also coherent with Sedodo et al. (2014) that the dietary

diversity score of undergraduates is poor. Only meals serve on Sundays (breakfast: millet porridge; lunch: Gari and beans with stew; supper: Banku with groundnut soup and meat) and Thursdays (breakfast: Fonio porridge; Lunch: Banku with groundnut soup and meat; Supper: Plain rice with stew) in the school are diversified based on the study findings.

The food category of meat, poultry, and fish recorded a low dietary diversity score, contrary to Van den Berg et al. (2013) findings but consistent with Sedodo et al. (2014) study where they found a poor dietary diversity score with the meat and meat products category which according to them was attributed to financial constraints of students in fending for themselves. However, in this study, students are fed by the school which is supposed to provide diversified foods to meet their needs. Similarly, the dietary diversity scores for green leafy vegetables and fruits, known for their micronutrient-rich content, were low which supports that of Van den Berg et al. (2013). This low or inadequate consumption could be attributed to the geographical location of the school and the difficulty in accessing these food groups in that part of the region.

5.5: Delimitations

The study is considered to be a peculiar one that can be carried out in any Health Training College. However, the focus of this study was the Bole Nursing and Midwifery Training College (BNMTC), in the Bole district of the savanna region. It is one of three schools in the region that train students to become professional nurses. So the study was limited to only BNMTC due to the geographical proximity, and also easy access to the research participants to collect data.

CHAPTER SIX
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.0: Introduction

This chapter presents the summary of the nutritional status and nutritional quality of meals of students of Bole Nursing and Midwifery Training College (BNMTC). It summarises the results of the research outcomes and conclusions drawn from the study. In addition, recommendations have been made to Health Training Institutions (HTI) to facilitate effective planning of students' meals.

6.1: Summary of Main Findings

The key objective of the study was to assess the nutritional status and nutritional quality of meals of students of Bole Nursing and Midwifery Training College (BNMTC). The study analysed and presented data on the nutritional status of trainee nurses, their nutrient intake adequacy and the dietary diversity of meals served in the college. This portion summarises the key findings of the study.

- The prevalence of underweight in the study was 4 per cent with males (7.3%) at a higher chance of being underweight compared to females (3.0%), χ^2 (3) = 28.657, $p < .001$.
- Overweight and obesity prevalence was 20.6% and 7.2% respectively in the study with all being females.
- The study also revealed a significant difference in BMI between male and female students (t (203) = 6.59, $p < .001$).
- Underweight prevalence was high (5.2%) among students pursuing the RNAP program and first year-students (4.5%).
- Students in the PNNM program had the majority of overweight (50%) and obesity (33.3%).

- Anaemia prevalence among student nurses in the study area was 21.5% with more females (26.2%) than males (7.3%).
- Females were at a higher risk of developing anaemia in the study population (χ^2 (1) = 8.779, p = .003).
- The highest prevalence of anaemia was recorded among the RNAP students (27.3%) and second-year students (30.1%).
- The majority (81.6%) of students had a normal waist-to-hip ratio with 92.7% being males and 77.8% representing females.
- The majority (61.1%) of PNNM students had a high waist-to-hip ratio.
- The school meals contributed adequate quantities of carbohydrates, protein, and a fairly adequate amount of energy and fibre.
- The fat and cholesterol content of the meals in the study area was inadequate.
- There were adequate quantities of Vitamin C, Vitamin B_1, Vitamin B_6, and folate in the meals provided by the college while Vitamin K, Vitamin A, Vitamin B_{12}, and Vitamin B_2 were inadequate.
- There was an inadequate amount of iron, calcium, potassium, and zinc in the meals provided by the college.
- The essential amino acid requirements of the students were met by the school meals.
- The mean nutrient adequacy ratio of both macronutrients and micronutrients was adequate.
- The meals served in the school to students were not diversified.

6.2: Conclusion and Recommendations

The resulting conclusions can be drawn based on the study findings:

The study found evidence of the triple burden of malnutrition in the school with undernutrition, overnutrition, and anaemia prevalence at 4 per cent, 27.8%, and 21.5% respectively. Also, the anaemia prevalence of 21.5% among students is a moderate public health problem. The school meals contributed adequate quantities of the carbohydrate, protein, and folate requirements of students. However, inadequacies were recorded for fat, cholesterol, and some micronutrients such as vitamin A, vitamin B_{12}, iron, calcium, potassium, and zinc. More so, the college's meals are not diversified and hence contribute less than the needed micronutrient requirements of students.

The following suggestions are made in association with the study findings:

i. Bole Nursing and Midwifery Training College should re-develop its feeding menu that will promote the intake of a range of foods to step up the quality of meals served to students
ii. Students should engage in regular recreational and physical activities to attain and maintain ideal body weight and also reduce their risk of developing metabolic complications.
iii. The Health Training Institutions in collaboration with other stakeholders should develop a standard Food-Based Dietary Guideline (FBDG) that could be used by all Nursing and Midwifery Training Colleges (NMTC) in the country to help address the issue of the double burden of malnutrition.
iv. Since fruits are not served as part of the dining meals, the Bole Nursing and Midwifery Training College should create a common market within the college for the sales of fruits by private individuals to complement the school's meals and help fill the gap in the micronutrient inadequacies.

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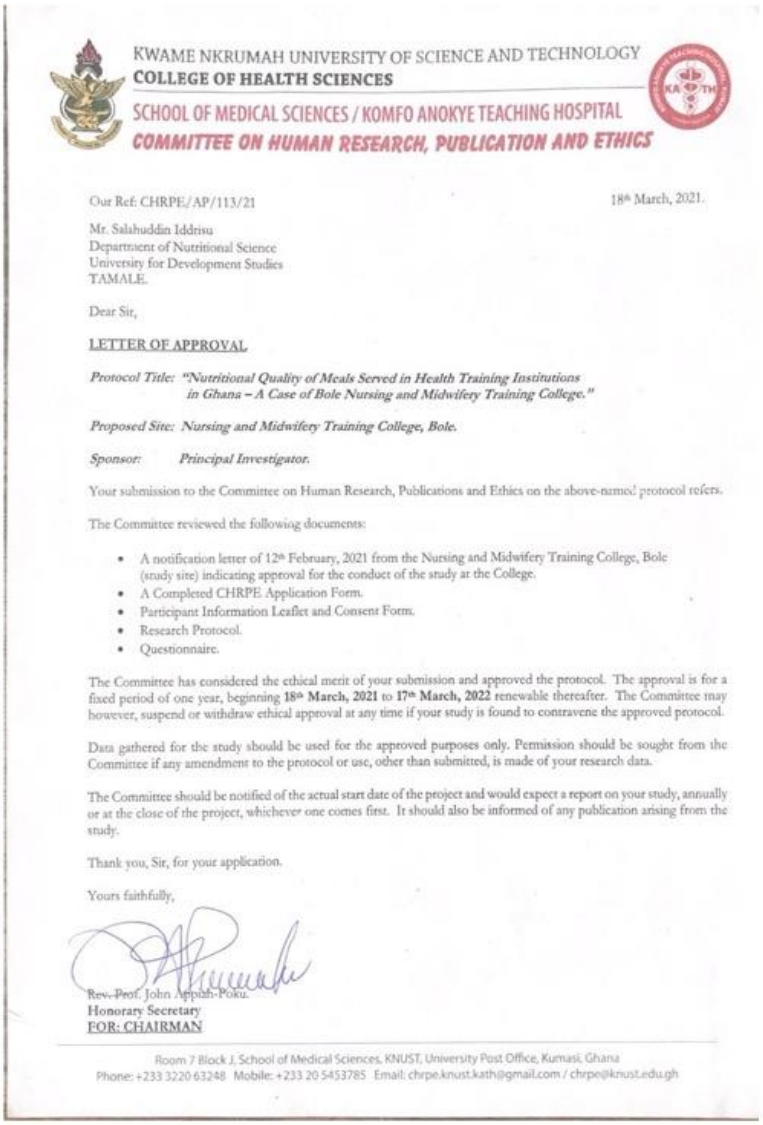
APPENDICES

Appendix I: Ethical clearance letter



KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY
COLLEGE OF HEALTH SCIENCES
SCHOOL OF MEDICAL SCIENCES / KOMFO ANOKYE TEACHING HOSPITAL
COMMITTEE ON HUMAN RESEARCH, PUBLICATION AND ETHICS

Our Ref: CHRPE/AP/113/21 — 18th March, 2021.

Mr. Salahuddin Iddrisu
Department of Nutritional Science
University for Development Studies
TAMALE.

Dear Sir,

LETTER OF APPROVAL

Protocol Title: "Nutritional Quality of Meals Served in Health Training Institutions in Ghana – A Case of Bole Nursing and Midwifery Training College."

Proposed Site: Nursing and Midwifery Training College, Bole.

Sponsor: Principal Investigator.

Your submission to the Committee on Human Research, Publications and Ethics on the above-named protocol refers.

The Committee reviewed the following documents:

- A notification letter of 12th February, 2021 from the Nursing and Midwifery Training College, Bole (study site) indicating approval for the conduct of the study at the College.
- A Completed CHRPE Application Form.
- Participant Information Leaflet and Consent Form.
- Research Protocol.
- Questionnaire.

The Committee has considered the ethical merit of your submission and approved the protocol. The approval is for a fixed period of one year, beginning **18th March, 2021** to **17th March, 2022** renewable thereafter. The Committee may however, suspend or withdraw ethical approval at any time if your study is found to contravene the approved protocol.

Data gathered for the study should be used for the approved purposes only. Permission should be sought from the Committee if any amendment to the protocol or use, other than submitted, is made of your research data.

The Committee should be notified of the actual start date of the project and would expect a report on your study, annually or at the close of the project, whichever one comes first. It should also be informed of any publication arising from the study.

Thank you, Sir, for your application.

Yours faithfully,

Rev. Prof. John Appiah-Poku.
Honorary Secretary
FOR: CHAIRMAN

Room 7 Block J, School of Medical Sciences, KNUST, University Post Office, Kumasi, Ghana
Phone: +233 3220 63248 Mobile: +233 20 5453785 Email: chrpe.knust.kath@gmail.com / chrpe@knust.edu.gh

Appendix II: Participant information leaflet

Title of Research:

Nutritional Status and Nutritional quality of meals of students of Bole Nursing and Midwifery Training College, Ghana

Name and affiliation of researcher:

This study is being conducted by Salahuddin Iddrisu, a Master student at the University for Development Studies, Tamale.

Background:

This study is purely for academic purposes and conducted as part of the award of a post-graduate degree in Public Health Nutrition (MPhil).

Purpose(s) of research:

The purpose of the study is to examine the nutritional status and nutritional quality of meals of students of Bole Nursing and Midwifery Training College (NMTC).

Procedure of the research:

As part of the study, a total of 230 participants will be selected using a probability proportionate to the size of each class. The number required will then be selected randomly from the sampling frame of each class. A food frequency questionnaire and food record will be administered to help assess dietary diversity and adequacy of the school meal. Weight, height, waist circumference, hip circumference, and haemoglobin (Hb) level of participants (students) will as well be measured by the researcher.

Risk(s):

Volunteers risk information to be shared with the researcher. Also, Interviews may deprive participants of their time and likely discomfort during blood sample taking.

Benefit(s):

The goal of this study is to find out the quality of the meals served in the school. The findings will provide the basis for HTI to formulate standard Food-Based Dietary Guidelines (FBDG) for schools. It will also inform the school of the contribution of their meals to the nutritional status of the beneficiaries (students).

Confidentiality:

All information collected in this study will be given code numbers. No name will be recorded. Data collected cannot be linked to you in any way. No name or identifier will be used in any publication or report from this study.

Voluntariness:

Taking part in this study should be out of your own free will. You are not under obligation to participate in the research. Research is entirely voluntary.

Alternatives to participation:

If you choose not to participate, this will not affect your stay in this school in any way.

Withdrawal from the research:

You may choose to withdraw from the research at any time without having to explain yourself. You may also choose not to answer any question you find uncomfortable or private.

Consequence of Withdrawal:

There will be no consequence if you choose to withdraw from the study. Please note, however, that some of the information that may have been obtained from you without identifiers (name etc), before you chose to withdraw, may have been modified or used in analysis reports and publications. These cannot be removed anymore. We do promise to make a good faith effort to comply with your wishes as much as practicable.

Compensation: There will be no compensation for participating in this study.

Contacts: If you have any questions concerning this study, please do not hesitate to contact:

- **Salahuddin Iddrisu**, Principal Investigator (PI)
  Tel: 0249690663

- **Dr. Anthony Wemakor**, Supervisor of the study
  Tel: 0540254975

Further, if you have any concerns about the conduct of this study, your welfare or your rights as a research participant, you may contact:

The Office of the Chairman
Committee on Human Research and Publication Ethics
Kumasi
Tel: 03220 63248 or 020 5453785

Appendix III: Consent form

Statement of the person obtaining informed consent:

I have fully explained this research to _____ and have given sufficient information about the study, including that on procedures, risks and benefits, to enable the prospective participant to make an informed decision to or not to participate.

DATE: _____ NAME: _____

Statement of the person giving consent:

I have read the information on this study/research or have had it translated into a language I understand. I have also talked it over with the interviewer to my satisfaction.

I understand that my participation is voluntary (not compulsory).

I know enough about the purpose, methods, risks and benefits of the research study to decide that I want to take part in it.

I understand that I may freely stop being part of this study at any time without having to explain myself.

I have received a copy of this information leaflet and consent form to keep for myself.

NAME:_____

DATE: _____ SIGNATURE/THUMB PRINT: _____

Appendix IV: Questionnaire

FORM A

RESPONDENT: STUDENT

PART I: SOCIO-DEMOGRAPHIC INFORMATION

ID Number: _____ Date: ____/ ____/ 2021

1.1 Age (Years): __ __ __

1.2 Sex: 1. [ ] Male 2. [ ] Female

1.3 Place of residence: 1. [ ] On campus 2. [ ] Off-campus

1.4 Program of study: 1. [ ] RNAP 2. [ ] RCN 3. [ ] PNNM

1.5 Academic level: 1. [ ] 1st Year 2. [ ] 2nd Year 3. [ ] 3rd Year

1.6 Marital status: 0. [ ] Single 1. [ ] Engaged 2. [ ] Married 3. [ ] Divorced
4. [ ] Widowed

1.7 Main source of income: 1. [ ] Parents 2. [ ] Spouse 3. [ ] Self 4. [ ] Partner
5. Other family members [ ]

1.8 Religion: 1. [ ] Catholic 2. [ ] Anglican/Methodist/Presbyterian
3. [ ] Pentecostal/Charismatic 4. [ ] Other Christian (…….)
5. [ ] Muslim 6. [ ] Traditionalist/Spiritualist 7. [ ] No religion
8. [ ] Others (…….)

1.9 Ethnicity: 1. [ ] Akan 2. [ ] Dagomba 3. [ ] Gonja 4. [ ] Dagaaba
5. [ ] Waala 6. [ ] Frafra/Kasem 7. [ ] Ga/Dangme 8. [ ] Ewe
9. [ ] Konkomba 10. [ ] Moshi 11. [ ] Guan 12. [ ] Brifor
13. [ ] Others (……..)

1.10 Type and make of mobile phone …….

1.11 Father's occupation: 1. [ ] Professional/Technical or managerial 2. [ ] Agriculture
3. [ ] Sales and services 4. [ ] Clerical positions
5. [ ] Skilled manual labour 6. [ ] Unskilled manual labour
7. [ ] Others (……)

1.12 Father's highest educational level: 0. [ ] No education 1. [ ] Primary education
2. [ ] Middle/JSS 3. [ ] Secondary education
4. [ ] Tertiary education

PART II: ANTHROPOMETRY AND BIOCHEMICAL DATA

2.1 Weight (kg): _____

2.2 Height (cm): _____

2.3 Waist circumference (cm): _____

2.4 Hip circumference (cm): _____

2.5 Hb level (g/dL): _____.

FORM B

PART I: FOOD RECORD (WEIGHING METHOD)

(To be completed daily for seven days)

ID Number: _____ Date: ____/____/2021

Day of the week:_____

Food/Drink	Preparation Method/Description	Quantity served (ml or g)					
		1	2	3	4	5	Average
BREAKFAST							
LUNCH							
SUPPER/DINNER							

PART II: FOOD FREQUENCY QUESTIONNAIRE

For each food group below, indicate whether students ate food(s) from that food group or not using 0 for “No” and 1 for “Yes”.

S/N	Food Category	Description	**Consumed** "Yes"= 1 "No" = 0						
			Sunday	**Monday**	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**
A	Grains, white roots and tubers, and plantains	*Porridge, bread, rice, pasta/noodles or other foods made from grains, White potatoes, white yams, cassava, cocoyam, any other foods made from white-fleshed roots or tubers, or plantains*							
B	Pulses (beans, peas and lentils)	*Mature beans or peas (fresh or dried seed), lentils or bean/pea products*							
C	Nuts and seeds	*Any tree nut, groundnut/peanut or certain seeds, or nut/seed “butters” or pastes*							

D	Dairy	*Milk, cheese, yoghurt or other milk products but NOT including butter, ice cream, cream or sour cream*							
E	Meat, poultry and fish	*Liver, kidney, heart or other organ meats or blood-based foods, including wild, Beef, pork, lamb, goat, rabbit, wild game meat, chicken, duck or other bird game*							
F	Eggs	*Eggs from poultry or any other bird*							
G	Dark green leafy vegetables	cassava leaves, bean leaves, pumpkin leaves, amaranth leaves, baobab leaves, bitter leaves, okra leaves and others							
H	Other vitamin A-rich fruits and vegetables	*Pumpkin, carrots, squash or sweet potatoes that are yellow or orange inside, Ripe mango, ripe papaya, red pepper (sweet)*							

I	Other vegetables	*Green pepper, bitter melon, tomato, okra, lettuce, onion, mushroom, cucumber,*							
J	Other fruits	*Apple, Avocado, banana, baobab fruit, blackberry, cashew fruits, coconut flesh, dates, guava, lemon, orange, pineapple, pear, watermelon, tangerine*							
K	Condiments and seasonings	*Ingredients used in small quantities for flavours, such as chillies, spices, herbs, fish powder, tomato paste, flavour cubes or seeds, garlic, ginger, monosodium glutamate (MSG)*							