AKENTEN APPIAH-MENKA

UNIVERSITY OF SKILLS TRAINING AND ENTREPRENEURIAL DEVELOPMENT

EXAMINING THE FOOD ADDITIVES IN MEALS PREPARED BY COOKS AND MATRONS OF SENIOR HIGH SCHOOLS IN GHANA - A CASE STUDY OF THREE (3) SELECTED SENIOR HIGH SCHOOLS IN THE OLD-TAFO MUNICIPALITY IN THE ASHANTI REGION

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A Dissertation in the Department of Hospitality and Tourism Education, Faculty of Vocational Education, submitted to the School of Graduate Studies, Akenten Appiah-Menka University of Skills Training and Entrepreneurial Development, in partial fulfilment of the requirements for the award of the Master of Technology Education (Catering and Hospitality) degree

DECEMBER, 2020

DECLARATION

STUDENT'S DECLARATION

I ASAMOAH JANET, hereby declare that this thesis is entirely my own original work and has not been submitted either in part or whole for any academic award either in this or other institutions of higher learning, for academic publication or for any other purpose. Where I have consulted other materials or journals, the authors are duly acknowledged and are indicated at the references section.

Signature …… Date……..

SUPERVISOR'S DECLARATION

I declare that this dissertation was written under my supervision and that the candidate has been consistent in his interaction with me for guidance and directions.

……..……... ……

(Date) **DR. MRS. ELLEN OLLU**

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I humbly wish the Almighty God's blessings on them all.

DEDICATION

I wish to dedicate this work to my husband and mother, Mr. Gideon Asamoah and Mrs Agartha Acheampong respectively who have been supporting me both morally and physically which strengthens me and allowed me to get the needed time to conduct this study.

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ABSTRACT

The purpose of this study is to examine the food additives in meals prepared by cooks and matrons of senior high schools in Ghana to find out about the different types of additives; the benefits and the potential harmful effects in the use of some of them; and finally to find some of the best ways which can be adopted to keep ourselves and families safe from the potentially harmful additives. After reviewing a lot of relevant literatures, the model for the research was developed based on three research questions that were asked and in answering those questions, a survey was conducted in three schools with a sample of 150 respondents comprising 18 kitchen staff members and 132 students. After analyzing and grouping all the data under the three research questions, it was discovered that some of the types of additives found in the ingredients used by the kitchen staff for meal preparations included flour improvers, flavor enhancers, color additives, Preservatives, softening/curing agents, and Salt and Sugar used as flavorants and/or preservatives. It was also found that, some of the benefits in the use of additives included preserving; improving/maintaining the color, texture, flavor or the nutritional value of foods; enhancing the safety of foods; and allowing foods to be transported over long distances. Finally, it was found that some of the best ways to adopt to be safe from harmful additives in our foods include trying to avoid most processed foods; checking on ingredient labels of food products for additive contents in order to avoid the harmful or potentially harmful ones; cutting down or lowering the daily intake of salt and sugar; including more wholesome or organic foods in our diets; and reporting any abnormality or additive concerns in food products to the authorities or the FDA for investigations and/or further actions to be taken.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

According to the World Health Organization (WHO), Food additive means "any substance not normally consumed as a food by itself and not normally used as a typical ingredient of the food whether or not it has nutritive value, the intentional addition of which to food for a technological (including organoleptic) purpose in the manufacture, processing, preparation, treatment, packing, packaging, transport, or holding of such food results or may be reasonably expected to result (directly or indirectly), in it or its by-products becoming a component of or otherwise affecting the characteristics of such foods."

For many centuries people have been adding substances to food to either preserve, enhance flavor and/or their color (Burdock & Carabin, 2004). An example of this is the use of salt to preserve meats or adding herbs to enhance the flavor of food. There are many different food additives, and they can be classified as natural or artificial. Most food additives are naturally occurring with a lot of them carrying out a variety of useful functions which are often taken for granted. For instance, foods are subjected to many environmental conditions, such as temperature changes, oxidation and exposure to microbes which can change their original composition. Food additives in these instances play a key role in maintaining the food qualities and characteristics that consumers demand, keeping them safe, wholesome and appealing almost as obtained from the farm to the dining table.

In recent years however, the amount of additives in food has dramatically increased (Sloan, 2004). It is estimated that over 2500 different additives are currently being used in foods (Branen, 2002). Some of these substances have been questioned by scientists as well as some consumers.

For example, common natural food additives such as citrus acid and ascorbic acid are categorized as food preservatives because they work on enzymes and disrupt metabolism in foods which leads to preservation and extension of the shelf life of the foods. Nevertheless, due to their mechanism of action, they may harm the friendly bacteria in our body and that may cause issues such as digestion problems. Also, some well known artificial (synthetic) food colorings such as Tartrazine and Sunset yellow are linked with hyperactivity and migraine headaches in some sensitive children (Food Standards Agency – FSA, 2008).

In Ghana and like many other countries, the use of food additives is limited by specific regulations that generally follow the recommendations by the joint FAO/WHO Expert Committee on Food Additives and the safe use of food additive. Notwithstanding, in order to maintain or improve the safety and reliability of additives in our foods, it is crucial that a great deal of effort is spent to continuously check the use of additives in foods that end up on our tables. It is therefore very important on this background that, additives in meals prepared by cooks and matrons in the country be carefully examined to ensure their safe use and to help avoid the potentially harmful ones that may be on the market.

1.2 Statement of the Problem

Most of the food products that are purchased at the stores and supermarkets have chemical additives in them. Among the several reasons why manufacturers add these chemicals to the foods are to preserve them or improve their texture and stability to ensure they last longer, to increase their sweetness (flavor) and to improve their visual appeal (color) to encourage people to buy. It is clear therefore that generally, the benefits in the use of additives in processed foods on the market are both to the manufacturers and to consumers. However, the importance of food additives to consumers has always been on a health safety aspect. Consumers and scientists have raised questions about the necessity and safety of these additives. Nevertheless, a comprehensive framework of legislations are in place by major regulatory and governing bodies in the world such as the World Health Organization (WHO), European Food Safety Authority (EFSA) and the Food and Drug Administration (FDA) of the United States of America. These legislations also serve as references for food authorities in other countries around the world including Ghana. Apart from the legislations in place, the major regulatory bodies occasionally carry out assessments and tests on all authorized additives to ensure that their addition to foods by manufacturers do not pose any health risks to the population and particularly to the youth of school going age (such as those in the Senior High Schools) who have distinct food intake patterns due to their rapid metabolism rates. Since it requires a high level of expertise and funds before one can embark on safety assessments and tests on chemical additives, it is done by the Scientific Committee on Food (SCF) and the European Food Safety Authority (EFSA) and is available as a public information on the FDA website which is accessible to every country. Notwithstanding, a regular food

additive exposure assessment is still very much required in every country to help ascertain the possible risks of exposure to people in the country.

In Ghana, the use of additives by manufacturers of processed foods on the market is limited by specific regulations made by the Ghana Food and Drug Authority (GFDA) who also periodically conduct checks on products on the market to ensure their compliance to regulations. However, these checks by the authorities are not usually extended to the individual homes, schools and other institutions which represent the end users or final consumers – where some of the products may escape the FDA checks. Hence, a gap is created which requires the need to examine the additives in food products used for meal preparations by end users such as cooks and matrons who prepare meals for a large number of people in schools and other institutions.

1.3 Purpose of the Study

For most people, additives in their food is not a problem in the short term. Yet, some food additives are more likely than others to cause reactions in some sensitive people. It is often the additives that are used to give food a marketable quality such as color, that most commonly cause allergic reactions. Some of these allergic reactions include Digestive disorders such as diarrhea and colicky pains; Nervous disorders like hyperactivity, insomnia and irritability; Respiratory problems such as asthma, rhinitis and sinusitis as well as Skin problems which include hives, itching, rashes and swelling. It is important to realize however that many of the above symptoms on a person may be wrongly attributed to food allergy disorders which in fact could be caused by a different disease altogether (Baig, & Kasim, 2018). The Main Objective Or Purpose Of This Research Is Therefore To Examine The Additives In Food Products Commonly Used By Cooks And Matrons

Of Senior High Schools In Ghana For Meal Preparations To Find Out About The Benefits And Any Possible Health Effects They May Have On Human Health.

1.4 Justification

Food additives are in most of the things we eat. Most people consume additives every day in their diet. There are some common additives that people know about and many others that the average person has no knowledge about. Additives may be classified as flavorings, emulsifiers, thickeners, colorings, preservatives and so on. Salt and sugar for instance are the most common additives that have been used for many years either as flavorings or preservatives. Salt **(**Sodium chloride**)** is used in most processed foods which include cured meats, soups, snack chips, crackers, and others. According to the Center for Science in the Public Interest (CSPI), the level of sodium in salt that is consumed by people every day is probably the single most harmful substance in the food supply since many of the diets of such people are filled with way over the daily amount of sodium intake. This can be deduced from the fact that, the safe use of any additive can be expressed in terms of its acceptable daily intake (ADI) which represents the amount of the substance that can be consumed daily, even for a lifetime, without health hazards. This can be expressed in mg of the additive per kg body weight (WHO, 1987). For instance, the acceptable daily intakes of benzoic acid and its Sodium salts is 0 - 5 mg/kg of the body weight as was approved by the Joint Expert Committee on Food Additives (JECFA) of the WHO in 1996, yet there are other additives that contribute additional sodium to our diets such as monosodium glutamate and sodium benzoate. However, it is also a known fact that diets that are high in sodium can lead to heart diseases. It is these

and other similar concerns that are generally feared by the public when it comes to the use of additives in processed foods.

Therefore, the justification for conducting this study is that, the findings will provide a better understanding of the various food additives in food products that are bought from the market and used for meal preparations. It will also help us to know the benefits and potential harmful effects which these additives may have on our health be it a short or long term.

1.5 Specific Objectives of the Study

The entire research shall be guided by the following specific objectives:

1. To discover the different types of additives in food products used by cooks and matrons of senior high schools in Ghana for meal preparations.
2. To examine the benefits in the use of additives in food products and the potential harmful effects some of them may have on human health.
3. To determine the best ways that cooks, matrons and individuals could adopt in order to keep themselves and others safe from potentially harmful additives when buying food products from the market.

1.6 Research Questions

In order to simplify the data collection and analysis to help arrive at the right conclusions, the following questions were developed from the research guide or the specific objectives:

1. What additive types in food products are used by cooks and matrons in Ghana for meal preparations?

2. What are the benefits and the potential harmful effects of food additives on our health?
3. What are the best ways to be safe from harmful or potentially harmful additives in our foods?

1.7 Significance of the Study

This study will generally throw light on the benefits in the proper use of additives in our foods to the general public. It will also provide awareness on the potentially harmful additives on the market to consumers which include cooks and matrons at the various schools.

The information in the study may serve as a guide to tourism policy makers in making the necessary restructurings to affect changes in the use of certain additives in foods by food sellers.

The study is also is expected to help expose producers and sellers of potential harmful additives.

This will enable users or consumers to differentiate between those that are good to use and those that may be harmful to human health.

1.8 Hypothesis

The use of most food additives is visibly beneficial as it results in preventing the growth of harmful bacteria, preserving its flavor or enhancing its appearance, taste, or other qualities which all aid in the prevention of food spoilage and enhance their supply. However, there are controversies over the use of some of the food additives. This is partly because some individuals are hypersensitive and suffer allergic reactions if they are

exposed to some of these chemical additives. Additionally, some individuals hold the belief that low levels of chronic toxicities and diseases might be caused after prolonged intake of some of the additives. For instance, Benjamin Feingold, M.D. hypothesized to the American Medical Association in 1973 that *the role of food additives is a contributing cause of hyperactivity in children*. This claim which also became known as the "Feingold hypothesis" has since been hotly debated in the scientific community in several literatures, journals and articles.

Notwithstanding, thousands of chemicals additives were approved by the U.S FDA decades ago, when we had far less understanding about their impacts on human health.

Therefore, the hypothesis of this study is based on that of Feingold's which will be investigated in the context of senior high schools in the country. Thus, the notion that some food additives cause reactions or diseases in humans either in the long or short terms will be examined by this study. It is hoped that, by the end of the study the findings would help to arrive at a meaningful conclusions at least within the contexts of the three selected senior high schools.

1.9 Limitations of the Study

Since limitations in researches of this nature are inevitable, financial constraints coupled with limited time frame for the study did not allow the researcher to cover all the schools in the country with cooks and matrons during the study. Additionally, it was not an easy task to get the responses in both segments of the interview and the questionnaire even after managing to get permission from the school authorities. In some cases, the people were either too busy or in a hurry to go somewhere or were just not willing to spare some few minutes of their time to grant the interviews or provide their responses to the

questionnaire. Some who even promised to take their questionnaires home to fill and submit on the next day eventually did not keep up with their promise time. This caused some extension in the days used for the data collection before getting the required responses from the targeted respondents. Due to the above limitations, responses that were obtained from the sampled population and the subsequent analysis that was used to draw the conclusions of the study may not be exactly the same situation in all schools across the country since the study did not cover all schools in the country.

1.10 Delimitation

Due to the aforementioned limitations of the study in the above section, the scope of the research was narrowed to the three public Senior High schools in the *Old-Tafo* municipality namely; Osei Kyeretwie Senior High (OKESS), Al-zaria Islamic Senior High (AZASS) and Uthmaniya Senior High (UTHMASS). The interviews conducted and the survey questionnaires together were limited to a non-randomized sample size of 150 respondents involving the pantry, cooks, matrons and the students. The pantry, cooks and matrons were both interviewed and given a questionnaire whiles a different set of the questionnaire was administered to the sampled students.

Narrowing the scope of the study to a sample size of 150 respondents from three schools enabled the researcher to devote enough time for all aspects of the research within the allowed time frame which included the design and development of the study, collection of data and write up of the study.

1.11 Organisation of the Study

This research work has been organized into five chapters. Chapter One is the introduction which provides comprehensive information about the research to a firsthand reader.

Through background of the study, the chapter expounded on why the researcher chose to conduct the study. The justification for the study, the purpose, specific objectives, research questions, significance of the study, hypothesis, limitations and delimitation of the study are all expatiated in this chapter. The chapter ends with the definitions of some important terms used in the study.

Chapter Two which is the literature review provides an overview of the existing literatures related to the topic as well as the conceptual framework for the study. The chapter does so by reviewing related areas of literatures on the topic and exposing the gap(s) in them so that, the gap(s) can serve as a springboard from which the current study will depart. The chapter ends by laying down the conceptual framework upon which the study is being conducted.

Chapter Three describes the methodology employed for conducting the study. These include the methods used for the population sampling, instruments selection, data collection as well as the methods used for the analysis and interpretation of the collected data.

Chapter Four is dedicated to the presentation of the analysis and results obtained from the data collection process as well as discussions of the findings from the analysis.

Chapter Five concludes the thesis with a summary of the study, recommendations and conclusions.

1.12 Definition of Terms

The following are the operational definitions of some terms used as they appeared in the write up.

Menu: A list of dishes that are served as a meal.

Meal: The food served and eaten in one sitting.

Food Allergies: An unpleasant or severe immune system reaction after a certain food is eaten.

Toxicology: The study of adverse effects of chemical substances on living organisms.

Food product: A substance that can be used or prepared for use as food.

Food additive: Any substance not normally consumed as food itself but is added to foods to perform a technological function such as preservation.

Consumer: A person who eats food and/or its products or the end user of food or its products.

Exposure Assessment: Assessment of the chemical additives that a present in the meal of a person.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter provides a review of literatures related to this study and subsequently lays down the theoretical framework for the development of the research. The review in this study is done by means of critical assessment of related areas of literatures on the topic to identify the gap that will be addressed by this research. This literature review has been structured under the following five themes:

- Definition and concepts of food additives.
- Classification and uses of additives.
- Advantages and disadvantages of food additives.
- Research gap analysis.
- Conceptual framework of the study.

Essentially, the final parts of this chapter will expose the gap in areas of research works that relate to the topic which will in effect justify the rationale behind the choice of the topic for the study. Then, based on the findings from the reviewed literature and the gap analysis, a theoretical framework for conducting the research will be established.

2.1 Definition and Concepts of Food Additives

The third edition of Encyclopedia of Analytical Science (2019), defines food additives as molecules used in the processing of foodstuffs to improve food quality, expiry date, safety, color, stability, flavor, sweetness and other properties of food. A number of authors have also come up with their own versions of the definition which are all quite

similar in meaning. For instance, Daniel M. (2007) defined food additives as chemical substances deliberately added to foods, directly or indirectly in known quantities for purposes of assisting in the processing of foods; preservation of foods; or in improving the flavor, texture, or appearance of foods. Thus, additives according to Daniel M. are added to foods during their processing to increase their shelf life by maintaining the product's consistency, wholesomeness and freshness for a longer time. This makes it possible for consumers to buy and safely store an array of convenient foods without the stress of daily shopping or cooking.

Winter (1994) also stated that food additives are substances that food manufacturers intentionally add to food in small quantities during their production or processing to improve the organoleptics of the food. By this definition, Winter implies that additives are added to foods to improve their properties that affect our sense organs when we eat them. From these definitions, the use of most additives in foods can undoubtedly be said to be beneficial to both manufacturers and consumers since they generally result in improved public health, prevention of spoilage and enhancement of food supply.

Food additives can be referred to as *direct* or *indirect* according to how they get into food substances. Direct food additives are those that are intentionally added to foods for a specific purpose and indirect food additives are those to which the food is exposed during their processing, packaging, or storage (Boca Raton and Smoley, 1993). Therefore, if a substance is added to a food for a specific purpose, it is referred to as a direct food additive. For example, the low-calorie sweetener *aspartame* used in beverages, puddings, yoghurt and other foods, is considered as direct food additive. Many direct food additives are written on the ingredient label of the foods which they are added to. Also, per the

explanation by Boca R. and Smoley, indirect food additives are those that become part of the food in trace amounts during packaging, storage or handling. For example, minute amounts of packaging substances such as metals which include aluminum (foils or laminates), tinplates and tin-free steel; paper or paperboards and plastics may find their way into foods during their storage (Abdulmumeen *et al*., 2012).

It must be emphasized however that due to the perceived outbreaks of food related diseases or illnesses during the past decades with corresponding media attention and outspoken consumer concerns, the use of additives in processed foods has been very carefully controlled by regulatory bodies in countries across the world. For instance, the food and Drugs Administration (FDA) of the USA severely restricts the use of additives in processed foods and therefore has a set of regulatory frameworks to govern the safety, control and the trade of food and food products. These regulatory frameworks were adopted mostly from the *Codex Alimentarius* (Latin word for "food code") which is an international instrument for the harmonization of food standards. It was established through a resolution of the governing bodies of the UN Food and Agriculture Organization (FAO) in 1961 and the World Health Organization (WHO) in 1963. The primary objective of the Codex Alimentarius was to protect consumer health and to ensure fair practices in food trade through elaboration, harmonization and publication of food standards and other related texts.

In Ghana, the Food and Drugs Authority (or FDA, formerly known as the Food and Drugs Board) is the government agency responsible for the implementation of the Food and Drugs Law of 1992, (PNDCL 305B). Thus, the FDA has the mandate to protect and promote public health by ensuring that food and drugs consumed in Ghana are

wholesome and safe in accordance with Part seven of the Public Health Act, 2012, Act 851.

2.2 Classification and Uses of Additives

Most writers classify additives according to their function or the purpose for which they are added to foods. For instance, Madden (1980) classified additives into five groups. They are colorings, flavorings, preservatives, nutritional additives and improvers/physical conditioning additives. She also differentiated the additives as either natural or synthetic; Kinston and Ceserani (2002) also classified additives into twelve groups. They are preservatives, coloring agents, flavoring agents, sweeteners, emulsifying agents, anti oxidants, flour improvers, thickeners, humectants, polyphosphate, nutritional additives and miscellaneous additives (example anti caking agents, anti-foaming agents, enzymes and leavening agents). The above classifications by their respective authors are not different from that of Mehas and Rodgers (1994) who also classified additives into seven groups according to their use namely; preservatives, anti oxidants, stabilizers, buffers, odours, flavors and sweeteners. The following sections are the summary of explanations given by the above mentioned authors for the classifications of food additives.

2.2.1 Food Colorings

A coloring or color additive is any dye, pigment or substance that imparts color when it is added to food or drink. They come in different forms consisting of granules, powders, pastes, and solutions.

Madden (1980) is of the opinion that a food color improves the appearance of food and stimulates appetite. She continued that the color of a food is generally a good indication of its maturity, quality and freshness. Mehas and Rodgers (1994) also stated that color

additives are used to improve or make food more appetizing to customers thereby allowing manufacturers to choose from the wide variety of approved food colors to meet the consumer's preference. These authors also grouped food colorants into two according their source, namely; natural food colorants and synthetic or artificial food colorants.

Natural food colorants

Mehas and Rodgers (1994) and also madden (1980) mentioned in their literatures that natural food colorants are colorants that occur naturally in foods. They include:

- *Carotene or Provitamin "A"*: Coloring pigments found in carrot, tomatoes, pepper, peaches and some shell fishes.
- *Chlorophyll*: A green coloring present in green plants or vegetables.
- *Tannin*: A brown pigment found in tea, coffee, cocoa, beer.
- *Cochineal*: A red coloring made from dried insects.
- *Saffron*: A bright yellow coloring from the dried stigmas of a type of crocus.
- *Caramel*: A brown color obtained by prolongs boiling of sugar.
- *Turmeric*: A yellow spice used in curry and eastern dishes.
- *Annatto*: A yellow coloring used to give butter and cheese a consistent yellow Color.

Synthetic food colorants

Mehas and Rodgers (1994) stated that synthetic food colors are colorants that are created at the laboratory. They added that synthetic food colors are identified by numbers. In the United States, they are designated with FD&C followed by the color name and a specific number. For example, a synthetic colorant commonly known as sunset yellow is identified as FD&C Yellow No. 6. This colorant is used on foods such as cereals, bakery

goods and snack foods. In Europe however, each approved additive including synthetic colorants are assigned a unique "E number". For example, the sunset yellow above is identified as E110 in Europe. This numbering scheme for additives is also adopted and extended by the Codex Alimmentarius Commission - details of which can be found at their website (https://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/gsfa/en/).

2.2.2 Flavorings

According to Mehas and Rodgers (1994), flavorings are substances added to food to enhance its flavor. They also stated that flavorings constitute the largest number of additives that are added to processed foods, be it from a natural or synthetic source.

Natural Flavorings

Madden(1980) observed that natural flavorings are created using ingredients from natural sources such as seeds, leaves, roots or the barks of plants and they are the origin of many herbs and spices. She added that the other sources are meat extracts, oil from the peel of citrus fruit, salt, citric acid, acetic acid and the strong flavored extracts from plants known as essential oils.

Synthetic Flavorings

Madden (1980) explained that synthetic flavorings are obtained from natural products by chemical means while others are created solely from chemicals. The chemical flavors are created from compounds such as esters and aldehydes which are blended together to produce flavors like; pear flavors, strawberry flavored - benzyl acetates, rum flavored - ethyl acetates, cherry and almond flavored – benzaldehydes and so on.

2.2.3 Preservatives

Mehas and Rodger (1994) defined preservatives as chemicals used to prevent bacterial growth that could cause food spoilage. According to them, many foods are produced long before their consumption and also far from where they are consumed. Therefore, the only way such foods can be transported over greater distances safely is by using preservatives to delay the time for their spoilage.

Rustin (1976) had also asserted that there are different types of preservatives but each of them is best suited to a particular type of preservation effectively against a particular food spoilage organism or chemical change. She added that some preservatives help to protect the health of consumers by either inhibiting bacterial growth, preventing contamination, inhibiting food spoilage or preventing bacteria food poisoning. According to these authors, there are two types of preservatives namely, those from natural sources and the others from artificial or synthetic source.

Natural Preservatives

This group includes

- Sodium chloride (salt) which is used for preserving meat, fish and vegetables
- Acetic acid
- Sugar
- Herbs and spices
- Alcohol
- Wood smoke which produces coating of tar that has a preservative effect on meat and fish. According to the aforementioned authors, most bacteria and mould cannot survive strong concentrations of these natural substances.

Synthetic or Chemical Preservatives

According to *Madden (1980)* the commonest permissible chemical preservatives are;

- Sulphur dioxide which is used to preserve wine, fruit drink and sausage.
- Benzoic acid used in the production of coffee
- Potassium salt or saltpetre (εkaw, in twi) used in restricted amount for curing beacon.
- Nisin, an antibiotic used in cheese and canned milk.
- Ascorbic acid, nitrites, antibacterial preservatives used in canned meat products. These have the added effect of inhibiting the growth of the deadly clostridium botulinum.

2.2.4 Nutritional Additives

According to Madden (1980), nutritional additives are the vitamins and minerals that may be added to foods to replace the ones that are lost during processing or to increase the nutritional value of a food product. *Shank et al* (1981) and *Aurand et al* (1987) compiled a list of approved nutritional additives that help to maintain or improve the nutritional quality of food in their literatures and these included; Thiamine, Riboflavin, Niacin, Ascorbic acid, Vitamin A and D, Potassium iodine, Iron etc.

The authors also indicated that the above nutritional additives may be added to foods such as cereals, flour and bread, milk, margarine, macaroni and noodle products to either restore, enrich or fortify them with the required nutrients.

Shank and Chapman et al (1981) had described the process of improving a food's nutritional value as nitrification. According to them, a food is nitrified either by *restoration*, *enrichment* or *fortification*. Thus, the three terms were explained as follows;

- ***Restoration****:* A process used to put back lost nutrients in foods during their processing to match the nutrient level of the unprocessed food.
- ***Enrichment****:* A process used to add nutrients already present naturally in foods to bring them to a nutritional level that is higher than the unprocessed food.
- ***Fortification****:* A process used to add nutrients to foods which did not naturally contain such nutrients.

2.2.5 Improvers or Physical Conditioning Additives

Improvers or Physical conditioning additives are a type of additives that are added to foods to help improve their texture or physical outlook. Improvers are grouped by Madden (1980) under particular names according to the specific functions they perform. Some of these groupings are;

- ***Emulsifiers****:* A food emulsifier acts as a bond that holds particles of ingredients altogether. They are used in food such as bakery products, cake mixes, ice cream and frozen desserts to help maintain the correct even mixture or consistency of the foods. Emulsifiers added to foods leads to a better particle dispersion, solubilization, foaming and creaming ability. Examples are; fatty acid derivatives, polyglycerol polyricinoleate (PGPR), ammonium phosphatide (AMP) and mono and diglycerides.

- ***Stabilizers***: According to *Madden* (1980), food stabilizers are substances that help foods to remain in an emulsion and retain their physical characteristics as long as their normal shelf life. They may also increase the viscosity of foods by means of a thickening effect and help to keep foods smooth and uniform in texture, color and

flavor. They are used in sauces, syrups and custards and examples include; lecithin, pectin, vegetable gums and gelatine.

- ***Humectants:*** Humectants are substances used to prevent food from drying out and losing their palatability according to *Aurand et al,* (1987).

  Madden (1980) also opined that humectants are used to maintain or keep the moisture in foods like desiccate coconut, candy, dietary foods and flavor solvents. Examples are propylene glycol and inverted sugar.

- ***Flour improvers***: Flour improvers are chemicals such as bromate, ascorbic acid and l-cysteine which are used to speed up the natural maturing or oxidation of flour. (Madden, 1980). Freshly milled flour is yellowish in color and makes very poor dough. As time goes on and it ages, it whitens and reacts chemically with oxygen in the air and gradually improves to become quality flour. Floor improvers are therefore used to speed up this process.

2.3 Advantages and Disadvantages of Additives

A number of surveys that have been conducted have established that consumers are unaware of the function, role or advantages of food additives and that many of them perceive additives to be unhealthy and hence approach them negatively. Studies have shown that a significant number of people suspect that additives approved by governments were derived from insufficient information and that there is lack of clarity in risk communications among stakeholders such as the government, industry, and consumers. (Gábor T., 2003; Bibi N. *et al*, 2012; Legesse A. *et al*, 2015; Sachithananthan

V., 2017). Thus, a lot of people feel that foods without additives are of better quality than when additives are added to them.

However, food additives are an important part of our food supply. For without them, it would simply not be possible to keep the lots of varieties in the current selection and quality of foods.

The benefits in the use of food additives as was stated by Madden (1980) are as follows;

- They preserve food and reduce food wastage.
- They improve or maintain the color, flavor and/or the nutritional value of foods.
- Preservatives help prevent food poisoning.
- Additives enable many bland and unpalatable foods to be used.
- They facilitate food transportation and distribution and make a wider choice of food available.

Also, as part of the founding principles for the establishment of the Joint Expect Committee on Food Additives (JECFA) in 1956 by the Food and Agriculture Organization (FAO) and the World Health Organization (WHO), the many advantages in the use of food additives were stated to include the following;

- To improve the appearance of food.
- To enhance the flavor of certain food.
- To maintain the texture or storage properties of foods.
- To prevent food spoilage or deterioration.
- To enhance food safety.

Thus, without the use of additives, it would be impossible to enjoy the many varieties of convenience foods which we often take for granted.

On the disadvantages of food additives, the bad effects of some of them may be immediate or long term after constant accumulations beyond their accepted daily limits (ADI's).

The immediate effects may include headaches, change in energy level, alterations in mental concentration, behaviour, or immune response (Pandey, and Upadhyay, 2012). Long-term effects may be an increase in one's risks of cancer, cardiovascular disease or other degenerative conditions. Usually, when someone has a reaction after eating a certain food, an allergy is suspected. But some people may not have a reaction until a day or two later, so it is difficult to know what will be causing the problem. In such situations therefore, they may stop eating all suspected foods and may introduce them later one at a time to see if a reaction occurs.

According to Pandey and Upadhyay (2012) some modern synthetic preservatives have become controversial because they have been shown to cause respiratory or other health problems. Some studies have also pointed out that synthetic preservatives and artificial coloring agents aggravate some Attention Deficit Disorder (ADD) or Attention Deficit Hyperactivity Disorder (ADHD) symptoms in those affected (Gustafsson *et al*., 2003). However, in most of the above studies and as Anon (2004) puts it, parental reports were used rather than clinical tests.

Moreover, Madden (1980) in her book made some assertions on the effects of food additives. These are summarized as follows;

- Large amounts of food additives may be toxic.
- It is impossible to test the toxicities of all permutations of chemical additives in different foods.

- Some additives may have a cumulative effect in the long term if they are stored in the body until their toxic levels are reached.

2.4 Research Gap Analysis

Aside the occasional assessments, tests and checks conducted by the various regulatory bodies on additives, literatures on the health implications with their use in Ghana is scanty and most of them being anecdotal. But in other countries outside Africa, several studies have investigated on adverse reactions as a consequence of food additive intakes by some people (Saltmarsh 2013, Young 1997). For example, Benjamin Feingold in 1973 was the first to propose that salicyclates, artificial colors, and artificial flavors can cause hyperactivity (or Attention deficit hyperactivity disorder, ADHD) in some children and that was followed later on with further studies by other researchers (Stevens L.J *et al*, 2011; Arnold *et al*. 2013). However, in Africa or in Ghana, studies on the many food additive types such as preservatives, coloring agents, sweeteners, anti-caking agents and their health implications on humans are largely unavailable. The very few of the studies that have been conducted on additives such as the one done by Courage Kosi Setsoafia Saba and was published in the *Journal of Food Resource Science 4 (3): 73-81* in 2015 only looked at the potentially hazardous additives that were included in the ingredient list of sixty-three (63) food products in the Ghanaian market. The rest of the other research works on food additives either focused on reviewing only documented literatures on "effects of food additives on humans" – which are mostly foreign or were merely conducted to reveal the knowledge, attitudes and perceptions of consumers on food additives (Kaptan, & Kayisoglu, 2015; Inetianbor, Yakubu, & Ezeonu, 2015; Bearth, A., Cousin, & Siegrist, 2014; Bibi, & Badroonesha, 2012; Tarnavolgyi, 2003; Altug &

Elmaci, 1995). A gap therefore exists as result of the lack of actual research works on the effects of additives in processed foods used in individual homes, schools and other institutions where the end users or consumers are located. Hence, in an attempt to help address the above gap, this study was undertaken to: (1) discover the different types of additives in food products used by cooks and matrons of senior high schools in Ghana for meal preparations, (2) examine the benefits in the use of such additives in food products and the potential harmful effects some of them may have on human health and (3) determine the best ways that cooks, matrons and individuals could adopt to keep themselves and others safe from harmful or potentially harmful additives when buying food products from the market.

2.5 Conceptual Framework for the Study

The Conceptual framework of the study is as shown in Figure 1.0 below. This was developed based on ideas from the KAP model as well as some of the most basic theories in the literatures reviewed during this research. The KAP model stresses on the importance of *knowledge* and *attitude* as the main factors of *good practices*. In this model, *food safety knowledge* is correlated with *food shopping attitude* with both pointing toward *good kitchen practices* which revolve around food safety, food quality and food integrity. Thus, the KAP model advocates that if food safety knowledge is provided to end users or consumers, food safety and food hygiene practices could be improved. Also, if consumers have the right attitude towards the safety, quality or integrity of food, it would lead to increased food safety awareness when shopping or when preparing meals (Zanin *et al*., 2017). Therefore, the conceptual framework for this study (figure 1.0) was designed for the common understanding that, adequate knowledge on additives in food

products or lack of it generally translates to good or bad health effects from their use or none use. Thus, if a consumer or an end user has adequate knowledge on the additives in food products, it helps them to make good safety judgments on their meals or perform good kitchen practices which ultimately results in good health. On the other hand, lack of knowledge on additives in food products leads to poor judgments on food safety or bad kitchen practices which consequently result in bad health of the consumer.

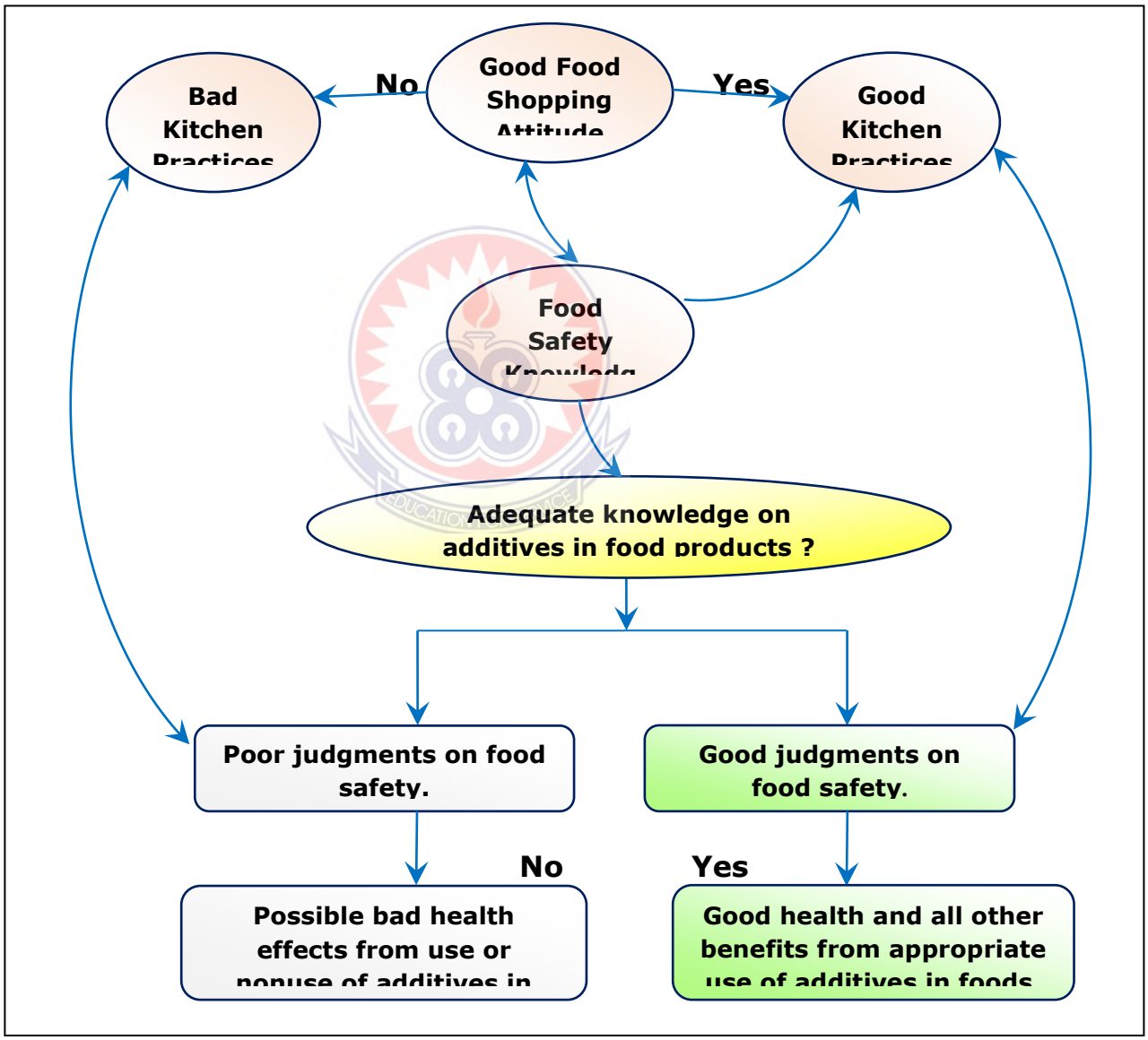


Figure 1.0 Conceptual Framework of the Study.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

Research methodology is a collective term used to describe the structured processes for conducting a research. In other words, the methodology of a research prescribes the research methods used such as procedures followed to gather data, analyze and interpret them - often with a range of statistical analytic tools in order to find answers to research questions (Goundar, 2012). This chapter therefore presents the methodology that were used to address the research questions asked at section 1.6 of chapter one which are also in line with the main objective and the theoretical framework of the study.

The chapter has been grouped under the following sub-headings: Research Design, Population and Sampling Technique, Data Collection Instruments, Data Collection Procedure and Data Analysis Procedure.

3.1 Research Design

A research design is the overall strategy for answering research question(s) using empirical data (Shona McCombes, June 7, 2021). Creating a research design can be done with any one of the two main design approaches or a combination of both. These are qualitative research designs and quantitative research designs. Qualitative research designs are used to investigate descriptive or non - numerical data such as the knowledge, attitudes and/or beliefs of respondents. However, quantitative designs are used for researches that involve numerical or quantifiable data such as exams scores, heights, weights, ages, cost and so on. In this study, a combination of both perspectives was employed - thus, quantitative design procedures were used to analyze the quantified

responses in the data while a qualitative approach was used to focus on the in-depth interpretation and analysis of the descriptive responses given by the respondents. Specifically, this research was conducted as a case study. This is because a case study is a more flexible type of qualitative design which makes it easier to explore under-researched problems (such as this topic) and helps to generate new ideas. Lastly, since the purpose of the study was to examine food additives in meals prepared by cooks and matrons of senior high schools in Ghana, the researcher adopted these above design approaches to allow sufficient information gathering to assist in the drawing of conclusions that will be valid and reliable.

3.2 Population and Sampling Technique

3.2.1 Study Area

This study was conducted in three public Senior High schools in the *Old-Tafo* municipality in the Ashanti region from July 2021 to August 2021. According to the 2020 GES updated school's register, the Ashanti region has 134 public senior high (SHS) and Technical/ Vocational (TVET) schools which represent the highest (18.6%) out of the 722 public schools (including TVET institutions) in the country. All students in these public senior high schools benefit from the school feeding program introduced under the government's free SHS policy in September 2017 with the aim of improving the nutritional status of students and to increase enrolment in the SHS level. This policy offered 3 square meals for residential students and later on in 2018, nonresidential students were also given a hot lunch on school days. The policy was implemented progressively starting with the 2017/2018 first year students and has since been extended to cover third year students as well.

As can be observed from the government's policy to feed a lot of the youth in all public senior high schools across the country through the services of the kitchen staff, it is vital therefore that the researcher choose this area for the study in order to make valid and reliable conclusions on the topic.

3.2.2 Population

The study targeted three specific population groups from the study area, namely; Osei Kyeretwie Senior High School (OKESS), Al-zaria Islamic Senior High School (AZASS) and Uthmaniya Senior High School (UTHMASS). These groups which together numbered up to about 6,500 individuals consisted of both males and females and also comprised the pantry, cooks and matrons (collectively referred to herein as 'kitchen staff'); residential students; and non- residential students all from different ethnic backgrounds.

3.2.3 Sample

A sample size of 150 respondents (50 each from the three selected schools) was considered for the study. An important criterion for the selection of respondents in the sample was that, participants were to have some bit of knowledge on the research topic and were to be willing to participate. These were done to ensure that, the data or responses to be gathered would be accurate and reliable.

3.2.4 Sampling Technique

A non-randomized sampling technique was used to select all the 150 respondents from the three schools for the interview and the questionnaire. The interviews were conducted on focus group basis with only the selected kitchen staff members whiles two different

questionnaire sets - one each, was administered to the kitchen staff and the selected students respectively.

The non-randomized sampling technique was used because it proves to be time and cost – effective as compared to a random probability sampling. Also, since a non-random sampling approach is useful for populations with similar traits, it implied that the choice of this sampling method for the selection of respondents from the three schools (same education sector) would most likely yield valid and reliable results.

3.3 Data Collection Instruments

Data collection instruments refer to the tools that are used to collect information from relevant sources be it a ***primary*** or ***secondary source*** to be able to find answers to a research problem.

Primary sources of data are the first hand information that are obtained directly from respondents and they include questionnaires, observations and interviews. *Secondary sources* of data on the other hand refers to the information that are obtained from already existing works such as articles, journals or published documents which were gathered for other purposes but are relevant to the study being conducted (Kotler & Amstrong, 2014). In this study, four categories of instruments that were used to collect the research data are from both primary and secondary data sources. These are questionnaires, interviews, observations and existing document or records.

3.3.1 Questionnaire

A questionnaire is a data collection instrument of research which consists of a series of questions (or other types of prompts) for the purpose of gathering information from respondents through a survey or statistical study (Robert H. Gault, 1907). Different forms

of this instrument are the online and paper questionnaires types. The latter is the type that was used for this study.

3.3.2 Interview

Interview is a data collection instrument otherwise known as oral questionnaire. It involves a process where a researcher solicits information from respondents through verbal interaction (Aina, 2004).

The researcher prepares a scheduled list of structured questions relating to the study before interacting with the respondents for their opinions on the matter. During the interview the researcher poses questions to the respondent(s) and the answers are recorded by the researcher. Materials that could be used to record the responses include tape recorder and/or paper and pen. The main advantage of this instrument is that, it produces high response rate. Also personal contact of the researcher with respondents enables the researcher to explain any ambiguous question(s) to the respondent, clarify any response given and to arouse interest in respondents (Popoola, 2011).

The different types of interviews are the structured, unstructured and semi-structured interviews but these may be conducted either as individual (or face-to-face) verbal interchange, face-to-face group interview (or focus groups), Telephone or electronic mailing surveys depending on the circumstances and convenience of the particular interview.

The type that was used in this study is the semi-structured face-to-face group or the focus groups interview type.

3.3.3 Observation

This is a data collecting instrument employed by a researcher in which an individual behaviour, a group or a situation is observed and recorded (Akinade & Owolabi 2009). Two types of the observation instrument are; participant observation and non-participant observation. In participant observation, the researcher joins in and become part of the group to be observed but in the non-participant type, the researcher does not join or is not a member of the group. However, both observation types enhance first hand information, are flexible and cheaper to carry out. Also they demand less or no active cooperation of the observed and both of their results are reliable for any research.

3.3.4 Existing Documents or Records

This is a data collection instrument which in itself does not involve the conduction of any survey but is rather concerned with the use of existing (secondary) data from sources such as published documents or records that contain information about the topic being researched on.

3.4 Data Collection Procedures

Permissions to collect data from three schools were sought from their respective heads with a formal request letter on the first day of visit to the schools. About a week later when approvals were given, the researcher then contacted the heads of department and the kitchen heads in all the three schools to seek their consent and assistance in encouraging prospective respondents to fully cooperate.

After that, three working days was used to orient each of the populations from the three schools consisting mainly of students and the kitchen staff starting from Friday the 7th of May 2021. They were oriented about the objective of the data gathering exercise and

what would be required of every participant. All the data were collected with the above mentioned data collecting instruments through the respective procedures discussed in the following sections.

3.4.1 Procedures for the Questionnaires

On Wednesday the 12th of May 2021, paper questionnaires were distributed to a total of 150 participants from the three schools. These consisted of 18 questionnaires, one each being administered to 18 selected kitchen staff participants (6 from each of the three schools) and a different set being administered to a total of 132 students from the three schools – both males and females, residing and non-residing students. The questionnaires generally covered demographic characteristics, knowledge on the type of additives in meals served to the students and whether there were any report(s) of possible health problems associated with the consumption of meals prepared by the kitchen staff of the school feeding program. The questionnaires consisted of both closed ended questions (with short answers provided) and open ended questions (without answers). Where applicable, a four-point likert scale questions were added to elicit the needed information. It was administered personally by the researcher to all the participants to ensure that only first hand information was gathered with this instrument.

3.4.2 Procedures for the Interviews

Three days was used to conduct the interviews from Wednesday, 12th May 2021 to Friday the 14th of May 2021. Three separate face-to-face group interviews were conducted with six (6) selected kitchen staff members from each of the three schools. These interviews were used to gather information on the school menu and all the ingredients used to prepare the various types of meals by the kitchen staff as well as how to avoid harmful or

potentially harmful additives. In order to prevent discomfort in the interviews on the part of the kitchen staff with questions about how and what goes into their meal preparations, a semi-structured interview style was adopted. This style helped to establish some rapport through conversation with the participants while the actual structured interview guide was still followed. During the interviews all the responses obtained were recorded and noted down in writings afterwards to be compared with data from the other instruments for the analysis.

3.4.3 Procedures for the Observations

This instrument was used by the researcher from the onset of the first visits to the selected schools to ascertain the extent to which the conducting of the research would be justified and would contribute to existing knowledge on the research theme – "food additives". Also this instrument helped to determine the right techniques to be used in gathering the needed information for the study.

Generally speaking, a lot of the investigations which were done in all the three the schools and their kitchens to examine the additives in their meals for any possible effects were done with this research instrument.

3.4.4 Procedures for existing Document Review

The researcher collected and analyzed several secondary documents or written materials that contained data on food additives which related to the study topic and used that information to compare and/or contrast with the data that were gathered from the actual field survey (primary source). This procedure helped the researcher to cross-check and ensured that all her research instruments and methods used were appropriate and that the results obtained were reliable.

3.5 Data Analysis Procedure

The data analysis of this study was done to address the three research questions asked at section 1.6 of chapter one and are as follows;

1. What are the additive types in food products used by cooks and matrons in Ghana for meal preparations?
2. What are the benefits and the potential harmful effects of food additives on our health?
3. What are the best ways to be safe from harmful or potentially harmful additives in our foods?

Both qualitative and quantitative methods were used in the data analysis and the softwares used were Microsoft Excel (MS Excel) and Statistical Package for the Social Sciences (IBM SPSS version 26). The Microsoft Excel was used to design most of the tables whereas the SPSS tool was used to generate graphical charts and some of the tables that were used in the analysis. Generally, the interview responses were coded before being analyzed whereas the questionnaire responses were analyzed directly. After collecting all the field responses with the various research instruments, they were categorized under the three specific objectives stipulated at section 1.5 of chapter one. Under each category, the responses from the questionnaires, interviews and observations of the researcher – if any, were separated. For example under the category 'different types of additives in food products used by cooks and matrons for meals preparation', the responses from the interviews with the kitchen staff were separated from the observations of the researcher. Another example of this is the category of 'benefits in the use of additives in food products and potential harmful effects of some of them' which has the questionnaire responses of the kitchen staff separated from that of the students'.

Afterwards, a thorough reading of all the written interview responses were carried out in such a way that common ideas from the interviews were grouped and tagged with either single words or phrases to represent the prevailing ideas. For example, words or phrases like ‘verify’, ‘check additives’, and ‘avoid all additives’ were used to tag and represent responses that suggested on some of the safe ways to avoid harmful or potentially harmful additives. These tagging of words and phrases to the interview responses served as initial codes that were grouped under a common theme. Then, the analysis was conducted focusing on the frequencies (F) and percentages (%) of the coded interview responses as well as the questionnaire responses. However, with the questionnaire responses, where a four-point likert scale was used, the weighted means (M) of the responses from each focus group were calculated and compared with the acceptance point or midpoint (2.5) of the likert scale. Hence, any weighted mean (M) below the acceptance point was regarded as unpopular or rejected whereas those above it were accepted. Finally, the researcher’s observations and the existing documents reviewed were used to compare and/or confirm with the other information gathered from the survey. These data analysis and discussions are presented in the next chapter.

CHAPTER FOUR

ANALYSIS AND RESULTS

4.0 Introduction

This chapter presents the data analysis and detailed discussions of the results of the study. These are presented under two major headings namely, 'demographic characteristics' and 'analysis of the research questions'. The objective of the data analysis is to find answers to the three research questions which were developed in section 1.6 of chapter one. The three research questions which also revolve around the purpose of the study are as follows;

1. What are the additive types in food products used by cooks and matrons in Ghana?
2. What are the benefits and the potential harmful effects of food additives on our health?
3. What are the best ways to be safe from harmful or potentially harmful additives in our foods?

As a recap, the purpose of the study was to examine the additives in food products commonly used by cooks and matrons of senior high schools in Ghana for meal preparations to find out about the benefits and any possible health effects they may have on human health.

The research was conducted as a case study and the design methods used involved a combination of both quantitative and qualitative methods.

4.1 Demographic Characteristics of Respondents

The demographic characteristics of the respondents are as presented in the next two sub-sections.

4.1.1 Gender of Respondents

The respondents were asked to indicate their gender which was the first item on the scheduled list of questions in the demography section of the questionnaire and the results are as shown in table 4.1 below. Also, the figures 4.1(a), (b) and (c) give graphical representations of this gender distribution.

Table 4.1: Gender Distribution of Respondents

Respondents	Gender	Frequency	Percentage
Students	Males	73	55.30%
	Females	59	44.70%
	Sub Total	132	
Kitchen Staff	Males	5	27.78%
	Females	13	72.22%
	Sub Total	18	
	Overall		
Students + Kitchen Staff	Males	78	52%
	Females	72	48%
	Grand Total	150	100%

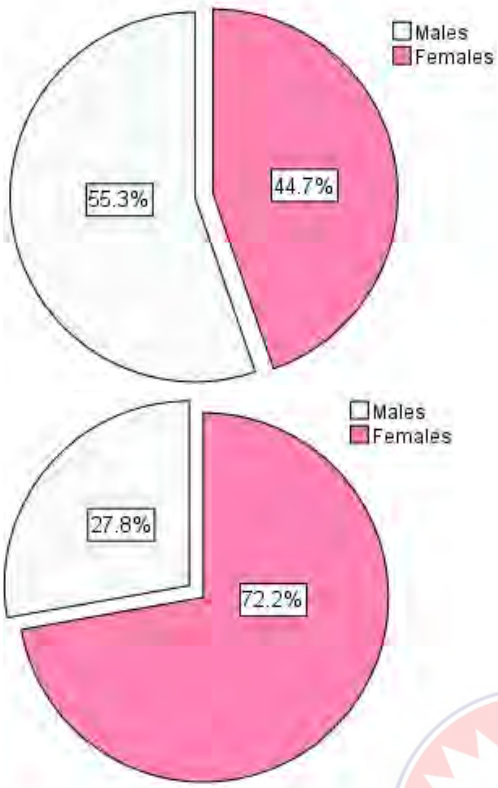


Figure 4.1 (a): Gender of Students (n = 132)

Figure 4.1 (b): Gender of Kitchen Staff (n = 18)

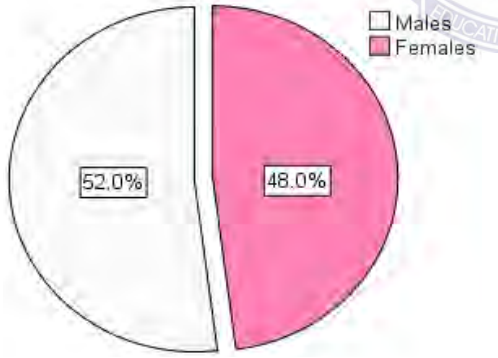


Figure 4.1 (c): Overall Gender Distribution (n = 150)

From the study and from the table and figures above, it shows that the male student respondents (55.3%) were 10.6% more than the female student respondents (44.7%). This indicates the dominance of male students over their female counterparts in the three selected

schools which are all mixed schools. Also, the overall gender distribution of the study sample shows that out of the 150 respondents, 78 representing 52% were males while 72 representing 48% were females. This again indicates the dominance of males over females in the selected schools although the kitchen staff alone had more females than males.

The above information is in line with the 2011/2012 academic year data of the Education Management Information System (EMIS) of the Ghana Education Service (GES) which reported a gross male to female enrolment ratio in the Senior High School to be 37% to 34.4% respectively.

4.1.2 Education level of respondents

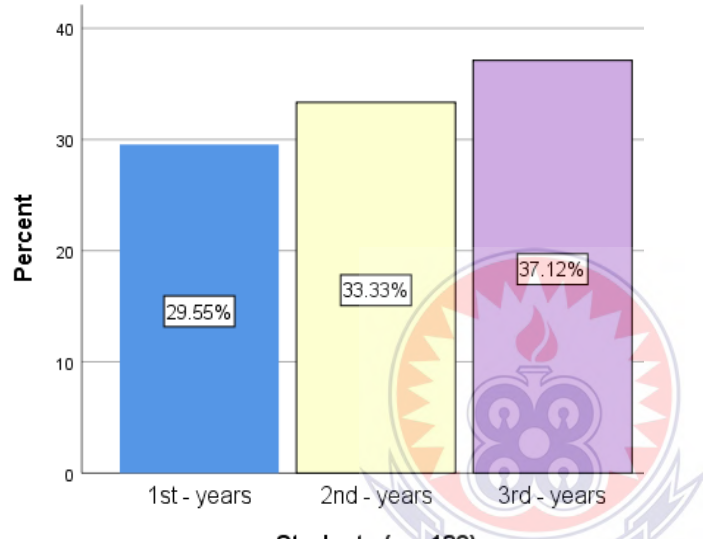
The educational level of the respondents were asked and the data from the responses were categorized into two and presented as 'year group of students' (in Table 4.2 (a) and Figure 4.2 (a)) and 'educational level of kitchen staff' (in Table 4.2 (b) and Figure 4.2 (b)). These are shown below;

Table 4.2 (a): Year Group of Students

Respondents	Year	Frequency	Percentage
Students	1	39	29.55%
	2	44	33.33%
	3	49	37.12%
	Total	132	100%

Table 4.2 (b): Education Level of Kitchen Staff

Respondents	Education Level	Frequency	Percentage
Kitchen Staff	SSS / SHS	10	56%
	Tertiary	8	44%
	Total	18	100%



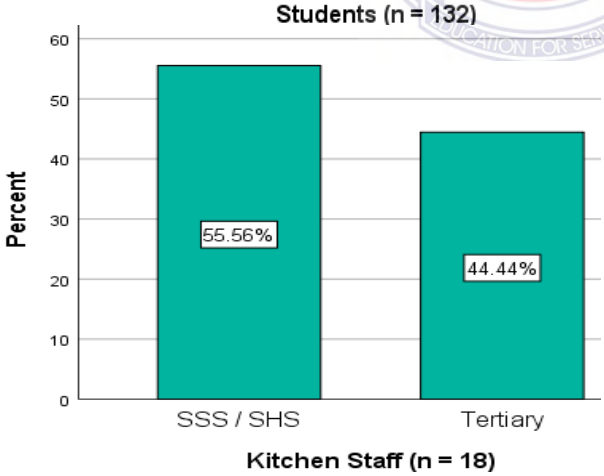


Figure 4.2 (a): Year Group of Student Respondents Fig. 4.2 (b): Education level of Kitchen Staff

The distribution in table 4.2 (a) and its representation in Figure 4.2 (a) show that, more third - year students (37.12%) were selected for the study than the first (29.55%) and second - years (33.33%) and more second - years were selected than the first - years in that order. The second table (4.2 (b)) and Figure 4.2 (b) also show that the kitchen staff that were selected as respondents had at least completed senior secondary or senior high school. These were done to ensure that, the selected participants at least had some knowledge on the research topic which would in effect assist in getting accurate and reliable data for the analysis.

4.2 Analysis of the Research Questions

4.2.1 Research Question One

What are the additive types in food products used by cooks and matrons in Ghana?

Here, the researcher sought to find out the different types of additives in the meals that are prepared and served by the kitchen staff in the three schools. The required data were collected through *structured* focus group *interviews* (items 1 and 2) with the kitchen staff and *observation* of the ingredient list of the weekly menu. After the data collection and organizing, the following three tables (table 4.3a, table 4.3b and table 4.3c) were compiled.

Table 4.3(a): Breakfast Menu and Additive Contents - Interview items 1 & 2.

Days	Breakfast	Main Ingredients	Main Additive(s) in ingredient(s)
Mon	Hausa Porridge & Bread	Millet, Bread, Sugar	Flour improver (Ascorbic acid), Sugar
Tue	Tombrown & Bread	Tom brown powder, Bread, Sugar	Flour improver (Ascorbic acid), Sugar
Wed	Rice water with milk and bread	Rice, Milk, Bread, Sugar	Flour improver (Ascorbic acid), Sugar
Thu	White Porridge & Bread	Corn dough, Bread, Sugar	Flour improver (Ascorbic acid), Sugar
Fri	Hausa Porridge & Bread	Millet, Bread, Sugar	Flour improver (Ascorbic acid), Sugar
Sat	White Porridge & Bread	Corn dough, Bread, Sugar	Flour improver (Ascorbic acid), Sugar
Sun	Chocolate Tea & Bread	Cocoa Powder, Milk, Bread, Sugar	Flour improver (Ascorbic acid), Sugar

*Number of interviewees (n) = 18

Table 4.3(b): Lunch Menu and Additive Contents – Interview items 1 & 2.

Days	Lunch	Main Ingredients	Main Additive(s) in ingredient(s)
Mon	Rice & Beans Stew	Rice, Beans, Vegetables, Oil, Spice, Salt	Spice/cubes: monosodium glutamade (MSG/E621), color caramel, Potassium sorbate (E202), Salt
Tue	Banku with Groundnut Soup & Fish	Corn dough, Cassava dough, Groundnut, Vegetables, Fish, Spice, Salt	Spice/cubes: monosodium glutamade (MSG/E621), Potassium sorbate (E202), Salt
Wed	Waakye With stew (Pepper Sauce) & Egg	Brown Rice, Beans, Vegetables, Oil, Spaghetti, Spice, Salt	Spice/cubes: monosodium glutamade (MSG/E621), color caramel, Potassium sorbate (E202), Salt

Thu	Gari & Beans	Gari, Beans, Saltpetre (εkaw), Salt	Saltpetre (KNO_3 - E252 or $NaNo_3$ - E251), Salt
Fri	Kenkey, Hot Pepper & Canned Fish	Corn dough, Pepper, Tomatoes, Canned Fish, Salt	Salt
Sat	Waakye With Stew & Egg	Brown Rice, Beans, Vegetables, Oil, Spice, Salt	Spice/cubes: monosodium glutamade (MSG/E621), color caramel, Potassium sorbate (E202), Salt
Sun	Yam & Vegetable Sauce	Yam, Vegetables, Oil, Spice, Salt	Spice/cubes: monosodium glutamade (MSG/E621), color caramel, Potassium sorbate (E202), Salt

*Number of interviewees (n) = 18

Table 4.3(c): Supper Menu and Additive Contents - Interview items 1 & 2.

Days	**Supper**	**Main Ingredients**	**Main Additive(s) in ingredient(s)**
Mon	Rice with Tomato stew & Egg	Rice, Vegetables, Oil, Eggs, Spice, Salt	Spice/cubes: monosodium glutamade (MSG/E621), color caramel, Potassium sorbate (E202), Salt
Tue	Kenkey with Pepper Sauce & Canned Fish	Corn dough, Pepper, Tomatoes, Oil, Canned Fish, Salt	Salt
Wed	Rice balls with Groundnut Soup & Fish	Rice, Vegetables, Groundnut paste, Fish, Salt, Spice	Spice/cubes: monosodium glutamade (MSG/E621), Potassium sorbate (E202)
Thu	Boiled Yam with Beans/Spinash Stew	Yam, Vegetables, Beans, Oil, Salt, Spice/Salt petre	Spice/cubes: monosodium glutamade (MSG/E621), color caramel, Potassium sorbate (E202), Salt
Fri	Rice with beans stew	Rice, Vegetables, Beans, Oil, Salt, Spice/Salt petre	Spice/cubes: monosodium glutamade (MSG/E621), color caramel, Potassium sorbate (E202), Salt

Sat	Kenkey with Pepper Sauce & Canned Fish	Corn dough, Pepper, Tomatoes, Canned Fish, Salt	Salt
Sun	Jollof Rice with Egg	Rice, Vegetables, Oil, Eggs, Salt, Spice	Spice/cubes: monosodium glutamade (MSG/E621), color caramel, Potassium sorbate (E202), Salt

*Number of interviewees (n) = 18

From the above common weekly meals menu of the three schools, the main types of additives found in the ingredients used by the kitchen staff for meal preparations are, flour improvers (Ascorbic acid) used in bread making; flavor enhancers (Monosodium glutamade - MSG/E621) in spice; color additives (Caramel) in spice; preservatives (Potassium sorbate - E202) in spice; softening/curing agent (Saltpetre - KNO_3 / 'ɛkaw' in the Twi language) sometimes used in the boiling of beans; and Salt and Sugar being the most common flavorants and/or preservatives.

Detailed information on the above additives and others can be found at the official websites of the major food regulatory bodies such as, the US FDA (https://www.fda.gov/food/food-additives-petitions/food-additive-status-list) and the European Food Safety Authority, EFSA (https://webgate.ec.europa.eu/foods_system/main/?sector=FAD&auth=SANCAS). Although all the above listed additives have been approved by the various food regulatory bodies both local and international for use, their approvals are not given without a statement on conditions of use and a disclaimer. This at least gives some indication that, the use of these additives in foods by everyone cannot be without any possible health effects be it now or in the future. Furthermore, a review of some existing

documents on the above listed additives revealed the following information about their use and safety profile:

***Additive name**	**Ascorbic acid**
Type	Flour improver and/or Preservative
Foods commonly found in	Baked goods, Fruit sauces and jellies, cured meats, beverages, oils and margarines, dressings, snack foods, cereals, fruits and vegetables
Acceptable Daily Intake (ADI)	Not Specified _ *Evaluated by JECFA (1981) for FAO/WHO
Possible health risk(s)	Ascorbic acids are generally safe when used as a flour improver. However, there is the possible risk when some bread producers replace Ascorbic acid with Potassium bromate which is linked to possible cancer in humans.
CSPI recommendation	Ascorbic acid is safe
US FDA information on it	Ascorbic acid is generally recognized as safe (GRAS) substance for use as additives and as a dietary supplement (i.e., Vitamin 'C').
***Additive Name**	**Monosodium glutamade (MSG or E621)**
Type	Flavor enhancer
Acceptable Daily Intake (ADI)	0 - 30 mg/kg body weight (bw) per day *Evaluated and established by EFSA (2017)
Foods commonly found in	Processed and packaged foods including spices and seasonings.
Possible health risk(s)	Its use as an additive is controversial as some study reports link MSG's to reactions such as headaches (migraines), chest tightness, heat

		palpitations, nausea, wheezing, and asthma attacks in certain people.
CSPI recommendation		Avoid if sensitive.
US FDA it	information on	Generally recognized as safe (GRA) - There is no evidence in the available information on L-glutamic acid, L-glutamic acid hydrochloride, monosodium L-glutamate, monoammonium L-glutamate, and monopotassium L-glutamate that demonstrates, or suggests reasonable grounds to suspects, a hazard to the public when they are used at levels that are now current and in the manner now practices. However, it is not possible to determine, without additional data, whether a significant increase in consumption would constitute a dietary hazard.
***Additive Name**		**Color caramel (E150)**
		**Note: GRA color additives such as caramel are not required to be declared by their name on labels but might be declared simply as color added or colorings*
Type		Color additives
Foods commonly	found in	Many processed foods such as spices, seasonings, baked goods, cheese, pie fillings, candies, jellies, snack foods, margarine, gelatins, and pudding.

Acceptable Daily Intake (ADI)	Class I caramel: 'Not specified' Class II caramel: 0 - 160 mg/kg body weight (bw) per day Class III & IV caramel: 0 -200 mg/kg body weight (bw) per day *Evaluated and established by JECFA (2011)
Possible health risk(s)	Caramel coloring, when produced with ammonia, contains contaminants, 2-methylimidazole and 4-methylimidazole. In 2007, studies by the U.S. National Toxicology Program found that those two contaminants cause cancer in male and female mice and possibly in female rats. In 2011, the International Agency for Research on Cancer, a division of the World Health Organization, concluded that 2- and 4-methylimidazole are "possibly carcinogenic to humans."
CSPI recommendation	Avoid
US FDA information on it	Generally recognized as safe (GRA) - There is no evidence in the available information to show that caramel as a food ingredient constitutes a hazard to the general public when used at levels that are now current or might reasonably be expected in the future.
***Additive Name**	**Potassium sorbate (E202)**
Type	Preservative
Foods commonly found in	Spices, Seasonings, Fruit sauces and jellies, baked goods, cured meats, Soft drinks, oils and margarines, dressings, snack foods, cereals, fruits and vegetables

Acceptable Daily Intake (ADI)	0 - 25 mg/kg body weight (bw) per day *Evaluated and established by JECFA (1973) for FAO/WHO
Possible health risk(s)	No known health risk
CSPI recommendation	Safe
US FDA information on it	Generally recognized as safe (GRA) - There is no evidence in the available information on sorbic acid and its sodium, potassium and calcium salts that demonstrates, or suggests reasonable grounds to suspect, a hazard to the public when they are used at levels that are now current or that might reasonably be expected in the future.

***Additive Name**	**Saltpetre - (KNO3 - E252 or NaNo3 - E251)**
Type	Softening agen/Thickening agentt/Color retention agent/ Preservative
Foods commonly found in:	Softening agent in beans cooking, Thickening agent in soups such as okro soup, Preservatives for corned beefs and other cured meats.
Acceptable Daily Intake (ADI)	0 - 3.7 mg/kg body weight (bw) per day *Evaluated and established by the SCF (1997) and JECFA (2000)
Possible health risk(s)	high level intake is suspected of increasing the risk of certain cancers which include stomach cancer – Thus, nitrites in saltpetre can produce the carcinogen 'nitrosamine' when it reacts with amines in food under acidic conditions in the stomach; it may also alter the human thyroid gland function or cause hypothyroidism.
CSPI recommendation	Avoid
US FDA information on it:	Generally recognized as safe (GRA) - There is no evidence in the available information on Nitrites and Nitrates that demonstrates, or suggests reasonable grounds to suspect, a hazard to the public when they are used at levels that are now current or that might reasonably be expected in the future.

From the foregoing, it can be seen that although the US FDA classifies all the above listed additives (and many others not listed here) as 'generally recognized as safe' (GRA), the Center for Science in the Public Interest (CSPI) as well as other researchers or corporate bodies have carried out separate researches on most of the additives with some of their findings contradicting with some of the GRA additive declarations by the

US FDA (Whysner and Williams, 1996; Dybing, 2002; Amchova *et al.,* 2015; Martin, 2008; Branen, 2002; Clydesdale, 1997; Potter and Hotchkiss, 1995). Also, salt and sugar which are two of the oldest and commonest household flavorants and/or preservatives perhaps present challenging issues for the regulatory bodies. This is because, although both substances are classified under GRA's and have been consumed by people for a long time, there are evidences that show their involvement in a host of health problems which the regulatory bodies appear to be not addressing, hence, leaving it on end users to judge for themselves. For instance, it is known that high consumption of salts can make a person develop high blood pressure (high BP), which may lead to strokes and/or other circulatory diseases. It is also well known that, high consumption of sugars can cause tooth decay, weight gain, as well as diabetes and hypoglycemia in genetically predisposed individuals (Branen, 2002; Encyclopedia, 2020; Clydesdale, 1997; Potter and Hotchkiss, 1995).

It is in this context and in line with the conceptual framework of the study that the researcher sought to find out about the knowledge of the kitchen staff on the meaning and functions of additives in foods in order to help evaluate their understanding of additives and their use, and to evaluate the validity of the responses they gave. The following four (4) tables therefore present the results of the responses and analysis of the questionnaire items 1, 2 and 3 which were used to access the knowledge of the kitchen staff on the meaning and functions of food additives.

Table 4.4: Kitchen Staff's (KS) Knowledge on Additive Definition – KS Questionnaire Item 1.

(Statement: Food additives are natural or artificial substances added intentionally to food products to improve the flavor, the color and shelf-life of foods)

Respondents	Frequencies				Weighted mean (M) of each Group
	4 - Strongly Agree	3 – Agree	2 - Disagree	1 - Strongly Disagree	
Kitchen Staff Group 1	4	2	0	0	3.7
Kitchen Staff Group 2	3	3	0	0	3.5
Kitchen Staff Group 3	4	1	1	0	3.5
			Mean ($\mathbf{M_3}$) of all three Groups		3.6

* Acceptance Point/Midpoint ($\mathbf{M_0}$) of likert scale = **2.5**

***Number of respondents (n) = 18

***** Group numbers are not linked to school names for the purpose of anonymity.

Table 4.4 above is a four-point likert scale developed for questionnaire item 1 for the kitchen staff (See Appendix B) and used to analyze their knowledge level on the meaning of food additives. There were three (3) groups with six (6) respondents from each group (or school) making a total of 18 respondents. The acceptance point of the scale which was 2.5 was used as the accepted or the required knowledge level (or reference point). Therefore, any response or weighted mean of a group response below this point was judged as undesirable and those above it were considered as desirable.

From the above scale, it can be observed that, the weighted means of each of the three groups about their response on the meaning of additives were all desirable since they were all above the acceptance point. Also, the overall weighted mean of 3.6 for the three groups was desirable - although a detail check shows one person who either had a

different view altogether or just lacked the knowledge about the meaning of food additives. Nevertheless, it can generally be concluded that, the kitchen staff had adequate knowledge about the meaning of food additives.

Table 4.5: Kitchen Staff's (KS) Knowledge on Function of Additives - KS Questionnaire Item 2.

(Statement: The functions of food additives are to improve the flavor, the color and shelf-life of foods)

Respondents	**Frequencies**				**Weighted mean (M) of each Group**
	4 - Strongly Agree	**3 – Agree**	**2 – Disagree**	**1 - Strongly Disagree**	
Kitchen Staff Group 1	4	2	0	0	3.7
Kitchen Staff Group 2	3	3	0	0	3.5
Kitchen Staff Group 3	3	2	1	0	3.3
			Mean ($\mathbf{M_3}$) of all three Groups		3.5

* Acceptance Point/Midpoint ($\mathbf{M_0}$) of likert scale = **2.5**

***Number of respondents (n) = 18

***** Group numbers are not linked to school names for the purpose of anonymity.

Questionnaire item 2 for the kitchen staff in table 4.5 above was used to access the staff's knowledge about the functions of the various additives in food products. In a form of four-point likert scale, this item was also the second of the four questionnaire items under research question one that were developed to access the general knowledge of the kitchen staff on additives (see Appendix B).

From the scale of responses (table 4.5) above, it can be observed that although one respondent (from group 3) did not agree on the statement about the functions of additives (for possible reason(s) of either lack of knowledge on it and/or simply having different

ideas altogether), the weighted means of all the three groups as well as the overall mean of 3.5 were all above the acceptance point (2.5).

Therefore, it can be concluded on this item that, the kitchen staff generally had adequate knowledge about the functions of additives in foods or food products.

Table 4.6(a): Kitchen Staff's (KS) Knowledge on Additive Names – KS Questionnaire Item 3a.

(Question: Do you know the name of any additive? Yes / Don't Remember / No)

	Frequencies		
Respondents	**Yes**	**Don't Remember**	**No**
Kitchen Staff Grp 1	1	3	2
Kitchen Staff Grp 2	3	2	1
Kitchen Staff Grp 3	1	2	3
Total	5	7	6

*Number of respondents (n) = 18

*Group numbers are not linked to school names for the purpose of anonymity.

The questionnaire item 3a for the kitchen staff in table 4.6 (a) above was developed to verify whether members of that staff were familiar with some of the names of additives on food labels. From their responses and in the table, it can be observed that, out of the 18 respondents, 5 representing 27.8% were familiar and knew the name of at least one additive; 7 representing 38.8% were familiar with additive names but did not remember any name as at that time; and 6 representing 33.3% were not familiar and did not know any additive name as at that time. This implies that, 12 out of the total 18 sampled kitchen staff members representing 66.7% were at least familiar with the names of

additives on food labels but only 5 or 27.8% out of this were actually able to recall any additive name.

Table 4.6(b): Kitchen Staff's (KS) Knowledge on Additive Names – KS Questionnaire Item 3b.

*(Question: If '**Yes**', can you mention any one additive name)*

Respondents	Name of additive	Frequency	Percentage
Kitchen Staff	Sugar	2	40.0%
	Salt	2	40.0%
	Monosodium glutamade (MSG)	1	20.0%
	Total	5	100%

*Number of 'Yes' responses = 5

Table 4.6 (b) above is a summary of the responses for questionnaire item 3 (b) which was a follow-up question to the item 3 (a) for the kitchen staff. Thus, all the five (5) members who responded 'yes' to the previous questionnaire item 3 (a) were further asked to mention any additive name they remembered.

From the summary of their responses in table 4.6 (b), it can be observed that, salt and sugar which are the two most common and oldest additives were mentioned the most with a Frequency of 4 (or 80%). The only next additive name that was mentioned after the salt and sugar was Monosodium glutamade (MSG) with a frequency of 1 (or 20%). These implies that, the 18 selected kitchen staff members generally had adequate knowledge on food additives and were familiar with some of the names on food labels,

however, only a few (5 or 27.8%) out of the 18 sampled staff members were able to recall just one additive name from off their heads.

4.2.2 Research Question Two

What are the benefits and the potential harmful effects of food additives on our health?

The researcher sought to find answers to this research question directly from the population under the study through the selected sample. Also, it was hoped that this information together with other ones would further give some insight on how the cooks and matrons generally viewed additives and their use in foods. The required data were collected with the kitchen staff questionnaire items 8 through to 10 (See Appendix B). After the data collection and organizing, the following six tables (tables 4.7, 4.8, 4.9a, 4.9b, 4.10a and 4.10b) were compiled:

Table 4.7: Kitchen Staff's (KS) Knowledge on Additive Benefits – KS Questionnaire Item 8b.

(Question: Do you know of any benefits in the use of additives?… If '**Yes**', can you mention any one of the benefits?)

Respondents	Benefits of additives	Frequency	Percentage
Kitchen Staff	They make food tasty	5	41.7%
	They preserve food for later use	4	33.3%
	They improve the color of food	2	16.7%
	They improve food nutrients	1	8.3%
	Total	12	100.0%

*Number of 'Yes' responses = 12

In table 4.7 above, the responses to the questionnaire item 8b (see Appendix B) of the kitchen staff is summarized and the following points can be drawn from the table:

- A total of 12 out of the 18 sampled kitchen staff members were aware that there are some benefits in the use of additives in foods.
- Majority (9 out of 12 or 75%) of the mentioned benefits were about additives adding taste to foods and additives preserving foods.

Table 4.8: Kitchen Staff's (KS) Knowledge on Additive Harmful Effects - KS Questionnaire Item 9b.

*(Question: Do you know of any harmful or potential harmful effects of additives?... If '**Yes**', can you mention any one of them?)*

Respondents	Potential harmful effects of additives	Frequency	Percentage
Kitchen Staff	Possible allergies	8	57.1%
	Risk of diseases	6	42.9%
	Total	14	100.0%

*Number of 'Yes' responses = 14

Table 4.8 above gives a summary of the responses to the questionnaire item 9b (Appendix B) of the kitchen staff and the following are the key points which can be drawn:

- A total of 14 out of the 18 selected staff members believed or knew that the use of additives in foods could have some harmful effects on human health.

- The harmful effects of additives that were mentioned are 'allergies' and 'risk of diseases'.
- The 14 responses on this item also mean that, more staff members (i.e.; 2 or 11.1%) were familiar with the potential harmful effects aspects of additives than they were with the benefits.

Table 4.9(a): Kitchen Staff's (KS) Food Reaction Complain Reception - KS Questionnaire Item 10a.

(Question: Have you got any complain(s) this year on allergy or health of students after they consumed any of the school meals?)

Respondents	Yes - Frequency	No – Frequency
Kitchen Staff Group 1	0	6
Kitchen Staff Group 2	2	4
Kitchen Staff Group 3	1	5
Total	3	15

*Number of respondents (n) = 18

The questionnaire item 10a (as in Appendix B) was used to find from the kitchen staff whether they received student report(s) about food reactions after they consumed any of the school meals. From the results of the responses in Table 4.9 (a) above, it can be observed that, two groups (or two schools) –reported 'yes' through three (3) respondents and all respondents in one group (or one school) reported 'no'. The 'yes' responses were however probed further with the next questionnaire item, 10b below.

Table 4.9(b): Kitchen Staff's (KS) Food Reaction Complain Reception - KS Questionnaire Item 10b

*(Question: If '**Yes**', what is the complain about, how many and what particular food(s)? Does the complain repeat with the same food(s)?)*

Respondents	Type Complain	Number of complains	Particular Food(s)	Does complain repeat with same food? (Yes/No)
Kitchen Staff Grp 2	Stomach upset	3	Gari & Beans	Yes
Kitchen Staff Grp 3	Headache, Stomach upset	1, 1	Gari & Beans	Yes

*Number of 'Yes' responses = 3

From table 4.9 (b) above which is a summarized responses to the follow – up questionnaire item 10b, it can be observed that, two types of complains namely, stomach upsets and headaches were received by the kitchen staff of two schools as reactions from eating gari and beans in the school meals. According to the responses, the number of complaints was four (4) for the stomach upset in two schools and one (1) for the headache in one school.

Table 4.10(a): Students' Food Allergy Complains – Students' Questionnaire Item 1a.

(Question: This year, did you or any of your friends get any reaction or did you complain about your health after eating any of the school meals?)

Respondents	Yes - Frequency	No – Frequency
Students Group 1	1	43
Students Group 2	4	40
Students Group 3	3	41
Total	8	124

*Number of respondents (n) = 132

In order to verify the food reaction complain responses by the kitchen staff, 132 sampled students - 44 from each of the three selected schools, were also given a different set of questionnaires to respond to. The students comprised males and females from all the three-year groups. The questionnaires also contained only two items (i.e.; item 1a and 1b) apart from the demographic information section.

Table 4.10 (a) above shows the results of the students responses on questionnaire item 1a which asked the students weather they or any of their friends experienced any reaction(s) or complained of their health after eating any of the school meals. From their responses and in the table above, a total of 8 students responded 'Yes' and the remaining 124 students responded 'No'. However, students who responded 'yes' were further probed with the next questionnaire item, 1b below.

Table 4.10(b): Students' Food Allergy Complains – Students' Questionnaire Item 1b.

*(Question: If '**Yes**', what is the complain about, how many and what particular food(s) are they? Does the complain repeat with the same food(s)?)*

Respondents	Type of Complain	Number of complains	Particular Food(s)	Does reaction recur with same food? (Yes/No)
Students Group 1	Body itching	1	Much of Sugary foods	Yes
Students Group 2	Stomach upset	4	Gari & Beans	Yes
Students Group 3	Headache, Stomach upset	1, 2	Gari & Beans	Yes

*Number of 'Yes' responses = 8

Table 4.10 (b) above is the summarized responses of the 8 students who responded 'yes' to the first questionnaire item 1a (see Appendix C). From the table it can be observed that, stomach upset after eating of gari & beans was the commonest complain of reactions

– with 5 cases, reported by the students. This was followed by headache – with 2 cases, also after the students eat gari & beans.

Also, by comparing the responses of the group 1 students here with that of the group 1 kitchen staff in table 4.9 (a), it can be noticed that the complain of one student (body itching after consuming much of sugary foods) probably had not been received by the kitchen staff. Aside that, it can be stated that the students' responses corresponded with that of the kitchen staff.

From the above analysis, it is clear that most of the responses of the kitchen staff on the benefits and potential harmful effects of additives among others were fully covered in the literature and document reviews - the benefits which included their ability to preserve, improve the taste, color or the nutritive content of foods; and the potential harmful effects which were also mentioned as possible allergies and risk of diseases.

4.2.3 Research Question Three

What are the best ways to be safe from harmful or potentially harmful additives in our foods?

Here, the researcher sought to find answers to the question by analyzing the knowledge and current practices of the kitchen staff and reviewing recommendations from experts as well as existing documents on the matter in order to determine the best ways that cooks, matrons and individuals could adopt to keep themselves and others safe from harmful or potentially harmful additives when buying food products from the market. The required data for this section were collected through focus group interviews, questionnaires and

related document reviews. After the data collection and organizing, the following five tables (tables 4.11; 4.12; 4.13; 4.14 and 4.15) were compiled.

Table 4.11: Kitchen Staff's (KS) Knowledge on How to Avoid Harmful Additives – Interview Item 3.

(Question: What are the best ways to be safe from harmful or potentially harmful additives in our foods?)

Respondents	Ways to avoid potentially harmful additives (codes)	Frequency	Percentage
All Kitchen Staff	By avoiding all additives	6	28.6%
	By checking to avoid the harmful additives	11	52.4%
	Not sure	4	19.0%
	Total	21	100.0%

*Number of interviewees (n) = 18

Table 4.11 above is the summarized responses from the three groups of the kitchen staff on interview item 3 (Appendix A IV) which were categorized into codes. Each of the three groups through a face-to-face group (or focus group) interview were asked to mention what they think are some of the best ways to adopt in order to keep themselves and others safe from harmful or potentially harmful additives. In their responses and from the above table, the response (or code) with the highest frequency was 'checking to avoid the harmful additives' (frequency, 11 or 52.4%) followed by 'avoiding all additives' (frequency, 6 or 28.6%). In addition to this, there were some other four questionnaire items that sought to enquire from the kitchen staff on their knowledge and safety practices of checking for expiry dates and checking on food labels for additive

information. The results of these are also presented and discussed in the tables that follow.

Table 4.12: Kitchen Staff's (KS) Knowledge on How to Check for Expiry Dates on Food Products – KS Questionnaire Item 4.

(Question: Do you know how to check for expiry dates on food products at the market?)

Respondents	**F r e q u e n c i e s**				**Weighted mean (M) of each Group**
	4 – Yes	**3 – Somehow**	**2 - Not Sure**	**1 - Not at all**	
Kitchen Staff Grp 1	5	1	0	0	3.8
Kitchen Staff Grp 2	6	0	0	0	4.0
Kitchen Staff Grp 3	6	0	0	0	4.0
			Mean ($\mathbf{M_3}$) of all three Groups		3.9

*Acceptance Point/Midpoint ($\mathbf{M_0}$) of likert scale = **2.5**
***Number of respondents (n) = 18**

Above (Table 4.12) are the results of the responses from the kitchen staff on questionnaire item 4 (see Appendix B) in the form of a four point likert scale. This item asked the respondents to indicate whether they knew how to check for expiry dates on food products. With the acceptance point of the scale as 2.5, the responses from all the three groups showed that, the kitchen staff very well knew how to check for expiry dates on food products since the weighted means of all the groups exceeded the acceptance point even by significant margins.

Table 4.13: Kitchen Staff's (KS) Knowledge on How to Check for Additive Information on Food Labels – KS Questionnaire Item 5.

(Question: Do you know how to check for additive information on labels of food products at the market?)

Respondents	Frequencies				Weighted mean (M) of each Group
	4 – Yes	3 – Somehow	2 - Not Sure	1 - Not at all	
Kitchen Staff Grp 1	1	1	3	1	2.3
Kitchen Staff Grp 2	1	2	1	2	2.3
Kitchen Staff Grp 3	1	2	2	1	2.5
			Mean (M_3) of all three Groups		2.4

* Acceptance point/Midpoint (M_0) of likert scale = **2.5**

*****Number of respondents (n) = 18

The next questionnaire item (item 5) similarly asked the kitchen staff to indicate whether they knew how to check for additive information on labels of food products and their responses were entered into the four point likert scale (Table 4.13). By comparing the weighted means of each group (or school) with the acceptance point of 2.5, it showed that the knowledge of the kitchen staffs on this question was either just at the acceptance point (i.e., group 3) or slightly below that point (i.e., groups 1 and 2). Further checks in table show that, while about half of the members of each group of the kitchen staff knew how to check for additive information on food labels, the remaining half were either not sure or did not know how to check for additive information on food labels. The overall mean of 2.4 for the three groups clearly summarizes all the above.

Table 4.14: Kitchen Staff's (KS) Frequency of Checking Expiry Date on Food Products - KS Questionnaire Item 6.

(Question: How often do you check on expiry dates on food products before you buy or use?)

Respondents	Frequencies				Mean (M_1) of each Group
	4 - Always	3 – Sometimes	2 - Rarely	1 - Never	
Kitchen Staff Grp 1	1	3	2	0	2.8
Kitchen Staff Grp 2	2	2	2	0	3.0
Kitchen Staff Grp 3	2	2	2	0	3.0
			Mean (M_3) of all three Groups		2.9

* Acceptance Point (M_0) of likert scale = **2.5**

***Number of respondents (n) = 18**

In order to compare their knowledge on how to check for expiry dates with how often they actually put that into practice, the next questionnaire item (item 6) asked the kitchen staff to indicate how often they checked for expiry dates on food products before buying or using them. The closed ended responses for this were then transferred unto a four point likert scale shown in table 4.14. By comparing the weighted means of responses from each of the three groups with the acceptance point of 2.5, it is noticed that each of the groups on the average did check on expiry dates before buying or using any product. This is because according to the responses, the weighted mean of each of the group in the scale is above the acceptance point. However, detail checks show that, the probability of each of the groups actually checking for expiry dates on food products on a normal day before buying or using them was about 1/3 and was varied between 'always', 'sometimes' and rarely.

Table 4.15: Kitchen Staff's (KS) Frequency of Checking Additive Information on Food Products -

KS Questionnaire Item 7.

(Question: How often do you check for additive information on labels of food products before you buy or use?)

Respondents	**Frequencies**				**Mean (M_1) of each Group**
	4 – Always	**3 – Sometimes**	**2 – Rarely**	**1 – Never**	
Kitchen Staff Grp 1	0	1	3	2	1.8
Kitchen Staff Grp 2	0	2	2	2	2.0
Kitchen Staff Grp 3	0	2	1	3	1.8
			Mean (M_3) of all three Groups		1.9

* Acceptance Point of (M_0) of likert scale = **2.5**

***Number of respondents (n) = 18**

The knowledge of the kitchen staffs on how to check for additive information on food labels were also compared with how often they practiced that. All these were done in the hope that they would give some idea about the daily practices of the kitchen staff that boarded on the use of additives in their meal preparations. It was also hoped that the analysis of their daily practices in meal preparations may help to provide some understanding on why people may get some reaction(s) or effects after consuming certain meals. The summarized responses of the kitchen staff on questionnaire item 7 are as presented in table 4.15 in the likert scale. This item asked the kitchen staff how often they checked for additive information on food labels if they knew how to. From their responses presented in the above table, it is noticed that, each of the three groups did not check on any additive information on labels before buying or using any product. This is

because according to their responses, the weighted mean of each of the three groups (or schools) of the kitchen staff were all below the acceptance point (2.5). Detail checks also revealed that, none of the group members were in the habit of always checking for additive information on food labels - even some of the respondents that indicated they knew how to check for additive information on food labels per their responses in table 4.13 either occasionally, rarely or never checked them at all. The possible reason for this trend might be that some members of the kitchen staff may have the view that they are already familiar with the products they buy and hence there is no need for them to check on the additive contents. However in the same vein, since some of the cooks and matrons either rarely or never checked at all, it is possible that some of them might change their minds on certain products if they were to check on the additive contents and also got to know more about those additives.

From the above analysis of the kitchen staffs' responses on research question three, it was suggested by the respondents that, some of the ways to keep safe from potentially harmful additives are;

- By avoiding all additives
- By checking to avoid the harmful additives

Since not all food additives are bad and that it is quite difficult to entirely avoid all additives, recommendations from experts on additives as well as the related documents that were reviewed have provided some additional guidelines on how to keep ourselves and families safe from the harmful or potentially harmful additives. These additional guidelines are as follows:

- Cut down or lower the daily intake of added salt and sugar.

- In buying or choosing foods, avoid highly processed foods as far as practicable and include more wholesome or organic foods – either fresh or in a frozen state.
- Report any abnormality in food products or any additive concerns to authorities or the FDA for investigations and/or follow-up actions to be taken.

- Apart from checking on expiry dates, make it a habit to scan* through the ingredient list of prepackaged foods for information on additives that may be added. – after which a decision can be made to either accept or reject it.

Further information also revealed that, to be able to effectively check or scan for additive information on food labels, the following could serve as a useful guide.

- Food product ingredients are listed by quantity on their labels (i.e., from the highest to the lowest).

- This means that the first ingredient is what the manufacturer(s) used the most of.

- A good rule of thumb is to scan through the first three ingredients, as they make up the largest part.

- If the first three ingredients include names such as refined grains, hydrogenated oils or a sweetener (e.g.; sucrose (Sugar), fructose, sorbitol, mannitol, corn syrup, high-fructose corn syrup, saccharin, aspartame, sucralose, neotame, and acesulfame potassium (acesulfame-K)), it can be assumed that the product is unhealthy. Instead, try choosing food products that have whole foods listed as the first three ingredients on their labels - with or without a GRA or FDA approved additive(s).

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

The study began with a set of objectives which were used as a guide. Then, related areas of literature on the topic were reviewed to identify the research gaps which formed the basis for conducting the research. After that, both primary and secondary sources of data were collected and analyzed to arrive at some findings. This chapter therefore outlines a summary of those findings followed by the conclusions of the study. Furthermore, the chapter ends by giving some recommendations for healthier practices in the catering and hospitality industry as well as recommendations for further research on this study's topic.

5.1 Summary of Findings

The study was conducted to examine the additives in food products commonly used by cooks and matrons of senior high schools in the country for meal preparations to find out about the benefits and possible harmful effects that they may have on human health. Due to the large size of the study's population which required a lot of time and money, a sample size of 150 participants from three senior high schools (i.e., Osei Kyeretwie Senior High (OKESS), Al-zaria Islamic Senior High (AZASS) and Uthmaniya Senior High School (UTHMASS) in *Old-Tafo* municipal in the Ashanti region) were selected to provide responses to the survey questions.

The following is a summary of the findings that were made after analyzing all the data that were gathered with the various research instruments during the quest to find answers to the research questions. These findings are grouped under the three research questions as follows:

Research Question One

What are the additive types in food products used by cooks and matrons in Ghana?

From the study, it was found that each of the three selected schools followed a common weekly planned menu although the meals were sometimes interchanged due to the available ingredients and/or resources as well as other factors that may require such changes. Nevertheless, as was indicated by the cooks and matrons and also from the observations and document reviews, the types of additives that were found in the ingredients used by the kitchen staff for meal preparations included but not limited to flour improvers (Ascorbic acid) used in bread making; flavor enhancers (Monosodium glutamade - MSG/E621) in spices; color additives (caramel) in spices; Preservatives (Potassium sorbate -E202) in spices; softening/curing agent (Saltpetre - KNO_3) sometimes used in the boiling of beans or thickening of okro soups; and Salt and Sugar as flavorants and/or preservatives.

Research Question Two

What are the benefits and the potential harmful effects of food additives on our health?

It was also found from the information gathered from existing documents and the responses from the kitchen staff that, the benefits in the use of additives included preserving and reducing food wastage; improving or maintaining food's color, texture, flavor and/or nutritional value; enhancing the safety of foods; allowing foods to be transported over long distances; making it possible for some bland or unpalatable foods to be used; and helping to make a wider choice of foods available at all times.

The findings on the potential harmful effects of additives also included a possible short term allergic reaction(s) - which may be a headache; stomach upset; or a change in

immune response and a possible long term effects which may be an increased risk to certain diseases such as cancer, cardiovascular disease or other degenerative conditions. At the same time, it was discovered about these potential harmful effects that, most of the additives regulatory authorities and the scientists maintained that, due to the FDA's strict control on the use of additives by food manufacturers which ensures that their use fall within allowable limits as well as the rigorous safety testings that are conducted from time to time, the risks of these harmful effects are very much reduced – especially when consumers use them within their established acceptable daily intakes (ADI's).

Research Question Three

What are the best ways to be safe from harmful or potentially harmful additives in our foods?

From the interviews, questionnaires, existing documents, and the experts recommendations, it was found that some of the best ways to adopt to be safe from harmful or potentially harmful additives in our foods include trying to avoid most processed foods (i.e.; avoiding most additives); checking on ingredient labels of food products for their additives content in order to avoid the harmful or potentially harmful ones; cutting down or lowering the daily intake of salt and sugar; including more wholesome or organic foods in our diets; and reporting any abnormality in food products or additive concerns to authorities or the FDA for investigations and/or further actions to be taken. Moreover, a general guide from the experts on how to scan through or check for additive information on food labels were found to assert that;

- Food product ingredients are listed by quantity on their labels (i.e., from the highest to the lowest).

- This means that the first ingredient is what the manufacturer(s) used the most of.

- A good rule of thumb is to scan through the first three ingredients, as they make up the largest part.

- If the first three ingredients include names such as refined grains, hydrogenated oils or a sweetener (e.g.; sucrose (Sugar), fructose, sorbitol, mannitol, corn syrup, high-fructose corn syrup, saccharin, aspartame, sucralose, neotame, and acesulfame potassium (acesulfame-K)), it can be assumed that the product is unhealthy. Instead, try choosing items that have whole foods listed as the first three ingredients.

5.2 Conclusions

This study has examined the various additives in food products that are commonly used by cooks and matrons of senior high schools in Ghana for meal preparations. It has also been used to find out about the benefits and the possible health effects which they may have on human health.

The findings have shown that, a lot of the additives in food products that are used for meal preparations have been used for many years to either preserve, add/improve flavor, blend, thicken or improve the color of foods. Other nutritional additives (or Nutrition Supplement Additives) such as Riboflavin, Vitamins A and D, Niacin, Thiamine, and Ascorbic acid (Vitamin C) have also played an important and essential role in reducing the serious nutritional deficits in the county. Furthermore, it has been established that, additives help to make a wider choice of foods available at all times to meet consumer's demands from season to season. However, the other findings on the possible health effects that are associated with some additives remain a problem that needs to be tackled

by all and sundry. Some of the best ways that can be adopted to keep ourselves and families safe are that;

- If we need to use food additives or foods that contain additives because of their advantages, they should be the natural ones which have minimal effects or those that are FDA approved with their logo on it and also generally recognized as safe (GRAS). For additives that are approved but are not generally recognized as safe (Non GRAS), their acceptable daily intakes (ADIs) otherwise known as daily values which are mostly printed on the product's label should never be exceeded.
- To minimize the possible risk of developing health problems from additives, one should try as much as possible to avoid the use or consumption of highly processed foods and also endeavor to lower the daily intakes of salts and sugar.
- Before buying any prepackaged food, its ingredients label should be checked for information on the additives that they may contain so that an informed decision can be made.

5.3 Recommendations

5.3.1 Recommendations to End Users and All Stakeholders

- In accordance with the conceptual framework of the study, all food preparers as well as consumers must acquaint themselves with some fundamental knowledge on food additives so that, they can make right decisions on their choices of foods and the additives they contain which may reflect in their immediate or future general health.
- Cooks, matrons and individuals who prepare foods must consider if there are people who may be allergic to a certain additive so as to ensure that all additives in the

ingredients they use are safe for them and also fall within their acceptable Daily Intakes (ADIs).

- All non-essential food additives should be banned, especially the cosmetic agents such as food colorants. The FDA and the other regulating agencies can ensure that only additives that are generally recognized as safe (GRAS) may be added to foods by manufacturers.
- All foods that contain additives that are suspected to have carcinogenic, mutagenic or teratogenic properties should be clearly labeled with the appropriate warnings.
- Food regulators or the FDA should ban manufacturers from adding non - GRA additives to foods for babies or young children.
- All foods that have little or no nutritional value should be discouraged from all promotions. Also, TV adverts that promote unhealthy eating habits or encourage children to buy unhealthy junk foods should be banned by the regulating agencies.
- The regulating agencies must ensure that food manufacturers or the processing industries adhere to all the good manufacturing practices (GMP).
- The Education Authorities should include in their health education curricula, some specific lectures that stress on the prime importance of good nutrition in both the physical and mental health of children.
- Children who are diagnosed as hyperactive or children who are currently seen by psychiatric doctors should be screened for evidence of any possible food additive intolerance. This is because, if their hyperactivity is caused by an additive intolerance, even the simplest dietary changes that eliminates additive(s) such as

colored sweets, fizzy and sugary drinks from their diets can bring about a remarkable improvement in their health and behavior.

5.3.2 Recommendations for Further Studies

- The results of this study could serve as a foundation to further carry out a quantitative analytical study that will investigate the specific amounts of additives present in the ingredients that are used by the cooks and matrons in the senior high schools for meal preparations to find out if they are used within the allowed limits.
- Also, a future research may be required to look into the effects of possible cross reactions between direct additives that are intentionally added to foods and indirect additives (such as pesticides or packaging substances) that may accidentally find their way into foods during their processing, packaging, or storage.

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APPENDIX A I

FOCUS GROUP INTERVIEW SCHEDULE

FOR THE KITCHEN STAFF

- WELCOME NOTE - 1 minute.
- INTRODUCTIONS - 4 minutes.
- PURPOSE OF THE INTERVIEW – 5 minutes
- GROUND RULES - 5 minutes
- FILLING OF DEMOGRAPHIC FORMS BY INTERVIEWEES - 5 minutes
- INTERVIEW STARTS AND ENDS WITH OFFER OF SOFT DRINKS TO RESPONDENTS

  - 30 minutes

APPENDIX A II

DEMOGRAPHICS FORMS FOR KITCHEN STAFF PARTICIPANTS IN FOCUS GROUP INTERVIEW

Focus Group Participant Demographics

Before we start the interview, kindly provide the following short information about you by filling-in or ticking *(✓)* in the appropriate option.

Please be assured that, **your responses cannot be traced back to you and you will remain anonymous in our report.**

Date:	Time:	Place:

What is your gender?	What is your highest level of education?	What is your position in this department?
☐ Male ☐ Female	☐ Basic Education (Primary or JHS) ☐ Senior Secondary Education (SHS) ☐ Tertiary Education	_____.

APPENDIX A III

FOCUS GROUP INTERVIEW GUIDE

INTRODUCTIONS - 4 minutes.

Introduce yourself and your assistant moderator by mentioning your names and your roles in the interview to the group.

- **PURPOSE OF THE INTERVIEW – 5 minutes**

We invited you here today to participate in a research study we are conducting to look into the ingredients you buy for preparing your meals and the additives they may contain in order to find out if there are some benefits and/or possible health effects in using them. This study is being conducted to be submitted to the department of hospitality and tourism education of the University of Education, Winneba - Collage of Education, Kumasi in partial fulfillment of the requirements for the award of master of technology in catering and hospitality.

- **GROUND RULES - 5 minutes**

Please, in this interview;

1. WE WANT YOU TO DO THE TALKING.

However, the most important rule is that, only one person speaks at a time.

There may be a temptation to jump in when someone is talking but please wait until they have finished.

We would like everyone to participate. Also, I may call on you if I haven't heard from you in a while.

2. THERE ARE NO RIGHT OR WRONG ANSWERS

Every person's experiences and opinions are important. Speak up whether you agree or disagree.

We want to hear a wide range of opinions.

3. WHAT IS SAID IN THIS ROOM STAYS HERE
We want folks to feel comfortable sharing when sensitive issues come up.

4. WE WILL BE RECORDING THIS INTERVIEW ON TAPE
We want to capture everything you have to say.

We shall **NOT** identify anyone by name in our report. **You will remain anonymous.**

APPENDIX A III - CONTINUED

INTERVIEW QUESTIONS

Research Question - 1

1. What kinds of meals are prepared for the students?
   - Also, observe from the weekly meals menu.

2. What are the ingredients used for their preparation?
   - Also, observe from the weekly meals menu.

Research Question - 3

3. What are some of the best ways to keep ourselves and families safe from harmful or potentially harmful additives in our foods?

APPENDIX B

KITCHEN STAFF QUESTIONNAIRE

KS QUESTIONNAIRE

Thank you for taking this questionnaire!! Please, we would like you to take a few minutes of your time (less than five minutes) to answer the following few questions which will help us in our study that is aimed at examining food additives that may be contained in the ingredients that you buy for meal preparations.

This survey is anonymous. Therefore, you are not required to write your name on this paper. No one will be able to identify you or your answers, and no one will know whether you participated or not in this survey. However, lecturers at the University of Education, Winnneba – Kumasi, may inspect these records. If the data is published, no individual information will be disclosed.

Your participation in this study is also voluntary. By answering and returning this questionnaire, you are voluntarily agreeing to participate. You are free to choose not to answer any particular question which you do not wish to answer for any reason.

If you have any questions about the study, please contact the College of Technology Education – Department of Hospitality and Tourism Education - Kumasi, P.O. Box 1277, Kumasi Ghana. Telephone; (03220) 50331 / (03220) 53616.

Date:	**Time:**	**Place:**

Please answer the following questions by ticking (✓) in the box for the option that is appropriate to you or by writing your answer in the spaces provided.

1. Food additives are natural or artificial substances added intentionally to food products to improve the flavor, the color and shelf-life of foods

☐ Strongly Agree
☐ Agree
☐ Disagree
☐ Strongly Disagree

2. The functions of food additives are to improve the flavour, the colour and shelf-life of foods.

☐ Strongly Agree
☐ Agree
☐ Disagree
☐ Strongly Disagree

3. Do you know the name of any food additive ?

☐ Yes
☐ Don't Remember
☐ No

1 of 3

4. Do you know how to check for expiry dates on food products at the market?

☐ Yes
☐ Somehow
☐ Not Sure
☐ Not all

5. Do you know how to check for additive information on labels of food products at the market?

☐ Yes
☐ Somehow
☐ Not Sure
☐ Not at all

6. How often do you check on expiry dates on food products before you buy or use?

☐ Always
☐ Sometimes
☐ Rarely
☐ Never

7. How often do you check for additive information on labels of food products before you buy or use?

☐ Always
☐ Sometimes
☐ Rarely
☐ Never

8 (a) Do you know of any benefits in the use of additives?

☐ Yes
☐ No

8 (b) If yes can you mention any of the benefits?

_____

9 (a) Do you know of any harmful or potential harmful effects of additives?

☐ Yes
☐ No

9 (b) If yes can you mention any harmful or potential harmful effects of additives?

_____

_____

10 (a) Have you had any complain(s) this year on food allergies or health of students after they consumed any of the
school meals?

☐ Yes

☐ No

10 (b) If yes, what is the complain about, how many and what particular food(s)? Also, does the complain repeat with the same food(s)?

✶Type of Complain _____

✶Number of complains _____

✶Particular food(s) with complain(s) _____

✶Does complain repeat with same food? _____

3 of 3

APPENDIX C

STUDENTS QUESTIONNAIRE

QUESTIONNAIRE

Thank you for taking this questionnaire!! Please, we would like you to take a few minutes of your time (less than five minutes) to answer the following few questions which will help us in our study to examine food additives that may be contained in the ingredients that are used for meal preparations in the school.

This survey is anonymous. Therefore, you are not required to write your name on this paper. No one will be able to identify you or your answers, and no one will know whether you participated or not in this survey. However, lecturers at the University of Education, Winnneba – Kumasi, may inspect these records. If the data is published, no individual information will be disclosed.

Your participation in this study is also voluntary. By answering and returning this questionnaire, you are voluntarily agreeing to participate. You are free to choose not to answer any particular question which you do not wish to answer for any reason.

If you have any questions about the study, please contact the College of Technology Education – Department of Hospitality and Tourism Education - Kumasi, P.O. Box 1277, Kumasi Ghana. Telephone; (03220) 50331 / (03220) 53616.

Date: **Place:**

Please indicate your gender and your current level/form and proceed to answer the following questions by ticking (✓) in the box for the option that is appropriate to you or by writing your answer in the spaces provided.

• **Your gender?**	• **Your current level/form?**
☐ **Male**	☐ **SHS – 1**
☐ **Female**	☐ **SHS – 2**
☐ **Other**	☐ **SHS – 3**

1 (a). This year, did you or any of your friends get any allergy or food reaction or did you complain about your health after eating any of the school meals?

☐ Yes
☐ No

1 (b). If yes, what is the complain about, how many and what particular food(s)? Also, does the complain repeat with the same food(s)?

★Type of Complain _____

★Number of complains _____

★Particular food(s) with complain(s) _____

★Does complain repeat with same food? _____