UNIVERSITY OF GHANA

NUTRITIONAL STATUS, CULINARY KNOWLEDGE AND SKILLS OF UNDERGRADUATE DIETETICS STUDENTS IN GHANA

BY

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JULY 2018
DECLARATION

I, Effah Achiaa Pamela hereby declare that this dissertation is the results of my own diligent research work carried out in the Department of Nutrition and Dietetics, School of Biomedical and Allied Health Sciences, University of Ghana, under the supervision of Dr. Laurene Boateng. Neither whole nor any part of it has been or is being or is to be submitted for another degree at this or any other university. All references cited have been fully acknowledged.

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Dr. Laurene Boateng ......................................................... Date
(Supervisor)
DEDICATION

I dedicate this work to my parents Mr Samuel Effah and Mrs Janet Akowuah-Effah, for always loving me unconditionally and supporting my academic hopes and dreams. You have always been voices of encouragement and strength in this journey.

I also dedicate this work to every dedicated academic teacher and mentor in my life. I see far for you made me stand on your shoulders.

You made this dream a reality.
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I thank God Almighty for His unfailing love throughout my life and providing me with the strength and wisdom not only during my research, but throughout my life. I thank Him for this success and many more successes to come.

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Finally, to all student participants from both institutions, my course mates and all my friends and family. God bless you all.
ABSTRACT

**Background:** Dietitians are responsible for the dietary management of patients which involves the modification of meals/recipes and cooking methods. Dietitians are also responsible for training and supervision of hospital catering staff on the preparation of therapeutic meals. Dietitians must therefore possess adequate knowledge and skills in food preparation in order to successfully carry out their duties.

**Aim:** To assess the culinary knowledge, skills and nutritional status of undergraduate dietetics students in University of Ghana (UG) and University of Health and Allied Sciences (UHAS).

**Methods:** A cross-sectional study was conducted with 155 students. Structured questionnaires were used to assess participants’ culinary knowledge and skills and anthropometric measurements were taken to assess their nutritional status. Independent Sample T-test and ANOVA were used to compare knowledge scores of dietetics students by institutions, gender and academic level. The relationship between culinary knowledge scores and nutritional status of students was also analysed using linear regression. Statistical significance was set at p<0.05.

**Results:** Majority (66.8%) of the students were females. The mean age of all participants was 20.77 ± 2.00 years. The mean knowledge score for all participants was 6.44 ± 2.08. Compared to UG, students in UHAS had statistically higher mean culinary knowledge scores (p=0.010). Among gender, female participants had significant higher culinary scores than males (p= 0.025). Participants in the fourth year had the highest culinary knowledge means (6.48 ± 2.38) whilst students in first year had the lowest mean scores (5.89 ± 2.19). More than two- thirds (71.0%) of participants had normal BMI status whilst more than half (57.2%) had
normal total body fat percentage levels. Furthermore, almost all participants (96.1%) had normal visceral fat levels.

**Conclusion:** Findings of this study showed that dietetics students in UHAS had higher culinary knowledge scores than those in UG. Culinary knowledge scores of participants increased proportionally with the number of years spent in academic training. Majority of participants had normal BMI, total body fat percentage and visceral fat levels.
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<tr>
<td>ACHA-NHCA</td>
<td>American College Health Association– National College Health Assessment</td>
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<tr>
<td>BMI</td>
<td>Body Mass Index</td>
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<tr>
<td>CPD</td>
<td>Continuous Professional Development</td>
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<td>CVD</td>
<td>Cardiovascular diseases</td>
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<td>FCD</td>
<td>Food and Culinary Project</td>
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<td>MoHP</td>
<td>Ministry of Health Promotion</td>
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<td>RD</td>
<td>Registered Dietitian</td>
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<tr>
<td>SPSS</td>
<td>Statistical Package for Social Sciences</td>
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<td>UG</td>
<td>University of Ghana</td>
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<td>UHAS</td>
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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Food and its preparation have been part of human life through civilization. This skill can be learned through informal training from our family and community as well as formal education taught through instruction, experimentation and/or imitation (Benn, 2014).

Culinary (cooking) skills are considered as the knowledge, confidence and efficiency of food preparation (Sun, Buys, & Hills, 2014). It can also be defined as the translation of raw ingredients into cooked food with the use of heat or fire (Benn, 2014). Lavelle (2016) defined cooking as a method that improves the nutritional properties and pleasure of food (Lavelle et al., 2016). Thus, culinary skills encompass all of the cooking and food preparation knowledge and skills needed to prepare and provide regular, nutritious meals and snacks for an individual or family (Brown, 2015).

The phrases “cooking from scratch” and “home cooking” are commonly used to identify meals prepared from raw ingredients, as opposed to “convenience foods” and “fast foods” which refer to meals which require little or no preparation (Schaeffer & Miller, 2012). Factors such as availability, convenience and time make convenience foods more preferable than home cooked meals (Canter, Etta, & Boyce, 2007). Furthermore, food preparation skills among adults also accounts for food choices and consumption (Schaeffer & Warren, 2013). Most consumers notice the difference in quality between home cooked and fast food, yet they settle for the latter because of convenience (Schaeffer & Miller, 2012). The increase in consumption of convenience foods
has led to a rise in chronic diseases. These foods are high in fats, salt (sodium) and other artificial spices which are major contributors to chronic diseases (Buckley, 2016).

A dietetic professional interprets and communicates the science of nutrition to empower people make informed and practical choices about food and way of life, in both fitness and disease (Caballero, Allen, & Prentice, 2005). Dietetics practice includes community nutrition, wellness, nutrition informatics, obesity management, clinical dietetics, corporate nutrition, public policy, and food and health communication (Caballero et al., 2005). These practices call for expertise in food preparation, product development and research and foodservice managing prospects (Canter et al., 2007). In order for dietetic professionals to take the lead in conducting cooking skill interventions, they must possess the required skills (Begley & Gallegos, 2010).

According to Cooper, Mezzabotta, & Murphy (2016), an early interest in food and cooking often influences an individual’s decision to pursue a career in dietetics. Moreover, the Academy of Nutrition and Dietetics has stated that, children in homes that avoid cooking at home are less likely to acquire the skills of cooking (Begley & Gallegos, 2010). Furthermore, Begley & Gallegos (2010) stated that, current home economics courses, often referred to as family and consumer sciences, are uprooted in the academic world and replaced with scientific and practical aspects of food and nutrition. This is because cooking skills were considered as feminine and low paying skill (or unpaid) (Begley & Gallegos, 2010).

Dietitians must take a role as viable members in the food and culinary community as espoused by Canter et al., (2007), “If we allow other food professionals without a nutrition background to fill the void, we will have abdicated our role as the true food and nutrition experts” (Canter et al., 2007).
There is an increasing need for a more culinary-focused approach to healthcare (Canter et al., 2007). Ghanaian dietitians train and oversee diet cooks concerning the preparation of therapeutic meals (Asante et al., 2014). They also help patients in the modification of their meals/recipes and cooking methods. It is therefore important for dietitians to have the ability to practically demonstrate the skills they are advising others to use (Begley & Gallegos, 2010). They must further have an extensive knowledge of foods as well as their preparation in order to successfully educate and motivate clients, caregivers and other health professionals to make better food and culinary choices (Begley & Gallegos, 2010).

1.2 Problem Statement

In 2007, the Academy of Nutrition and Dietetics set up “The Phase 2 Future Practice and Education Task Force” to project the future roles and practices in the dietetics profession and suggest an educational plan to make sure that dietitians were adequately equipped with skills for meeting future challenges of the profession. One of the key recommendations of the task force focused on the development of food and culinary competencies for dietitians, dietetic interns and dietetics students (Canter, 2007).

Dietitians are responsible for the dietary management of patients among others. This often involves the modification of meals/recipes and cooking methods. In Ghana, dietitians are responsible for training and supervision of hospital catering staff on preparation of therapeutic meals (Asante et al., 2014). Dietitians must therefore have an extensive knowledge of foods as well as their preparation in order to successfully educate and motivate clients, caregivers and other health professionals to make better food and culinary choices. They should further have the ability to demonstrate the culinary skills they are advising others to use.
These skills that dietitians must possess in order to successfully carry out their roles have not been assessed in dietetic students thus; it is not known whether the culinary training given them is adequate. It is therefore important to investigate the culinary knowledge and skills of dietetics students (who are the future workforce for the dietetics profession) at various levels on the academic ladder.

1.2 Significance of Study

Understanding of foods, their preparation and handling are of utmost importance in the practice of dietetics. Findings from this study will highlight the culinary knowledge and skills of dietetic students at the various levels of academic training (Level 100-400) and will be useful for evaluation of undergraduate dietetics curriculum. It will also inform educators and other stakeholders of gaps or bottlenecks in culinary skills training of dietetics students. Furthermore, findings from this study will serve as a baseline for further research on the culinary knowledge and skills of dietetic interns and registered dietitians. Findings would be beneficial for the planning of workshops and Continuous Professional Development (CPDs) for students, interns and dietitians.

1.3 Aim and Specific Objectives

1.3.1 Aim

The aim of this study was to assess the culinary knowledge, skills and nutritional status of undergraduate students (level 100-400) at the University of Ghana and the University of Health and Allied Sciences.
1.3.2 Objectives

1. To determine the culinary knowledge and skills of level 100-400 undergraduate dietetics students of University of Ghana and University of Health and Allied Sciences.

2. To assess the nutritional status of dietetics students.

3. To evaluate the relationship between culinary knowledge scores and nutritional status of dietetics students.
CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview of Dietetics Profession

The word diet was derived from the Latin word “diaeta”, which means mode of life (Koleilat, 2004). This word until the 20th century was often used in a much broader sense than its current meaning (Koleilat, 2004). Currently, the word diet is derived from “dieto” meaning food (Winterfeldt, Bogle, & Ebro, 2011). The Academy of Nutrition and Dietetics defines dietetics as “integration and application of principles derived from the sciences of food, nutrition, management, communication, and biological, physiological, behavioural, and social sciences to achieve and maintain optimal human health” (O’Sullivan & Skates, 2005). The British Dietetic Association, also defines a dietitian as “a specially trained individual who helps to promote nutritional well-being, treat disease and prevent nutrition-related problems”. He/ She also offers practical, safe guidance, based on current scientific evidence and holds a degree qualification in nutrition and dietetics (British Dietetics Association, 2017).

The use of diet in the treatment of disease was already an ancient Greek practice even though it was based more on trial and error than on scientific knowledge (Winterfeldt et al., 2011). Many early physicians and scientists recommended that patients added or eliminated certain foods from their diet according to their disease symptoms although they possessed no scientific basis about food nutrients at that time to justify their recommendations (Winterfeldt et al., 2011).

2.2 Evolution of the Dietetics Profession

Dietetics as a profession, is a relatively new profession which has evolved from the use of diet in treatment of diseases to a scientific, evidence based and the application of safe and systematic
clinical practices (Gandy, 2014). Dietetics is both an art and a science that requires that a dietitian combines this practice with culinary knowledge and experience, together with an understanding of the individual’s circumstance in order to maintain and improve practice (Gandy, 2014).

Early practitioners in dietetics were in hospitals feeding the sick. They were referred to as “cooks” and were selected for this work because of their proficiency in cooking and not because of their scientific training in nutrition (Winterfeldt et al., 2011). Sarah Rorer, often considered as the first American dietitian, started her cooking school in Philadelphia in 1878. This became necessary because physicians were looking for a source of food for their patients who had illnesses which needed dietary adjustments (Canter, 2007). However, little was known about people’s nutritional needs in either health or illness. Food selection was not a priority. Menus were repetitive and usually featured only a few meals (Winterfeldt et al., 2011). The scientific basis for many of the eating recommendations was problematic, until the discovery of the major nutrients in food during the 19th and 20th centuries (Winterfeldt et al., 2011).

Early research focused on vitamin deficiency diseases while later research proposed daily requirements for protein, fat and carbohydrates (Koleilat, 2004). Medicine has extended its scope to include other paramedic professions such as dietitians. Adopting an evidence-based approach is no longer an alternative for the dietetics professional, but a basic requirement for achieving high quality patient care by applying valid, current research findings to clinical practice (Byham-Gray, Gilbride, Dixon, & Stage, 2005).

The profession continues to evolve with setting of standards both in education and in practice, the implementation of a code of ethics, and registration and licensure (Academy of Nutrition and Dietetics, 2013). The Academy of Nutrition and Dietetics instituted a system in 1969 in order to
protect the public by recognizing knowledgeable and skilled practitioners. Through these systems dietitians who met certain requirements were and are currently designated registered dietitians (RD) (Krieger, 2014).

2.2.1 Evolution of Dietetics Practice in Ghana

Dietetics profession has evolved through three key phases (Aryeetey, Boateng, & Sackey, 2014). The first period precedes the 1960s and was featured by dietary services provided by catering officers. The catering officers were taught and educated locally in institutional management (Aryeetey et al., 2014). The second period began in the early sixties when foreign-trained Ghanaian dietitians were enlisted and employed to work in major city hospitals. This changing tide resulted in a serious role conflict between catering officers and dietitians about who had superior decision-making authority over patients’ diets and supervision of meal preparation (Aryeetey et al., 2014).

In 1998, a six month thorough training program in dietetics was initiated at Korle-Bu (Asante et al., 2014). This skill-based program which became known as the “stop-gap program” admitted degree graduates from food science, nutrition and home sciences (Asante et al., 2014). The “stop-gap program” became essential when most practicing dietitians were pending retirement and others sent to be trained overseas failed to return to Ghana. The novel program marked the beginning of the third major period in the history of dietetics practice in Ghana and trained two cohorts of dietitians, who filled key dietitian positions in our hospitals (Asante et al., 2014).

The University of Ghana started MSc/MPhil Dietetics program in August 2004 with the aim of training faculty members and preceptors for undergraduate program. The undergraduate program commenced in the 2009/2010 academic year. Currently dietitians are being trained in other
universities such as Kwame Nkrumah University of Science and Technology, University of Allied Health Sciences and University of Cape Coast (Asante et al., 2014).

2.3 Role of Dietitians

The mainstream of registered dietitians work in hospitals, private practice and other smaller healthcare facilities (often part of a medical team) playing their role in management and prevention of disease and overseeing medical nutrition therapy. Others also work in food service settings, community and public health settings, academia and research. A growing number of registered dietitians work in food and nutrition industry, in business, journalism, sports nutrition, corporate wellness program and private practice. Major areas include clinical community management and consultant dietetics (Winterfeldt et al., 2011)

Clinical dietitians provide nutritional services for patients. They assess patients’ nutritional needs, develop and implement nutritional programs, and evaluate and report results. Some clinical dietitians in nursing care facilities or small hospitals may manage the food service department (Caballero et al., 2005). Community dietitians give guidance to individuals and groups on nutritional practices designed to prevent diseases and promote health, improve nutrition care plans, and instruct individuals and their relatives. Management dietitians manage large-scale meal planning and preparation in healthcare facilities, company cafeterias, prisons and schools (Caballero et al., 2005).

Consultant dietitians work under contract with healthcare facilities or in their own private practice. They execute nutrition screenings for their clients and offer advice on diet-related concerns such as weight management and cholesterol reduction (Caballero et al., 2005). Business dietitians serve as resource persons by providing expert opinion on nutrition for the media, hotels and restaurants. They critique and develop recipes, author cook books, corporate
newsletters and journals on nutrition and wellness. Others are sales representatives for food producing companies that provide nutritional supplements and tube feeding (parenteral and enteral) supplies (Caballero et al., 2005).

Dietitians sometimes also specialize in various fields in the medical nutrition therapy. Renal dietitians are attached to specialized renal units and are an integral part of the team involved in the treatment of individuals suffering from varying degrees of renal impairment, whether acute or chronic (Caballero et al., 2005). The dietitian is responsible for nutritional assessment, diet prescription, and monitoring responses to treatment. In addition, he or she must be able to devise appropriate individualized dietary plans, taking into account the socio-economic status of their patients as well as any other on-going disease conditions (e.g., diabetes mellitus, cardiovascular diseases). They also advise and teach the patient and family practical ways to modify their diets (Caballero et al., 2005).

Dietitians who specialize in nutritional support are trained to assist patients who are unable to feed themselves adequately by the normal oral route. They assess the nutritional status of the patients, and make clinical judgements about the most suitable method of nutritional support whilst advising on provision of the appropriate nutrition (Gossum et al., 2009). The duties of a nutrition support specialist may range from prescribing oral supplements for the patient who cannot eat enough of a nutrient of interest to modifying and advising on complete parenteral nutrition regimens for the unconscious patient in intensive care (Mahan & Raymond, 2017). There are also patients who need enteral feeds to provide complete or supplementary nutrition (Caballero et al., 2005).

Paediatric dietitians are an indispensable part of the support system for children with innate errors of metabolism (e.g. phenylketonuria and cystic fibrosis) and other conditions such as renal
disease or cardiovascular diseases, food allergies, diabetes, and many others (Caballero et al., 2005). The increase in childhood and adolescence obesity and the consequent increase in type 2 diabetes in young individuals is a very serious health concern (Copeland et al., 2013). A paediatric dietitian educates, often teaching the child’s parents and sometimes the child how to cope with the constraints of a modified diets both at home and at school (Canter, 2007).

2.4 Culinary Knowledge and Skills

Food skills was defined by the Canadian Ministry of Health Promotion (MoHP) in 2010 as “the necessary abilities needed for the knowledge, planning, conceptualization, preparation and perception of food” (Vrhovnik, 2012). Food knowledge refers to having basic understanding concerning label reading, food safety measures, food varieties, ingredients and exchanges to ingredients (Ministry of Health Promotion, 2010). Nutritional knowledge requires understanding the nutrients needed to sustain an in fine fettle lifestyle, where to find and how to make them available in food (Vrhovnik, 2012). Having the ability to read food labels entails being able to understand how to determine the nutritional value of food base on the nutritional facts provided on its label (Vrhovnik, 2012). Understanding food safety is necessary for the storage, preparation and handling of food. Lastly, food knowledge can be developed through an understanding of which foods can be exchanged for healthier options within a given recipe (Ministry of Health Promotion, 2010).

Planning is the ability to organize foods to offer good nutritional value (Fordyce-Voorham, 2011). This ability also focuses on being able to budget while shopping for desired healthy food items as well as understanding the preparation needed, factoring in time and skill needed to make food items (Fordyce-Voorham, 2011). Conceptualizing food requires creativity and awareness of food varieties (Ministry of Health Promotion, 2010).
Culinary skills needed in meals preparation include chopping, mixing, blending, roasting, use of traditional equipment and methods of cooking and the ability to follow recipes. By exercising these techniques, meals can be safely and creatively prepared (Ministry of Health Promotion, 2010). Other basic food skills include ingredients and flavour profiling, basic knife skills, understanding of basic cooking terminologies, ingredient measuring, seasoning, classical preparation of stocks, stews, soups and sauces, healthy cooking methods, preparation of vegetarian diets, therapeutic meals and exploration of indigenous foods (Canter et al., 2007).

2.4.1 Culinary Knowledge and Skills of Dietitians

Over the past ten years, cardiovascular diseases (CVD) have risen to be among the top causes of admissions and institutional deaths in Ghana. Cardiovascular diseases rose from being the seventh and tenth cause of non-communicable disease deaths to number one cause in 1991 and 2001 and it has continued as one of the major causes of mortality in the country (Agyei-Mensah & Aikins, 2011). Obesity is a major contributor to the prevalence of cardiovascular disease in the world. According to Poirier et al. (2006), obesity is a chronic metabolic disorder associated with cardiovascular diseases and increased morbidity and mortality (Poirier et al., 2006). Obesity also increases chances of contracting Type 2 diabetes and certain types of cancer. All of these diseases can be related to nutrition (Michaud, Condrasky, & Griffin, 2007).

There has been a growing demand for convenient foods, fast foods and pre-packaged foods. This modern way of living was ushered in to liberate “women” from the burden of cooking or cooking from scratch. As a result, the art of cooking has fallen out of fashion for many housewives and career women (Krieger, 2014). Meanwhile, consumption of fast foods and “take-away” foods is associated with lower diet quality and greater risk of obesity. Eventually, it has also brought about changes to people’s abilities to cook. There is decline and devaluing of
cooking skills from “home” and as a result many young people are growing with little or no knowledge or skills in cooking (Canter, 2007).

Dietitians are however in a unique position to deliver cooking skills interventions as part of their profession. Dietitians prescribe diets and distribute information on food and nutrition based on scientific evidence (Canter et al., 2007). Dietitians advice people on the recommended nutritional requirements and instruct them on the best method to obtain these nutrients through the preparation and eating of ‘quality’ food (Begley & Gallegos, 2010). Research suggests that effective RDs are experienced in all areas of food science, service and safety. This includes being familiar with most culinary competencies. The challenge however, lies in attaining greater culinary competency while also maintaining the current academic standard (Schaeffer & Warren, 2013).

The Food and Culinary Project (FCP) founded by the Academy of Nutrition and Dietetics in 1997 listed culinary arts to be a fundamental skill of a dietitian. The list comprised of recommended skills, methods, techniques, and basic knowledge of food and nutrition. These skills included: sensory perception and evaluation, basic cooking skills, cooking techniques, menu and meal planning, food safety, recipe development and modification and ingredient selection (Canter & Moorachian, 2007).

Studies have showed that a great number of registered dietitians have not been properly trained to deliver cooking skill interventions or demonstrations on healthy cooking techniques. In 2001, a survey by Zwick-Hamilton and Braves-Fuller was designed to identify needed areas of cooking skills development of registered dietitians (RDs) in Cleveland. Results from the study shows that, 94% of participants indicated that, they received requests for recipes, actual methods and skills of how to modify existing meals/recipes. Furthermore, 77% of the RDs felt accountable for
educating others about cooking and food preparation however, 66% felt they knew average to very little about the principles of food preparation (Zwich-Hamilton & Braves-Fuller, 2001).

2.4.2 Culinary Knowledge and Skills of Dietetics Students

The risk to public health posed by chronic diseases such as cardiovascular diseases, Type 2 Diabetes and childhood obesity has garnered widespread attention in the world (Green, King, Roglic, Sicree, & Wild, 2004). Current research has indicated that the present generation of children and young adults may be facing shorter lifespan than those of their parents due to the prevalence of paediatric obesity caused by negative dietary habits and way of life (Murray et al., 2015).

The national nutrition data of the United States also reported that young adults typically consume high amounts of sugar-sweetened beverages and high amounts of high-fat, high-sodium foods which are mostly eaten away from home (Murray et al., 2015). Other studies have concluded that, factors such as their level of self-confidence about food preparation, cooking skills, and time constrictions may play an important part in influencing their ability to cook meals for themselves on a regular basis (Schaeffer & Warren, 2013).

In addition, Canter et al. (2007) mentioned that current students have little food knowledge or culinary skills due to lack of food preparation experience at home while growing up (Canter & Moorachian, 2007). Copper et al showed in their study that, regardless of year of study, dietetics students noted that their culinary knowledge and skills were obtained from university (27%), their family (25%), and self-study via television, magazines books, and continuing education courses (25%) (Cooper, Mezzabotta, & Murphy, 2016). Dietetics educators have also identified a decrease in students’ competencies in culinary skills (Schaeffer & Miller, 2012). Furthermore, many students enter the field of dietetics ill-equipped to embrace career opportunities where
extensive food knowledge is important. Unfortunately, food courses in dietetic programs have decreased through the years, and a great number of dietetics students have not been properly trained to deliver cooking skill interventions or demonstrations on healthy cooking techniques (Begley & Gallegos, 2010).

Watson and Barrett (2001) used a 5 point Likert scale in their study to assess the attitudes of dietetics students about food and its importance in their education and careers. They found that, majority of students enjoyed trying new foods and cuisines and felt that culinary knowledge and skills were important for dietetics practice. However, other participants stated that, they did not intend to use these skills in their future careers (Watson & Barrett, 2001).

In 2016, Cooper et al examined food and cooking knowledge and skills of dietetic students in Canada. This study enlisted students in the second and third year of academic studies. An online bilingual questionnaire consisting of 11 skills, 5 knowledge, 5 perception and 3 demographic questions was used. A 4 point Likert scale with 1 being “I have never prepared the food” and 5 being “I have prepared the food by myself” was used to assess their culinary skills. Participants were given multiple choice questions with one specific correct answer in assessing their culinary knowledge. Their enthusiasm with regards to food and culinary skills was also measured using a Likert scale (Cooper et al., 2016).

Results from the study showed that, both academic levels had moderate knowledge and skills of food and culinary concepts in general, however, their perceived knowledge and confidence was proportional with the number of years spent in academic training (Cooper et al., 2016).

In a 2004 study by Levy and Auld, the impact of using video demonstrations on student learning was likely to be weaker than actual cooking classes. Hence, they concluded that, the use of
videos rather than hands on culinary classes will have less of an impact in culinary competences development (Levy & Auld, 2004). However, Jackson and his colleagues reported in 2011, that technology-enhanced pedagogies were becoming more evident in the classroom (Jackson, Helms, Jackson, & Gum, 2011).

2.5 Nutritional Status

The World Health Organization (WHO) defines nutritional status as “the condition of the body, resulting from the balance of intake, absorption, utilization of nutrient and the influence of particular physiological and pathological status” (WHO, 2003). Nutritional status can be measured for individuals, as required in clinical practice, or for groups of people, as required in research field, in order both to identify populations at nutrition impairment risk and to plan interventions (Andreoli, Garaci, Pio, & Guglielmi, 2016). Nutrition status assessment often involves anthropometry, biochemical investigations, clinical evaluation and dietary intake (Carlsson, 2011).

2.5.1 Anthropometry

Anthropometry is the science of obtaining human body measurements. It is calculated by taking physical measurements of individuals and comparing them to standards (Bonsu, 2017). Some common anthropometric measurements include height, weight, hip and waist circumference, total body fat, visceral fat and skinfold thickness (Mantatzis & Prassopoulos, 2014). Accurate measurements of an individual may be a good reflection of dietary intake and good nutritional health status (Andreoli et al., 2016). Anthropometric measurements are simple, inexpensive and non-invasive methods of nutritional status assessment (Bailey & Ferro-Luzzi, 1995).
2.5.1.1 Body Mass Index

In the assessment of the nutritional status of individuals and populations, anthropometric measurements play very significant roles which include the detection of adult malnutrition. Adult malnutrition (over or under nutrition) has received much less attention as compared to child malnutrition (White, Guenter, Jensen, Malone, & Schofield, 2012). A task force formed in 1992 of the International Dietary Energy Consultative Group, recommended that body mass index (BMI) should be used to define adult chronic dietary energy deficiency. The BMI or Quetelet index has been known since the last century as a measure of body proportions and composition, thinness or undernutrition and over-nutrition (WHO, 2003).

Body mass index (BMI) is a measure of weight adjusted for height, calculated as weight in kilograms divided by the square of height in meters (kg/m²) (Gomes, Anjos, & Leitir de Vasconcellos, 2009). In contrast to other methods, BMI relies solely on height and weight and with access to the proper equipment, that is the stadiometer and weighing scale respectively, individuals can have their BMI routinely measured and calculated with reasonable accuracy (CDC, 2010). Furthermore, studies have shown that BMI levels correlate with body fat and with future health risks such as morbidity and death (Lewis, McTigue, Poirier, Eckel, & Howard, 2009). However, factors such as age, sex, ethnicity, and muscle mass can influence the relationship between BMI and body nutritional status (WHO, 2003). Also, BMI does not distinguish between excess fat, muscle mass, or bone mass, nor does it provide any indication of the distribution of fat among individuals (WHO, 2003). For adults 20 years and older, BMI is interpreted by using standard weight status categories that are the same for all ages and for both men and women (Wang, Chen, & Eitzman, 2014).
A 2013 study by the American College Health Association– National College Heath Assessment (ACHA-NCHA) reported that, 21.7% of undergraduate students were overweight whilst 12% were obese (ACHA-NCHA, 2013).

Table 2.1 The Classification of Body Mass Index (BMI)

<table>
<thead>
<tr>
<th>BMI (kg/m²)</th>
<th>Weight status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Below 18.5</td>
<td>Underweight</td>
</tr>
<tr>
<td>18.5-24.9</td>
<td>Normal</td>
</tr>
<tr>
<td>25.0-29.9</td>
<td>Overweight</td>
</tr>
<tr>
<td>30.0 and above</td>
<td>Obese</td>
</tr>
</tbody>
</table>

Source: WHO, 2003

2.5.1.2 Total Body Fat Percentage

Total body fat is the combination of “essential” and “storage” fat, usually expressed as the amount of body fat mass in regards to the total body weight expressed as a percentage (Miwa et al., 2005). Essential body fat is the kind of fat needed for normal physiological functioning of the body and are stored in small amounts in the bone marrow, heart, lung, liver, spleen, kidneys, muscles and the nervous system (Arakaki et al., 2016). Men need approximately 3% of essential fat while women need about 12%. The higher percentage in females is due to body fat in the breast, pelvic regions and thighs that support reproductive processes (Miwa et al., 2005).

The human body has an infinite ability to store excess body fat and hence there is an increased risk of uncontrolled fat accumulation which can lead to an increased total body fat percentage. Having total body fat percentage ≥ 25% and ≥35% in males and females respectively is baseline for defining obesity (Zeng et al., 2012).
Table 2.2 Interpreting Total Body Fat Percentage Results

<table>
<thead>
<tr>
<th>Gender</th>
<th>Age</th>
<th>Low</th>
<th>Normal</th>
<th>High</th>
<th>Very high</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>18-39</td>
<td>&lt;8.0%</td>
<td>8.0-19.9%</td>
<td>20.0-24.9%</td>
<td>≥25.0%</td>
</tr>
<tr>
<td>Female</td>
<td>18-39</td>
<td>&lt;21.0%</td>
<td>21.0-32.9%</td>
<td>33.0-38.9%</td>
<td>≥39.0%</td>
</tr>
</tbody>
</table>

Source: Gallagher et al., 2000

2.5.1.3 Visceral Fat

Visceral fat is defined as the fat stored around internal organs such as pancreas, liver, intestines and kidneys in the abdominal cavity of an individual. It is sometimes known as organ fat or intra-abdominal fat and it is stored inside the peritoneal cavity (Mahan & Raymond, 2017). Increased levels of visceral fat leads to abdominal obesity which is a major risk factor in many chronic diseases such as metabolic syndrome and cardiovascular diseases. Visceral fat can be measured using waist circumference and waist-to hip ratio (WHR) or a bioelectrical impedance analyser (Foy et al., 2008).

A review article studying the visceral adipose tissue in children, adolescent and young adults concluded that, visceral fat indices though higher in males than females, had no statistical significance (Foy et al., 2008).

Table 2.3: Classification of Visceral Fat Levels

<table>
<thead>
<tr>
<th>Visceral fat levels</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-9</td>
<td>Normal</td>
</tr>
<tr>
<td>10-14</td>
<td>High</td>
</tr>
<tr>
<td>15-30</td>
<td>Very high</td>
</tr>
</tbody>
</table>

Source: Gallagher et al., 2000
2.6.1 Conclusion

Evidence presented above shows that, culinary knowledge and skills should not be overlooked in the training of undergraduate dietetics students. The culinary competencies of these students who would become registered dietitians in future would affect their ability to execute their roles as dietitians and further predict their nutritional status.
CHAPTER THREE

3.0 METHODS

3.1 Study Design
A cross sectional design was employed for this study.

3.2 Study Site
The study was carried out at the University of Ghana, Accra and University of Health and Allied Sciences in the Volta region of Ghana.

3.3 Study Population
The target populations were all undergraduate dietetics students of University of Ghana and University of Health and Allied Health Sciences.

3.3.1 Inclusion Criteria
All first, second, third and fourth year undergraduate dietetic students of University of Ghana and University of Health and Allied Sciences who consented to the study were included in the study.

3.3.2 Exclusion Criteria
Undergraduate dietetics students who did not consent to participate were excluded from the study.

3.4 Sampling Technique
All dietetic students in the University of Ghana and the University of Health and Allied Sciences were recruited. Therefore, total enumeration sampling method was used. Eligible participants
who gave their consent to partake in the study completed the questionnaire and their anthropometric measurements were taken after the study procedure was explained.

3.4.1 Sample Size

The sample size included all undergraduate dietetics students of University of Ghana and University of Health and Allied Sciences. There were 63 students in University of Ghana and 115 students in University of Health and Allied Sciences. That gave a total of 178 prospective study participants.

3.4.2 Questionnaire

This study adapted and modified questionnaires developed in similar studies (Ternier, 2010; Vrhovnik, 2012; Schaeffer & Warren, 2013). The questionnaire asked information about their general culinary experiences, their perceived competence in culinary skills and their culinary knowledge. A Likert scale was used as a proxy to measure the culinary competencies of participants due to inadequate kitchen facilities for participants to practically demonstrate their culinary skills. This proxy has been tested and validated by Vrhovnik (2012).

3.4.3 Pre-Testing of Questionnaires

Questionnaire was pretested with 20 undergraduate students from the Nutrition and Food Science Department from the University of Ghana.

3.5 Procedure for Data Collection

The Department of Nutrition and Dietetics of University of Ghana and University of Health and Allied Sciences were contacted for the current list of undergraduate dietetics students. Students were invited to partake in the study through face to face interaction. Questionnaires were hand delivered to students after seminars and lectures.
3.5.1 Anthropometric Measurements

3.5.1.1 Height

Height of participants was measured to the nearest 1 cm using the Seca 213 stadiometer. Participants were made to stand upright on a base plate without shoes with their heads in Frankfurt’s plane position and back straight, feet together and heels touching the back of the plate. The head plate was lowered to touch the top of the head and height noted to the nearest 0.1 cm.

3.5.1.2 Weight, Visceral and Total Body Fat

Body weight, visceral and total body fat were measured using a Full Body Sensor Body Composition Monitor and Scale (Omron BF511), with participants dressed in light clothing. Participants after wiping their feet and palms clean with tissues provided, stood barefoot on designated spots for feet on the bioelectrical impedance analysis (BIA) and held the grip electrode with their hands firmly. Their arms were horizontally raised at a 90° angle, and their elbows extended. The designated spots contained two electrodes from which small electrical current, undetectable to the individual was passed. The BIA works on the principle that muscle and other lean tissues are rich in water hence a good conductor of electricity while fat is a poor conductor.

3.6 Data Management Plan

Data from the questionnaire were entered and stored on a password protected personal computer. Questionnaires were kept under lock.
3.7 Analysis of Data

Data gathered was analysed using Statistical Package for Social Sciences (SPSS) Version 20.0. Knowledge scores were calculated for each participant by adding up the total number of correct answers for the knowledge questions. Perceptions of culinary skills were also calculated for each participant by ranking each response on a scale from 1 to 5 where 1 indicates low confidence and 5 indicates high confidence. Descriptive data was summarized using charts, figures and tables. The Independent Sample T-test and ANOVA were used to compare knowledge scores of dietetics students by institutions, gender and academic level. The non-parametric test (chi-square) was used to analyse the differences in culinary knowledge responses. The relationship between knowledge score and nutritional status of students was also analysed using linear regression. Statistical significance was set at p<0.05.

3.8 Ethical Consideration

Approval for the study was obtained from the Ethical and Protocol Review Committee of the College of Health Sciences, University of Ghana. Permission was sought from the Heads of Department of the Nutrition and Dietetics departments of both universities.

Written informed consent was obtained from students before they were recruited into the study. Confidentiality of all information received from the study was ensured.
CHAPTER FOUR

4.0 RESULTS

This study surveyed all undergraduate dietetics in UG and UHAS. The response rate was 87.1% with 155 out of 178 students consenting and participating in the study.

Majority of the respondents were females, 60.7% from UG and 68.9% from UHAS. Also 71.4% and 60.6% of students in UG and UHAS respectively, were within the ages of 18-21 years with a mean age of 20.77 ± 2.00 years.

Table 4.1: Descriptive characteristics of participants, n (%) 

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>UG n=56</th>
<th>UHAS n=99</th>
<th>Total N=155</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>22 (39.3)</td>
<td>31 (31.3)</td>
<td>53 (34.2)</td>
</tr>
<tr>
<td>Female</td>
<td>34 (60.7)</td>
<td>68 (68.9)</td>
<td>102 (65.8)</td>
</tr>
<tr>
<td><strong>Academic levels of participants</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year one</td>
<td>14 (25)</td>
<td>30 (30.3)</td>
<td>44 (28.4)</td>
</tr>
<tr>
<td>Year two</td>
<td>15 (26.8)</td>
<td>29 (29.3)</td>
<td>44 (28.4)</td>
</tr>
<tr>
<td>Year three</td>
<td>12 (21.4)</td>
<td>34 (34.3)</td>
<td>46 (29.7)</td>
</tr>
<tr>
<td>Year four</td>
<td>15 (26.8)</td>
<td>6 (6.1)</td>
<td>21 (13.5)</td>
</tr>
<tr>
<td><strong>Age ranges</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-21</td>
<td>40 (71.4)</td>
<td>60 (60.6)</td>
<td>100 (64.5)</td>
</tr>
<tr>
<td>22-24</td>
<td>14 (25.0)</td>
<td>35 (35.4)</td>
<td>49 (31.6)</td>
</tr>
<tr>
<td>25-27</td>
<td>2 (3.6)</td>
<td>4 (4.0)</td>
<td>6 (3.8)</td>
</tr>
</tbody>
</table>
4.1 Culinary Knowledge of Participants

Culinary knowledge assessment comprised of 13 questions which were scored as either correct or incorrect response.

Majority (72.3%) of students did not know the best time to thicken stew (Table 4.2). Also, 81.3% of students did not know the important characteristics to look out for when choosing cooking oils for deep frying whilst majority of students (70.3%) knew how to sauté vegetables. Almost all the students (96.1%) knew the meaning of deep frying with 89.0% being familiar with the principles of steaming (Table 4.2).

<table>
<thead>
<tr>
<th>Culinary knowledge</th>
<th>Incorrect</th>
<th>Correct</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sautéing of foods</td>
<td>46 (29.7)</td>
<td>108 (70.3)</td>
<td>≤0.001*</td>
</tr>
<tr>
<td>The significance of allowing an item to rest after it has been roasted</td>
<td>89 (57.4)</td>
<td>65 (42.6)</td>
<td>0.053</td>
</tr>
<tr>
<td>Steaming of foods</td>
<td>60 (38.7)</td>
<td>94 (61.3)</td>
<td>0.006*</td>
</tr>
<tr>
<td>Examples of moist cooking techniques.</td>
<td>88 (56.8)</td>
<td>66 (43.2)</td>
<td>0.076</td>
</tr>
<tr>
<td>The most appropriate time to thicken a sauce</td>
<td>112 (72.3)</td>
<td>42 (27.7)</td>
<td>≤0.001*</td>
</tr>
<tr>
<td>Preparation of food items about to be stirred- fried</td>
<td>64 (41.3)</td>
<td>90 (58.7)</td>
<td>0.036*</td>
</tr>
<tr>
<td>The most important considerations when choosing oils for deep frying</td>
<td>137 (88.4)</td>
<td>17 (11.6)</td>
<td>≤0.001*</td>
</tr>
<tr>
<td>Cooking medium (oil) best suited for deep frying</td>
<td>126 (81.3)</td>
<td>29 (18.7)</td>
<td>≤0.001*</td>
</tr>
<tr>
<td>Ingredients best suited for thickening stews and braises</td>
<td>84 (54.2)</td>
<td>71 (45.8)</td>
<td>0.296</td>
</tr>
<tr>
<td>The correct order to leach vegetables</td>
<td>102 (65.8)</td>
<td>53 (34.2)</td>
<td>≤0.001*</td>
</tr>
<tr>
<td>Techniques of deep-frying</td>
<td>6 (3.8)</td>
<td>149 (96.1)</td>
<td>≤0.001*</td>
</tr>
<tr>
<td>Techniques of steaming foods</td>
<td>17 (11.0)</td>
<td>138 (89.0)</td>
<td>≤0.001*</td>
</tr>
<tr>
<td>Difference between broiling and grilling</td>
<td>96 (62.0)</td>
<td>59 (38.0)</td>
<td>0.003*</td>
</tr>
</tbody>
</table>

Non-parametric test (chi-square), *significant at p<0.05.
4.1.1 Culinary Knowledge Score of Participants

The total knowledge score for each participant was calculated by adding up the number of correct responses. An overall score of 13 was expected for each participant. The mean knowledge score for all participants was 6.44 ± 2.08. Dietetics students from UHAS had significantly higher culinary knowledge score of 6.86 ± 1.77 compared to their counterparts from UG who had 5.71 ± 2.38 (Table 4.3). There was also a significant difference between mean culinary knowledge score of males and females student (p= 0.025), with females having a higher knowledge score of 6.71 ± 1.93 against their male counterparts who had 5.92 ± 2.28(Table 4.3).

<table>
<thead>
<tr>
<th></th>
<th>Mean ± SD</th>
<th>Mean ± SD</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>University</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>UG</td>
<td>5.71 ± 2.38</td>
<td>6.86 ± 1.77</td>
<td>0.001*</td>
</tr>
<tr>
<td>UHAS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>5.92 ± 2.28</td>
<td>6.71 ± 1.93</td>
<td>0.025*</td>
</tr>
<tr>
<td>Female</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Independent Sample T test, significant at * p<0.05

Although there was no significance in the mean scores among the various year levels, students in their final year had higher culinary knowledge mean scores. (Table 4.4).

<table>
<thead>
<tr>
<th>Academic Level</th>
<th>Mean ± SD</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year one</td>
<td>5.89 ± 2.19</td>
<td></td>
</tr>
<tr>
<td>Year two</td>
<td>6.40 ± 2.08</td>
<td></td>
</tr>
<tr>
<td>Year three</td>
<td>6.38 ± 2.20</td>
<td>0.070</td>
</tr>
<tr>
<td>Year four</td>
<td>6.48 ± 2.38</td>
<td></td>
</tr>
</tbody>
</table>

P-value from ANOVA
4.1.2 Culinary Knowledge Score Categorization

Culinary knowledge scores of students were classified as either poor, fair or good. A culinary knowledge score of 9 and above (≥70%) was considered good, scores between 5 and 8 (50-69%) were marked as fair and scores below 5 (<50%) was considered poor. Majority of students (62%) had fair culinary knowledge scores (Figure 4.1).

![Culinary knowledge score category](image)

≥70% = Good, 69-50% = Fair and <50% = Poor

Figure 4.1: Percentages of culinary knowledge score category of participants

4.2 Nutritional Status of Study Participants

The mean BMI for all participants was 22.15 ± 3.84 kg/m². Majority of students (71.0%) had BMI whilst more than half (57.2%) had body fat percentage within the normal ranges. A very small percentage (3.8%) of the students were obese (Table 4.5). Almost all respondents (99.3%) had normal visceral fat levels.
Table 4.5: Nutritional status of respondents, n (%)

<table>
<thead>
<tr>
<th>BMI Category</th>
<th>UG n=56</th>
<th>UHAS n=99</th>
<th>Total N=155</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>3 (5.3)</td>
<td>14 (14.1)</td>
<td>17 (11.0)</td>
</tr>
<tr>
<td>Normal</td>
<td>40 (71.4)</td>
<td>70 (70.7)</td>
<td>110 (71.0)</td>
</tr>
<tr>
<td>Overweight</td>
<td>9 (16.1)</td>
<td>13 (13.1)</td>
<td>22 (14.2)</td>
</tr>
<tr>
<td>Obese</td>
<td>4 (7.1)</td>
<td>2 (2.0)</td>
<td>6 (3.8)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total body fat category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
</tr>
<tr>
<td>Normal</td>
</tr>
<tr>
<td>High</td>
</tr>
<tr>
<td>Very high</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Visceral fat category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
</tr>
<tr>
<td>High</td>
</tr>
</tbody>
</table>


Total body fat % interpretation: Males between 18-39 years: <8.8% = Low, 8.0-19.9%= Normal, 20.0-24.9%= High and ≥25.0= Very high. Females between 18-39 years: <21.0%= Low, 21.0-32.9%= Normal, 33.0-38.9%= High and ≥39.0%= very high.

Visceral fat categorization: 1-9= Normal, 10-14= High and 15-30= Very high.
Source: Gallagher et al., 2000

4.3 Relationship between Culinary Knowledge Score and Nutritional Status (BMI)

Table 4.6: Comparison of Culinary Knowledge Scores by Nutritional Status (BMI)

<table>
<thead>
<tr>
<th>BMI Status</th>
<th>Mean± SD</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>7.00 ± 1.41</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Normal</td>
<td>6.29 ± 2.16</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Overweight</td>
<td>6.77 ± 2.00</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>Obese</td>
<td>6.33 ± 2.58</td>
<td>4</td>
<td>10</td>
</tr>
</tbody>
</table>
The mean culinary knowledge scores of participants based on their nutritional status (BMI) showed that, students who were underweight had the highest mean score (7.00 ± 1.41), whilst students with normal BMI had the lowest mean score (6.29 ± 2.16).

A linear regression analysis established that Body Mass Index (BMI) could not significantly predict culinary knowledge scores, [F (1, 152) = 0.307, \( p = 0.580 \)]. Body Mass Index accounted for only 2% of the observed variability in culinary knowledge scores.

### 4.4 Perceived Culinary Skills of Participants

The perceived culinary skills of students were assessed using a Likert scale ranging from 1-5 where one was poor competency and five excellent competency. This proxy was employed to measure their culinary skills competencies due to inadequate kitchen facilities for participants to practically demonstrate their culinary skills. There were a total of 22 culinary skills questions used for this study.

Perceived culinary skills ranged from 2.95 ± 1.496 to 4.48 ± 0.956 (Table 4.5). The culinary skills with the highest and lowest frequency were “Cook grains such as rice and wheat?” and “Read recipes?” respectively.
<table>
<thead>
<tr>
<th>Culinary skill</th>
<th>Mean ± SD</th>
<th>Poor</th>
<th>Fair</th>
<th>Average</th>
<th>Very good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparing foods for cooking by chopping, mixing and stirring</td>
<td>4.21 ± 1.29</td>
<td>6 (3.9)</td>
<td>5 (3.2)</td>
<td>28 (18.1)</td>
<td>36 (23.2)</td>
<td>79 (51.0)</td>
</tr>
<tr>
<td>Use different methods such as boiling, stir-frying, steaming and grilling</td>
<td>3.72 ± 1.21</td>
<td>8 (5.2)</td>
<td>22 (14.4)</td>
<td>27 (17.4)</td>
<td>47 (30.3)</td>
<td>51 (32.9)</td>
</tr>
<tr>
<td>The preparation of banku and neat fufu</td>
<td>3.48 ± 1.58</td>
<td>28 (18.1)</td>
<td>17 (11.0)</td>
<td>20 (12.9)</td>
<td>33 (21.3)</td>
<td>57 (36.8)</td>
</tr>
<tr>
<td>Use different equipment such as stove, microwave and oven for cooking</td>
<td>3.59 ± 1.30</td>
<td>14 (9.0)</td>
<td>18 (11.6)</td>
<td>36 (23.2)</td>
<td>36 (23.2)</td>
<td>51 (32.9)</td>
</tr>
<tr>
<td>Use different local equipment such as earthen ware (asanka), mortar and pestle</td>
<td>3.74 ± 1.36</td>
<td>15 (9.7)</td>
<td>17 (11.0)</td>
<td>27 (17.4)</td>
<td>30 (19.4)</td>
<td>66 (42.6)</td>
</tr>
<tr>
<td>Preserving food using methods such as freezing, salting, dehydrating and/or smoking</td>
<td>3.53 ± 1.32</td>
<td>14 (9.0)</td>
<td>23 (14.8)</td>
<td>35 (22.6)</td>
<td>33 (21.3)</td>
<td>50 (32.3)</td>
</tr>
<tr>
<td>Know how long certain foods ingredient such as yam, rice, pasta, banku and cassava takes to cook</td>
<td>3.96 ± 1.20</td>
<td>9 (5.8)</td>
<td>12 (7.7)</td>
<td>24 (15.5)</td>
<td>41 (26.5)</td>
<td>69 (44.5)</td>
</tr>
<tr>
<td>Handling, storing and preparing food safely</td>
<td>4.19 ± 0.94</td>
<td>1 (0.6)</td>
<td>7 (4.5)</td>
<td>29 (18.7)</td>
<td>42 (27.1)</td>
<td>76 (49.0)</td>
</tr>
<tr>
<td>Cooking grains such as rice and wheat</td>
<td>4.48 ± 0.96</td>
<td>5 (3.2)</td>
<td>4 (2.6)</td>
<td>9 (5.8)</td>
<td>30 (19.4)</td>
<td>1.7 (69.0)</td>
</tr>
<tr>
<td>Cooking vegetable such as kontomire, tomatoes and garden eggs</td>
<td>4.02 ± 1.24</td>
<td>9 (5.8)</td>
<td>14 (9.0)</td>
<td>21 (13.5)</td>
<td>32 (20.6)</td>
<td>79 (51.0)</td>
</tr>
<tr>
<td>Cooking meat including fish and poultry</td>
<td>4.17 ± 1.20</td>
<td>6 (3.9)</td>
<td>14 (9.0)</td>
<td>21 (13.5)</td>
<td>20 (12.9)</td>
<td>94 (60.6)</td>
</tr>
</tbody>
</table>
Table 4.8: Perceived culinary skills competencies of dietetics undergraduate students cont’d

<table>
<thead>
<tr>
<th>Culinary skill</th>
<th>Mean ± SD</th>
<th>Poor</th>
<th>Fair</th>
<th>Average</th>
<th>Very good</th>
<th>Excellent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cook foods such as groundnuts, plantain, corn and beans by roasting</td>
<td>3.04 ± 1.34</td>
<td>25 (16.1)</td>
<td>30 (19.4)</td>
<td>44 (28.4)</td>
<td>26 (16.8)</td>
<td>30 (19.4)</td>
</tr>
<tr>
<td>Prepare a well-balanced meal</td>
<td>4.02 ± 1.05</td>
<td>3 (1.9)</td>
<td>13 (8.4)</td>
<td>26 (16.8)</td>
<td>49 (31.6)</td>
<td>64 (41.3)</td>
</tr>
<tr>
<td>Prepare more than one food item so that they are ready at the same time</td>
<td>3.51 ± 1.50</td>
<td>16 (10.3)</td>
<td>19 (12.3)</td>
<td>40 (25.8)</td>
<td>38 (24.5)</td>
<td>41 (26.5)</td>
</tr>
<tr>
<td>Compare food prices to save money</td>
<td>3.85 ± 1.20</td>
<td>8 (5.2)</td>
<td>17 (11.0)</td>
<td>25 (16.1)</td>
<td>46 (29.7)</td>
<td>59 (38.1)</td>
</tr>
<tr>
<td>Read nutrition labels to make healthy choices</td>
<td>3.49 ± 1.31</td>
<td>16 (10.3)</td>
<td>19 (12.3)</td>
<td>39 (25.2)</td>
<td>35 (22.6)</td>
<td>46 (29.7)</td>
</tr>
<tr>
<td>Plan meals for a week</td>
<td>3.08 ± 1.48</td>
<td>35 (22.6)</td>
<td>22 (14.2)</td>
<td>30 (19.4)</td>
<td>32 (20.6)</td>
<td>36 (23.2)</td>
</tr>
<tr>
<td>Read recipes</td>
<td>2.95 ± 1.50</td>
<td>38 (24.5)</td>
<td>29 (18.7)</td>
<td>23 (14.8)</td>
<td>32 (20.6)</td>
<td>33 (21.3)</td>
</tr>
<tr>
<td>Use substitutes in recipes if you don’t have a specific ingredient</td>
<td>3.18 ± 1.44</td>
<td>29 (18.7)</td>
<td>23 (14.8)</td>
<td>32 (20.6)</td>
<td>33 (21.3)</td>
<td>38 (24.5)</td>
</tr>
<tr>
<td>Change recipes to make them healthier</td>
<td>3.35 ± 1.34</td>
<td>17 (11.0)</td>
<td>26 (16.8)</td>
<td>40 (25.8)</td>
<td>29 (18.7)</td>
<td>43 (27.7)</td>
</tr>
<tr>
<td>Use left overs to prepare new meals</td>
<td>3.05 ± 1.58</td>
<td>34 (21.9)</td>
<td>31 (20)</td>
<td>23 (14.8)</td>
<td>27 (17.4)</td>
<td>40 (25.8)</td>
</tr>
<tr>
<td>Teach your friends and family how to cook</td>
<td>3.50 ± 1.31</td>
<td>13 (8.4)</td>
<td>28 (18.1)</td>
<td>27 (17.4)</td>
<td>42 (27.1)</td>
<td>45 (29.0)</td>
</tr>
</tbody>
</table>
4.5 General Culinary Experiences of Participants

Majority of students, 95% indicated that they preferred home cooked meals to convenience foods (Figure 4.2).

![Importance of home cooked meals to participants](image1)

**Figure 4.2: Preference for home cooked meals**

Minority of participants indicated that they did not have basic cooking ingredients in their hostels (Figure 4.3).

![Possession of basic cooking ingredients in hostels](image2)

**Figure 4.3: Participants who had basic cooking ingredients in their hostel**
When participants were asked of the number of occasions they had eaten convenience foods within the last 24 hours, 55% of participants responded to 1-3 times, whilst 35.5% indicated that they have had no convenient food within the stipulated time (Figure 4.4).

Figure 4.4: Rate of convenience foods consumption within 24 hours

Figure 4.5: Meal students spend most time preparing
Figure 4. 6: Average time spent by participants in meals preparation

Figure 4. 7: Number of people participants are responsible for preparing their meals
Sources where students first learnt to cook

- FAMILY AND FRIENDS: 96.10%
- THE MEDIA: 0%
- SCHOOL: 2.60%
- I DON'T HOW TO COOK: 1.30%

Figure 4.8: How participants first learnt how to cook

How participants would like to learn more culinary skills

- Videos on the internet: 34.80%
- Through recipe books: 12.30%
- Family and friends: 51%
- Not interested: 1.90%

Figure 4.9: How participants would like to improve their culinary skills
Figure 4.10: Biggest influence in food preparation

<table>
<thead>
<tr>
<th>Influence</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Money and health</td>
<td>43.20%</td>
</tr>
<tr>
<td>Culture and family</td>
<td>9.70%</td>
</tr>
<tr>
<td>Availability of food items</td>
<td>45.80%</td>
</tr>
<tr>
<td>Media</td>
<td>1.30%</td>
</tr>
</tbody>
</table>

Participants' biggest influence on meal preparation
CHAPTER FIVE

5.0 DISCUSSION

The increase in non-communicable diseases in Ghana has led to a growing demand for a more culinary-focused approach to healthcare (Canter et al., 2007). In Ghana, dietitians are responsible for training and supervision of hospital catering staff on preparation of therapeutic meals (Asante et al., 2014). Dietitians are responsible for the dietary management of patients which often involves the modification of meals/recipes and cooking methods (Asante et al., 2014). For this reason the dietitian should have the ability to demonstrate the culinary skills they are advising others to use (Begley & Gallegos, 2010). They must also have an extensive knowledge of foods as well as their preparation in order to successfully educate and motivate clients, caregivers and other health professionals to make better food and culinary choices (Begley & Gallegos, 2010).

The aim of this study was to assess the culinary knowledge, skills and nutritional status of undergraduate dietetics students in University of Ghana and University of Health and Allied Sciences.

5.1.1 Background Characteristics of Participants

In this study, 155 undergraduate students participated from both institutions. There were 56 respondents from UG of which 60.7% were females whilst UHAS had 99 participants of which 68.9% were also females. This is similar to findings of Gheller & Lordly (2015) who found 95% of Canadian dietitians to be females (Gheller & Lordly, 2015). This also confirms another study also stated that dietetics is traditionally a female profession (Krieger, 2014). This could be because society has always considered food, its preparation and administration as the job of a woman. The ages of undergraduate dietetics students ranged from 18-27 years with a mean and standard deviation 20.77 ± 2.00 years. More than half (64.5%) of participants were within the
18-21 age ranges whilst only 3.8% were above 24 years. This is similar to a 2015 report from the University of Michigan which stated that the average age of their degree seeking students was 20 years. The report also stated that only 1.7% of their students were above 24 years (Arbor, 2015). However, a survey of online college students reported that, the mean age of online undergraduate students has decreased from 34 years in 2012 to 29 years in 2016 (Clinefelter & Aslanian, 2016).

5.1.2 Culinary Knowledge of Participants

The study assessed the culinary knowledge of undergraduate dietetics students by giving participants 13 validated culinary questions (Schaeffer & Warren, 2013) on various culinary knowledge. Majority of participants (70.3%) answered correctly on how to sauté vegetables. There was a significant difference between their correct and incorrect responses ($p \leq 0.001$). Also more than half (61.3%) of students knew the correct technique in steaming foods with the difference in their responses being significant, $p = 0.006$. These cooking methods are healthy techniques mostly recommended by dietitians for their clients in recipe modification (Bastin, 2000). Dietetics students being familiar with these cooking methods would be helpful in the execution of their duties. When asked about the principles of deep frying, nearly all (96.1%) the dietetics students responded correctly. This could be attributed to the fact that, deep frying is a common meal preparation method in Ghana. Majority of our main meals, snacks and desserts are made employing this method of cooking. Majority of students being able to correctly answer these questions is a good indicator to the depth of their culinary knowledge of students. As stated by Schaeffer and Warren, adequate knowledge of food and its preparation play an important role in all areas of dietetics practice (Schaeffer & Warren, 2013).
Knowledge scores were calculated for each participant by adding up the total number of correct answers for the culinary knowledge questions. An overall score of 13 was expected from each participant. The mean score for all participants was 6.44 ± 2.08 which falls within fair culinary knowledge categorization of this study. This could be an indication of inadequate or poor culinary training of undergraduate students which has resulted in poor culinary knowledge strength. It could also be a reflection of students’ lack of interest in the culinary aspect of dietetics practice (Watson & Barrett, 2001). There was a significant difference between the mean culinary knowledge scores between genders, \( p = 0.025 \) with females having a higher score of 6.71 ± 1.93 against male participants who had 5.92 ± 2.28. This agrees with Backer & Hudders (2016) who stated that despite the fact that men's cooking seems to be on the rise, women have always and continue to engage in daily cooking practices more frequently. This could be a contributing factor to the higher mean scores in females. The study also found that, dietetics students from UHAS had a significantly higher culinary score of 6.86 ± 1.77 compared to their counterparts in UG who had a score of 5.71 ± 2.38, \( p = 0.010 \). This could be attributed to the differences in gender distribution between the two institutions as UHAS had a higher percentage (43.9%) of female respondents as compared to respondents in UG (21.9%).

There was no significant difference in mean scores between the different academic levels, \( p = 0.070 \), however, numerically, participants in year four had the highest culinary knowledge scores (6.48 ± 2.38) whilst students in year one had the lowest culinary knowledge mean scores (5.89 ± 2.19). This could be attributed to the length of time spent in culinary training between the different academic levels. This is also in agreement with the 2016 study by Cooper et al when they assessed the perceived culinary knowledge of dietetics students in second and third years enrolled in the Baccalauréat spécialisé en sciences de la nutrition program. They concluded that,
perceived culinary knowledge was proportional to the number of years spent in academic training (Cooper et al., 2016).

The culinary knowledge scores of participants were classified as either poor, fair or good. A culinary knowledge score of 9 and above (≥70%) was considered good, scores 5-8 (50-69%) was marked as fair and scores below 5 (<50%) was considered poor. Majority of participants (62.0%) had fair culinary knowledge scores. The percentage of students who had good culinary knowledge scores was 20.60% whilst 17.40% of participants had poor culinary knowledge (Figure 4.1). This also affirms (Cooper et al., 2016)’s study which concluded that, overall culinary knowledge of undergraduate dietetics students was moderate in their participants. Dietetics educators from both institutions need to therefore strengthen their curriculum, monitoring and evaluation of their students culinary training to ensure that majority of their students have good culinary knowledge and skills.

5.1.3 Culinary Skills of Participants

The perceived mean values for culinary skills ranges from 2.95 ± 1.50 to 4.48 ± 0.96. Findings from the study suggested that, students had the highest perceived confidence in their ability to cook grains such as rice and wheat as evidenced by a mean value of 4.48 ± 0.96. This may be attributed to the fact that most Ghanaian dishes are made with grains as reported by 2011 Grain and Feed Annual (Grain and Feed, 2012). Participants showed the lowest perceived confidence levels in their ability to read recipes. This could be because recipe reading is not part of the Ghanaian culture. Students are however expected to learn these additional culinary skills (which are universally recognised) during their undergraduate training in order to equip them to administer therapy to clients and patients internationally. Furthermore, 17.4% of students indicated that they had an average perceived skills whilst 42.6% indicated they had excellent
perceived skills in using local equipment in cooking. This could be a result of the modernization of our kitchens in both the home and academic setting. Dietetics practice is both context and cultural specific and hence students need to have excellent skills in the use of local equipment in order to assist the Ghanaian populace with dietary modification especially those from the rural communities.

With regards to the perceived culinary competencies in handling, storing and preparing food safely, nearly half of participants (44.5%) had excellent perceived competencies whilst 18.7% had average perceived culinary skills. This should be an issue of concern for dietetics educators since the Food and Culinary Project list food safety as a fundamental skill for all dietitians (Canter et al., 2007). Also, 41.3% of participants indicated that they had excellent perceived culinary skills in the preparation of well balanced meals whilst only 1.9% of students indicated that they had poor perceived skills.

5.1.4 Nutritional Status of Participants

The nutritional status of participants was assessed using their anthropometric measurements (BMI, total body fat and visceral fat). Majority of students from both institutions, 71.4% and 70.7% from UG and UHAS respectively had BMI within the normal ranges. This accounted for 71.0% of the overall population. It also shows that the lowest percentages for both schools were recorded in the obese category also accounting for 3.8%. Furthermore, minority of participants (11.0%) and (14.2%) were underweight and overweight respectively. This is contrary to a survey in 2013 by the American College Health Association– National College Heath Assessment (ACHA-NCHA) which reported that, 21.7% of undergraduate students are overweight and 12% are obese (ACHA-NCHA, 2013). This could also be attributed to a positive change in eating patterns in undergraduate dietetics students as they advance in their academic training. This
conforms to a 2014 study among South African undergraduate dietetics students which reported that, there was a higher prevalence of eating disorders among first year students, however the rate of these eating disorders decreased among students in their later years of study (Kassier & Veldman, 2014).

Furthermore, this study also recorded 57.2% of participants having total body fat percentages within the normal ranges. Participants within the low and very high total body fat percentage represented 11% of the overall population individually. No student in UG had visceral fat levels outside the normal ranges however, 0.7% of participants in UHAS had high visceral fat levels. This could be attributed to the improved eating patterns of dietetics students as more than one third (35.5%) of participants indicated that they had not consumed convenience foods within a 24 hour period (Fig 4.4) (Kassier & Veldman, 2014).

5.1.5 Relationship between Culinary Knowledge and Nutritional Status of Participants

A linear regression analysis established that, nutritional status (BMI) could not significantly predict culinary knowledge scores, F(1, 152)= 0.307, \( p=0.580 \). BMI accounted for only 2% of the observed variability in culinary knowledge scores. Thus a change in BMI status of a participant does not imply a change in his/her culinary knowledge level.

Majority 95% indicated that they preferred home cooked meals to convenience foods. However, when students were asked of their consumption of convenience foods as a meal within the last 24 hours, 55.5% indicated 1-3 times, 5.2% responded 4-5 times, 3.8% stated more than 5 times. Furthermore, 35.5% of participants stated that they have had no convenience foods. These results are in agreement with (Canter et al., 2007) which stated that, even though consumers knew the benefits of home cooked meals over convenience foods, they preferred the latter because of convenience.
Also, when participants were asked of how much time they spent in making a meal, 47.7% indicated that they spent 31-60 minutes, 42.0% responded to 15-30 minutes whilst 7.1% and 3.2% responded to less than 15 minutes and “I do not cook meals” respectively. The length of time spent in meals preparation and their inability to cook may also be a contributing factors to students’ preference for convenience foods (Schaeffer & Warren, 2013).

Majority of participants (96.1%) indicated that they first learnt how to cook from their family and friends, with 2.6% learning culinary skills from school. Also, no student responded to first learning how to cook from the media. This is contrary to the findings of Cooper et al, 2016 which reported that, 25% of dietetics students obtained their culinary skills from their family and friends whilst 27% of their population first learnt how to cook from the university (Cooper et al., 2016). This could be attributed to the socialization system of the Ghanaian culture where children are taught how to cook at an early age.

When participants were asked how they would like to improve their culinary skills, 51% indicated that they would like to learn from their family and friends, 34.8% responded to videos on the internet. Others (12.3%) also opted to learn through recipe books whilst 1.9% of participants were not interested in improving their skills. Participants opting to improve their culinary skills from friends and family could be attributed to the high tuition fees for culinary lessons in Ghana. Also, learning culinary skills through videos on the internet could be convenient and affordable for students. Participants were further asked what their biggest influence in their meals preparation was. Close to half (45.8%) responded to availability of food items whilst 43.2% were influenced by their economic status and health. Others stated that culture and religion (9.7%) and media (1.3%) were their biggest influence. This finding is in agreement with a study by Chaparro et al which stated that, only 21% of undergraduate students
sampled in their study were food secured while 24% of students were at risk of food insecurity. This coupled with their economic status were big influences in their choice of food and meal preparation methods (Chaparro, Zaghloul, Holck, & Dobbs, 2009).

5.2 Conclusion

Findings of this study indicated that, dietetics students in UHAS had significantly higher culinary knowledge scores than those in UG. Participants in year four had the highest culinary knowledge scores whilst year one students had the lowest. Although majority of students preferred home cooked meals to convenience foods, majority of them patronized convenience foods at least 1-3 times a day. Majority of participants had normal nutritional status (BMI, Total body and visceral fat). BMI status of students did not predict the knowledge scores of students.

5.3 Limitation

The culinary skills of participants were not assessed through direct observation by the researcher to determine their actual culinary skills of dietetics students.

5.4 Recommendations

Both institutions should strengthen their culinary training curriculum for dietetics students. Further research should be done to assess the culinary knowledge and skills of postgraduate dietetics students, dietetics interns and Registered Dietitians.
REFERENCES


delivery in Ghana (pp. 33–43).


Lippincott Williams & Wilkins, 20–21.


Carlsson, M. (2011). *Nutritional Status, Body Composition and Physical Activity among Older People Living in Residential Care Facilities*.


APPENDICES

Participants Information Sheet

Study Title: Culinary Knowledge and Skills of Undergraduate Dietetics Students in Selected Universities in Ghana

Culinary skills refers to the knowledge, confidence and efficiency of food preparation. These skills are essential to prepare and provide regular, nutritious meals and snacks for an individual or family. Food preparation skills among adults have been shown to account for food choices and consumption. The increase in the consumption of convenience foods has led to the rise in chronic diseases. These foods are high in fats, salt (Sodium) and other artificial spices which are major contributors to chronic diseases. This has led to a growing demand for a more culinary-focused approach to health. In Ghana, dietitians are responsible for the training and supervision of hospital catering staff on preparation of therapeutic meals. Dietitians must have an extensive knowledge of foods and their preparation in order to successfully counsel their patients to increase the quality of nutrients in their meals. For this reason, dietitians should have the ability to demonstrate the cooking skills they are advising others to use.

This study will investigate the culinary knowledge and skills of undergraduate dietetics students (who are the future workforce for the dietetics profession). You will complete a short questionnaire and your Body Mass Index (BMI), Total Body Fat and Visceral Fat will also be taken. There will be no blood sample collection in this study. Your participation in this study is entirely voluntary. Data collected will be used for research purposes only and kept confidential on a password protected computer and filled questionnaire will be kept in a locked cabinet with access only to the researcher. There is no direct health risk associated with your participation in
this study except for a little discomfort in filling the questionnaire and anthropometric measurements. You will benefit from this study by getting to know your nutritional status.

For further enquires about this research, you can contact the following addresses below:

1. The Researcher, Pamela Effah Achiaa. Tel: 0500482057, email: peffahachiaa@gmail.com. School of Biomedical and Allied Health Sciences, Korle-Bu, Accra, Ghana.

2. Supervisor of the study, Mrs Laurene Boateng. Department of Nutrition and Dietetics, College of Biomedical and Allied Health Sciences, Korle-Bu, Accra, Ghana.
Consent Form

I, EFFAH ACHIAA PAMELA, have fully explained the nature and purpose of the above described research, its procedures, risks and benefits. I have allowed the subject to ask questions and have answered and will answer to the best of my ability, all questions relating to the study.

I, ..................................................... have read and understood the nature of the proposed study. I am aware of the fact that I can withdraw from the study at any point in time without receiving any objection. My signature below indicates that I have given my consent to participate in this study.

........................................................................................................................................................................

Name of Researcher  Signature  Date

........................................................................................................................................................................

Name of Participant  Signature  Date
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>[ ] Male</td>
</tr>
<tr>
<td>[ ] Female</td>
<td></td>
</tr>
<tr>
<td>Academic Level</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
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<tr>
<td>Height</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td></td>
</tr>
<tr>
<td>Body Mass Index</td>
<td></td>
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<tr>
<td>Total Body Fat</td>
<td></td>
</tr>
<tr>
<td>Visceral Fats</td>
<td></td>
</tr>
</tbody>
</table>
Questionnaire on Culinary Knowledge and Skills of Undergraduate Dietetics Students

General Culinary Experiences

The following set of questions will assess your general culinary experiences. Choose the option that best describes your current experience by circling.

1) Is eating a meal cooked at home important to you?
   a) Yes
   b) No

2) Basic ingredients are foods such as pasta, rice, fresh, frozen or canned fruits and vegetables, meats and seasoning. Do you have some or all of these basic ingredients in your home/hostel?
   a) Yes
   b) No

3) Convenience foods are pre-packed foods that are bought and prepared easily. For example: Meddiner, KFC, roadside ‘waakye’ frozen chicken fingers. In the past 24 hours, how many times have you eaten convenience foods for breakfast, lunch or dinner?
   a) None
   b) 1-3 times
   c) 4-5 times
   d) More than 5 times

4) Which meal do you spend the most time preparing?
a) Breakfast  
b) Lunch  
c) Dinner  
d) I don’t cook meals

5) On average, how much time do you spend on making that meal?  
a) Less than 15 minutes  
b) 15-30 minutes  
c) 31-60 minutes  
d) I don’t cook meals

6) How many people, including yourself, are you responsible for preparing meals for in your hostel?  
a) 1  
b) 2-3  
c) 4-5  
d) I do not prepare meals

7) How would you like to learn to develop more cooking skills?  
a) Through videos on the Internet  
b) Through a book (ex: recipe book)  
c) Family and friends  
d) Not interested
8) How did you first learn to cook?
   a) Family and friends
   b) Media (example: television, magazine, books, etc.)
   c) School
   d) I do not know how to cook

9) What is the **biggest** influence on how you prepare foods (please select only 1):
   - Senses (for example, Taste, smell, presentation, texture)
     a) Money and Health
     b) Culture and Family
     c) Availability of food items
     d) Media (example: television, magazine, books, etc.)

**PERCEPTION OF CULINARY COMPETENCIES**

Using a scale of 1-5, where 1 is **less competent** and 5 is **most competent**, rate your culinary competence for the following culinary skills.

<table>
<thead>
<tr>
<th>How <em>competent</em> are you in the following culinary skills:</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 Prepare foods for cooking by chopping, mixing and stirring?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Use different methods to cook foods such as boiling, stir-frying, steaming and grilling?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 The preparation of banku and/or neat fufu?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13 Use different equipment for cooking; for example, stove, microwave,</td>
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<td></td>
<td>Question</td>
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</tr>
<tr>
<td>14</td>
<td>Use different local cooking equipment? For example: earthen ware (asanka), mortar and pestle?</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Preserve food, for example, freezing, salting, dehydrating or/ and smoking?</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>16</td>
<td>Know how long certain food ingredient (yam, cassava, banku) will take to cook?</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Handle, store and prepare foods safely?</td>
<td></td>
<td></td>
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<tr>
<td>18</td>
<td>Cook grains, for example, rice, wheat?</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Cook vegetables, for example, kontomire, tomatoes and garden eggs?</td>
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<td></td>
<td></td>
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<tr>
<td>20</td>
<td>Cook meat including fish and/ poultry?</td>
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<tr>
<td>21</td>
<td>Cook foods by roasting. Example of foods include: Groundnuts, plantain, corn and beans?</td>
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<td>22</td>
<td>Prepare a well-balanced meal. A well balanced meal is rich in cereals and starchy roots and tubers, moderate in fruits, vegetables and meat and its products and the least amount of fats?</td>
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<td>23</td>
<td>Prepare more than one food item so they are ready at the same time. For example, cooking meat or fish and grains (rice) at the same time?</td>
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<td>24</td>
<td>Compare food prices to save money?</td>
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<td>25</td>
<td>Read nutrition labels to make healthy choices. For example, low fat, low salt, low calorie, high fiber?</td>
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<td>26</td>
<td>Plan meals for the week?</td>
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<td>27</td>
<td>Read recipes?</td>
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Use substitutions in recipes if you don’t have a specific ingredient?

Change recipes to make them healthier. For example, lower sugar, lower fat, lower sodium and higher fibre?

Use leftovers to prepare new meals?

Teach your friends and family how to cook?

COOKING KNOWLEDGE

Choose the most appropriate answer in this section by circling the correct answer.

32) How do we Sauté?
   a) Submerge food in boiling water in a pot on the stovetop
   b) Submerge food in boiling oil in a frying pan on the stovetop
   c) Cook food at medium-high heat with a thin layer of fat in a frying pan on the stovetop

33. Allowing an item to rest after it has roasted
   a) Will give the cook time to prepare the rest of the meal
   b) Stops the carryover cooking of the roast
   c) Redistributes the juices that have accumulated in the centre of the roast

34. Which one below is the correct way to steam food?
   a) Submerge food in water, allow the boiling water to cook the food faster
   b) Partially submerge food in the liquid allowing both the steam and boiling water cook the food
c) Place food in a separate steamer over hot water, allow the steam to cook the food but not come in contact with the water

35. Moist-heat techniques include:
   a) Sautéing, steaming and poaching
   b) Steaming, shallow poaching and deep poaching
   c) Frying, steaming and smoking

36. When preparing a stew, it is best to thicken the sauce
   a) Just before serving
   b) After the vegetables have been cooked and before the liquid is added
   c) After the main item is fully cooked and all the solid ingredients have been removed

37. Food items to be stir-fried are
   a) Cut into portion-size pieces
   b) Usually breaded, using the standard breading procedure
   c) Cut into bite-size pieces, which acts to tenderize the food

38. The most important consideration in choosing oil for deep frying are
   a) Neutral flavor and color and low smoke point
   b) Well-developed flavor and color and a high smoke point
   c) Neutral flavor and color and high smoke point

39. Which cooking medium is best suited for deep-frying?
   a) Olive oil
   b) Seasoned oils
   c) Vegetable oils
40. Which of the following are best used to thicken stews or braises
   
   a) Flour and starch
   
   b) Slurry and a reduction
   
   c) Pureed Vegetable

41. Which one below is the correct order to leach foods such as yam, potatoes and vegetables?

I. Slice food 1/8 inch thick

II. Peel and place the food in cold water

III. Soak for a minimum of two hours in warm water

IV. Rinse in warm water for a few seconds

V. Rinse under running water for a few seconds

VI. Cook vegetables with five (5) times the amount of water to the amount of vegetables

   a) II, I, IV, III, V, VI
   
   b) II, I, III, VI, V, IV
   
   c) IV, II, III, VI, I, V

Indicate in the next set of questions whether the statement is true or false by circling the correct answer.

42. Deep-frying is completely submerged food in hot oil.

   a) True
   
   b) False

43. When steaming, the steaming vessel should remain open.

   a) True
   
   b) False
44. Broiling is similar to grilling, except the heat source comes from the top.

a) True

b) False
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Dept. of Nutrition and Dietetics
SBAHS
Korle- Bu

ETHICAL CLEARANCE

Protocol Identification Number: CHS-Et/M.6 – P2.12/2017-2018

The Ethical and Protocol Review Committee of the College of Health Sciences on the 1st of March, 2018 unanimously approved your research proposal.

TITLE OF PROTOCOL: “Culinary Knowledge and Skills of Undergraduate Dietetics Students in Selected Universities in Ghana”

PRINCIPAL INVESTIGATOR: Effah Achiaa Pamela

This approval requires that you submit six-monthly review reports of the protocol to the Committee and a final full review to the Ethical and Protocol Review Committee at the completion of the study. The Committee may observe, or cause to be observed, procedures and records of the study during and after implementation.

Please note that any significant modification of this project must be submitted to the Committee for review and approval before its implementation.

You are required to report all serious adverse events related to this study to the Ethical and Protocol Review Committee within seven (7) days verbally and fourteen (14) days in writing.

As part of the review process, it is the Committee’s duty to review the ethical aspects of any manuscript that may be produced from this study. You will therefore be required to furnish the Committee with any manuscript for publication.

This ethical clearance is valid till 5th March, 2019.

Please always quote the protocol identification number in all future correspondence in relation to this protocol.

Signed: ........................................

PROFESSOR ANDREW A. ADJEI
CHAIRPERSON, ETHICAL AND PROTOCOL REVIEW COMMITTEE

cc: Provost, CHS
Dean, SBAHS
Head of Department