KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY,

KUMASI, GHANA

COLLEGE OF HUMANITIES AND SOCIAL SCIENCES

SCHOOL OF BUSINESS

DEPARTMENT OF MARKETING AND CORPORATE STRATEGY

ASSESSING THE MODERATING ROLE OF KNOWLEDGE ON THE RELATIONSHIP BETWEEN CONSUMPTION DETERMINANTS AND INTAKE OF FRUIT AND VEGETABLES: A COMPARATIVE STUDY OF HEALTH AND NON-HEALTH WORKERS IN KUMASI

BY

ABRAHAM AMPONSAH

NOVEMEBER, 2023

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ASSESSING THE MODERATING ROLE OF KNOWLEDGE ON THE RELATIONSHIP BETWEEN CONSUMPTION DETERMINANTS AND INTAKE OF FRUIT AND VEGETABLES: A COMPARATIVE STUDY OF HEALTH AND NON-HEALTH WORKERS IN KUMASI

BY

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(MBChHB, MGCP, MPH)

A THESIS SUBMITTED TO THE DEPARTMENT OF MARKETING AND CORPORATE STRATEGY, COLLEGE OF HUMANITIES AND SOCIAL SCIENCES, SCHOOL OF BUSINESS, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF BUSINESS ADMINISTRATION

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I hereby do declare that, except for the references to other people's work, which have been duly acknowledged, this piece of work is my own composition and neither in whole nor in part has this work been presented for the award of a degree in this University or elsewhere.

ABRAHAM AMPONSAH …… ……..……..

PG3973520 **Signature** **Date**

Certified by:

DR KWAME OHENE DJAN …… ……..……

SUPERVISOR **Signature** **Date**

Certified by:

PROF AHMED AGYAPONG …… ……..……..

HEAD OF DEPARTMENT **Signature** **Date**

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ABSTRACT

Ghana is already battling with infectious diseases such as malaria, HIV/AIDS, and Tuberculosis, but also currently experiencing a surge in non-communicable diseases (NCDs) such as stroke, heart diseases, diabetes and cancers. Adequate Fruit and Vegetable (FV) consumption has been associated with reduced incidence of cardiovascular diseases, diabetes, some cancers, and obesity, as well as increased immunity and lifespan. The World Health Organisation (WHO) therefore recommends daily consumption of at least 400g of FV representing five (5) daily servings of 80g each. However, consumption levels of FV is generally low worldwide, and even lower in low-and-middle-income countries, such as Ghana. The main objective of this study was to study the moderating role of knowledge of the recommended servings of fruits and vegetables consumption on the relationship between consumption determinants and consumption frequency, with a particular focus on raw FV; comparing health and non-health workers in the Kumasi metropolis. The study employed a cross-sectional study design, with a sample size of 200 formal sector workers, comprising of doctors, nurses, teachers and bank workers. Participants were purposively and conveniently selected to complete a self-administered questionnaire with both close-ended and open-ended questions with 200 questionnaires analysed with both descriptive and inferential statistics. Results of the study indicated that only 8.5% of the respondents had consumption recommendation knowledge; mean raw FV consumption frequency of respondents was 2.18 (approximately *once a week*); in terms of FV consumption determinants, availability of FV was not much of an issue compared to food safety concerns; and consumption recommendation knowledge significantly increased the effect of consumption determinants on consumption frequency (regression coefficient = 1.02, p-value = 0.02). There was no significant difference between health and non-health workers in terms of all three (3) variables under study: FV consumption recommendation knowledge (p-value 0.31), consumption frequency (p-value = 0.90) and consumption determinants (p-value = 0.17). Therefore it was recommended that much effort be put into creating awareness on recommended FV consumption targets, and how to achieve these targets, especially among health workers, in order to improve consumption among the populace.

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LIST OF ABBREVIATIONS

AHA:	American Heart Association
FAO:	Food and Agriculture Organisation
FAOSTAT:	Food and Agriculture Organisation's statistics
FV:	Fruits and vegetable
FVK:	Fruit and vegetable knowledge
FVI:	Fruit and vegetable intake
GEPA:	Ghana Export Promotion Authority
Ha:	Hectares
Hg/ha:	Hectogram/hectare
LMIC:	Low/Middle Income Countries
Mt:	Metric tonnes
Mt/ha:	Metric tonnes/hectare
MoFA-SRID:	Ministry of Food and Agriculture – Statistic, Research and Information Department
NCDs:	Noncommunicable diseases
WHO:	World Health Organisation
USAID:	United States Agency for International Development

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

According to the World Health Organisation (WHO), about 16 million (1.0%) disability-adjusted life years and 1.7 million (2.8%) of deaths globally can be attributed to inadequate fruit and vegetable (FV) consumption. Adequate intake of fruits and vegetables decreases the risk for cardiovascular diseases, colorectal cancer and stomach cancer (WHO, 2022). Specifically, sufficient intake of FV decreases the risk of type 2 diabetes, hypertension, heart attack, stroke, and prevents weight gain (Boeing et al., 2012 ; Gonzalez et al., 2012). Fruits and vegetables contain substances such as vitamins, minerals, antioxidants and fibre, which account for their health-promoting properties (Slavin and Lloyd, 2012).

On account of these health benefits of FV, the World Health Organisation (WHO) recommends consuming at least 400 grams of fruit and vegetables each day, which translates into about five servings of 80 grams per portion of serving (Agudo and FAO 2005; WHO, 2020a). This is further achieved by consuming at least a total of 160g of fruits twice daily and a total of 240g of vegetables thrice daily, with at least one of the servings of vegetables containing nutrient-rich vegetables, classified as leafy or orange and dark vegetables (Striegel-Moore *et al.*, 2006).

There have been several programmes and campaigns across the world to promote the consumption of FV. In the USA, the "Produce for Better Health Foundation" engaged in a public and private partnership communication strategies to encourage consumption of at least five servings of FV a day per week, with similar programmes in Canada, the UK, Germany, and several other countries (Pomerleau, Joint and Organization, 2005). Similarly, in response to changing patterns of diseases from infectious diseases more towards non-communicable diseases in Ghana, the Ministry of

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Health introduced a Regenerative Health and Nutrition (RHN) programme, with FV consumption indicated as key to achieving the objectives of the programme (Macro, 2009).

Globally, however, consumption of FV is far less than the WHO recommendation of 400g per day (FAO, 2020). Compared to other regions, consumption is even lower for those in sub-Saharan Africa (Amao, 2018), including the Ghanaian population(Ruel et al., 2005; Hall et al., 2009; Ghana Statistical Service ~~et al.~~, 2015; Wu et al., 2015; Ghose & Yaya, 2018),

Factors that influence FV consumption include tastes and preferences, convenience, storage life, accessibility, availability, affordability, socio-economic and socio-cultural factors (Li et al., 2012). A report from a workshop organised by Food and Agriculture Organisation (FAO) and WHO in 2020 also indicated that some possible factors that influence FV consumption included availability, affordability, competition with other alternatives, education and culture, lack of knowledge, food safety and hygiene concerns, and national policies (FAO, 2020).

Knowledge of the health and nutritional benefits of fruits and vegetables, as well as on recommended levels of intake, has been shown to be positively correlated with consumption levels (Worsley, 2002; Dickson-Spillmann & Siegrist, 2011; Appleton et al., 2018; Hill et al., 2020; FAO, 2020).Yet Fruits and vegetables knowledge (FVK) has been generally below expected levels (Shaikh et al., 2008; Grimm et al., 2010). A study conducted in an urban area in Ghana demonstrated that only 9% of the respondents stated adequately the WHO recommendation on daily FV consumption (Awuni *et al.*, 2017).

Health-workers, particularly doctors and nurses are at the forefront of educating healthcare clients on the health benefits of appropriate diet, which includes FV consumption. They are therefore expected to know what adequate consumption of FV is in order to perform this role appropriately. Yet a study conducted among health professionals at neighbouring Burkina Faso in its capital city of Ouagadougou also found that only 1.6% of health workers studied had sufficient knowledge of the benefits of FV, and 85.5% were not aware of WHO's recommendations concerning FV consumption (Yewayan *et al.*, 2020). The study further indicated very low consumption of FV

among the health professionals, with only 11.8% and 21.8% consuming fruits and vegetable everyday, respectively, and only 1.4% meeting the WHO recommendation of five servings or more.

Although as stated above, that knowledge on FV consumption recommendation has a positive influence on consumption levels, yet there is limited research on ~~to the best of the author's knowledge, no study has assessed the~~the study of knowledge on ~~influence of this knowledge on~~ the relationship between consumption barriers (determinants) and consumption frequency, at least, in Ghana. The expectation of these associations are that, as one gains recommendation knowledge to guide consumption, one may put in more efforts to overcome the barriers of consumption and consume more FV, in order to reap the health and nutritional benefits supported by these recommendations.

Similarly also, most studies on FV consumption, to the best of the author's knowledge, did not compare fruit and vegetable consumption determinants, recommendation knowledge, and intake, among health and non-health professionals. Again, most studies were not particularly focused on the consumption of FV in their raw states although there is evidence that preservation of nutrients and health benefits are derived more from raw and minimally-processed forms than processed ones such as juices, dried or canned products or cooked vegetables (FAO, 2020). Minimal processing of FV involve washing, peeling and chopping, and do not interfere with their fresh-like nature (Gil and Kader, 2008) and nutritional values (Parrish, 2014). Full processing of FV entails juicing, canning in brine, fermentation, and conversion into dried fruits, which reduces their fresh-like nature and nutritional values (FAO, 2020).

This study thus aims to assess the impact of fruits and vegetable consumption recommendation knowledge on the relationship between consumption determinants and intake, comparing health and non-health workers, with a particular focus on raw or minimally processed FV. The study will contribute to available knowledge on FV consumption knowledge and intake, and will provide the

necessary information to inform health education and promotion efforts towards FV consumption for their health benefits among the Ghanaian population.

1.2 Problem statement

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~~Non-communicable diseases (NCDs) accounted for 74% of worldwide deaths in 2019 (WHO, 2020b). Non-communicable diseases, sometimes referred to as chronic diseases, include cardiovascular diseases (e.g., stroke and heart attack), cancers, diabetes, and chronic respiratory diseases, such as chronic obstructive pulmonary disease and Asthma (WHO, 2021). Eighty-five percent (85%) of premature (30 to 69 years) deaths from NCDs occur in low and middle income countries such as Ghana (WHO, 2021). Lifestyle factors that increase the risk of acquiring NCDs include smoking, alcohol misuse, physical inactivity and unhealthy diet (WHO, 2021).~~ Fruit and vegetables are important components of healthy diets, and their consumption in adequate amounts has been linked to the prevention of diseases (WHO, 2022)~~NCDs~~. Yet consumption patterns of fruits and vegetables are globally below the WHO recommendation of 400g per day (FAO, 2020), and even lower in sub-Saharan Africa (Amao, 2018), including Ghana (Hall *et al*., 2009).

Health workers are commonly considered to be at the forefront of promoting healthy habits that include fruits and vegetable consumption. This requires them to have significant levels of fruit and vegetable knowledge as compared to the general population. In addition, they are expected to show by example the healthy habits that they preach, such as consuming adequate amounts of FV. For these reasons, most interventions to promote healthy behaviour have been directed towards training health professionals, particularly physicians and nurses, so that they can in-turn impact the knowledge to healthcare clients and the populace, through counseling and health education on healthy behaviours, such as healthy eating and physical activity. Such interventions have been shown to impact positively on improving health behaviour of health care clients or patients (ter Bogt et al., 2011; Grandes et al., 2011). The Ghana Regenerative and Nutrition Health Training

Programme, for instance, targeted healthcare workers as "agents of change" to promote, among other healthcare interventions, fruit and vegetable consumption in the Ghanaian population (MOH, 2007).

Other studies have also shown that health professionals who practice healthy lifestyles such as healthy diet and physical activity are also likely to counsel patients about the benefits of these health behaviours (Wells et al., 1984; Frank et al., 2002; Frank & Elon, 2003; Frank et al., 2007; Huijg et al., 2015). And most of the studies on this subject of health-worker knowledge and practice of health behaviours, and their influence on the general population have been conducted with physicians and nurses (Wells et al., 1984; Frank et al., 2002; Frank & Elon, 2003; ter Bogt et al., 2011; Grandes et al., 2011).

A study among community health workers in Brazil revealed that most of them did not know the recommendations of FV intake, consumed less than five portions a day of FV and were overweight, yet they were mandated to promote healthy habits among the communities they serve (Florindo *et al.*, 2015). The study also found that fruit and vegetable knowledge (FVK) and fruit and vegetable intake (FVI) were positively correlated (Florindo *et al.*, 2015). Similarly, another study among 20,000 health professionals in England found that the prevalence of obesity was not significantly different between healthcare and non-healthcare workers (Kyle *et al.*, 2017). A similar national survey in the USA among various occupational groups also revealed that females working in a healthcare setting were among those with one of the highest prevalence of obesity (33.5%) (Gu *et al.*, 2014). Meanwhile, creating and maintaining a workforce that is healthy is key to the performance of health systems. If the well-being of health professionals are not maintained, there will be increased absenteeism due to illness and that could affect patient care, the well-being of other colleagues who may have to overwork themselves, and overall, the healthcare organization (Royal college of physicians, 2015). In the same vein that a healthy healthcare workforce means a healthy population, a knowledgeable healthcare workforce about health promoting activities will impact positively on the populace. One such health promoting activities that health professionals

should be knowledgeable about, practise themselves and promote in the population is consumption of FV in adequate amounts for their nutritional and health benefits. Such fruit and vegetable consumption knowledge includes knowing about recommended daily intakes of FV, as this can guide consumption in adequate amounts. However knowledge on the WHO recommended intake guidelines was found to be less than 10% in a Ghanaian study (Awuni *et al.*, 2017). Similarly, a study among health professionals in neighboring Burkina Faso in the capital city of Ouagadougou found low knowledge (1.6%) of health professionals on health benefits of FV, and majority (85.5%) of them were not familiar with the WHO recommendation on FV consumption, with as low as 1.4% of them meeting the recommendations of five daily servings or more of FV intake (Yewayan *et al.*, 2020).

Most studies on FV consumption have not distinguished between the raw and processed forms in their measurements and consumption levels reported include both processed and raw forms lumped together (Ruel et al., 2005; Hall et al., 2009; Ghana Statistical Service ~~et al.~~, 2015; Kpodo et al., 2015; Wu et al., 2015; Ghose & Yaya, 2018; Awuni et al., 2017; Yewayan et al., 2020). In Ghana, for instance, vegetables are mostly eaten processed or cooked such as taken as ingredients in 'soups' with "banku" or "fufu" or eaten as ingredients in stews with rice or yam (Kpodo et al., 2015; Saavedra et al., 2016; van den Broek et al., 2018). The main intention of vegetable consumption in these cooked forms is not necessarily for their health benefits but because they are served as part of a meal or a local delicacy meant to satisfy taste and hunger. Meanwhile, it has been indicated that preservation of nutrients and health benefit is more likely in fresh or raw FV than processed ones such as juices, dried, canned or cooked vegetables, which informed the focus of FAO's "International Year of Fruits and Vegetables" campaign for the year 2021 on fresh and minimally processed products (FAO, 2020). This study therefore, unlike many other studies, found it appropriate to focus on FV consumption in their raw states and as minimally-processed as possible. The study seeks to assess the impact of FV consumption determinants on intake under

the influence of consumption recommendation knowledge, with comparisons made between health and non-health workers.

1.3 Rationale of study

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The WHO recommends consumption of at least 400g of fruits and vegetables daily in order to reap their nutritional and health benefits. This translates into five portion sizes of 80g each per day, comprising of two portions (160g) of fruits and three portions (240g) of vegetables (Agudo and FAO, 2005; Striegel-Moore et al., 2006; Afshin et al., 2019). Consumption levels have been generally low especially in low and middle income countries (Ruel, Minot and Smith, 2005).

Fruits and vegetables consumption recommendation knowledge and intake have been found to be positively correlated in some studies (Worsley, 2002; Dickson-Spillmann & Siegrist, 2011; Appleton et al., 2018; Hill et al., 2020; FAO, 2020). Therefore FV consumption recommendation knowledge could reduce the impact of some other FV consumption barriers on consumption. Yet FV knowledge and intake have been found to be low, even among healthcare professionals, in some studies.

Healthcare professionals are mandated to promote healthy-living among the populace, which includes fruits and vegetables consumption as part of a healthy diet. Studies have shown that health-worker fruit and vegetable consumption knowledge and intake can impact positively on the knowledge and intake of healthcare clients and the entire population.

This study thus seeks to ascertain the influence FV consumption recommendation knowledge on the relationship between consumption determinants and intake, making comparisons between health and non-health workers, with a particular focus on raw FV consumption. Outcomes of the

study will help strategise efforts in the campaign on improving FV consumption for their health benefits among the population, and also contribute to knowledge in the area of study.

1.4 General objective

The main objective of this study is to assess the moderating role of fruits and vegetables consumption recommendation knowledge on the relationship between consumption frequency and intake; comparing health and non-health professionals in the Kumasi metropolis.

1.5 Specific objectives

The specific objectives to achieve the main objective include:

1. To assess the knowledge levels of the recommended intake of fruit and vegetables among health and non-health workers
2. To compare the frequency of consumption of raw fruit and vegetables among health and non-health workers
3. To compare the determinants of fruits and vegetables intake among health and non-health workers
4. To assess the impact of knowledge of the recommendations on fruit and vegetable consumption on the relationship between consumption determinants and consumption frequency.

~~4.~~

1.6 **Research** questions

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1. What is the level of knowledge on recommendations of fruit and vegetable consumption among health workers compared with non-health workers?
2. What is the frequency of raw fruit and vegetable consumption of health workers compared with that of non-health workers?
3. Are the determinants of fruit and vegetable consumption in health workers different from that of non-health workers?
4. What is the impact of fruit and vegetable consumption recommendation knowledge on the relationship between consumption determinants and consumption frequency?

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1.7 Scope of study

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The study was limited to health workers (doctors and nurses) on Government pay-roll from selected health facilities, bank workers from selected banks, and senior high school teachers from selected public senior high schools in the Kumasi metropolis. The study took place within a specific period of time and therefore the analysis and conclusions were based on this time period.

1.8 Methodology

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The study employed a cross-sectional study design, with a sample size of 200 formal sector workers, comprising of doctors, nurses, teachers and bank workers. Participants were purposively and conveniently selected to complete a self-administered questionnaire with both close-ended and

open-ended questions with 200 questionnaires analysed with both descriptive and inferential statistics.

1.9 Organisation of study

The study is organised into five major chapters. Chapter one deals with the background to the study, problem statement, research questions and objectives, significance of the study, scope of the study, limitations and organisation of the study. Chapter two is a review of literature on what other researchers and authorities have written in the subject area. Chapter three also takes care of the study area and research methodology. In chapter four the results of data collected were presented and major findings summarised, and also included a discussion of the findings situated in the context of available literature on the subject, and implications of the findings. Chapter five deals with conclusion and recommendations.

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CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviewed available literature on fruits and vegetables knowledge and consumption. The chapter looked at the benefits of FV consumption, the meaning of FV, the production and marketing of FV in Ghana, consumption pattern and determinants of consumption, as well as recommended daily intake, and how to measure intake.

~~2.2 Health and nutritional benefits of fruits and vegetables~~

~~In addition to malnutrition, unhealthy diets contribute to the top ten risk factors for disease worldwide (FAO, 2020). Consuming adequate fruits and vegetables can help reduce the risk of acquiring non-communicable diseases, as well preventing malnutrition in all forms, such as micronutrient deficiency, undernutrition, and being overweight and obese (WHO and FAO, 2005; Afshin et al., 2019).~~

~~Higher intake of FV has been linked to lower risks of type 2 diabetes mellitus (Li et al., 2014), lower risk of certain cancers (Boffetta et al., 2010), and a healthy heart (Wang et al., 2014). Other benefits of consuming FV in adequate amounts include improved mental health (e.g., lower risk of depression and anxiety) (Conner et al., 2017), improved immunity (Chowdhury et al., 2020), and the promotion of growth and development of children (Xin, 2016). Generally, those who consume more FV were found to live longer than those who do not (Leenders et al., 2013).~~

2.~~2~~3 Meaning of fruits and vegetables

2.~~2~~3.1 Definition of FV

According to FAO (2020), "Fruit and vegetables are considered edible parts of plants (e.g., seed-bearing structures, flowers, buds, leaves, stems, shoots and roots), either cultivated or harvested wild, in their raw state or in a minimally processed form." (FAO, 2020; p3). Examples of fruits are banana, mangoes, apple, watermelon, pineapples and oranges, and so on. Vegetables include tomatoes, onions, cabbage, lettuce, pepper, cucumber and carrots.

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2.23.2 Modes of preparation and consumption of FV

Fruits and vegetables can be eaten fresh (raw) or processed. Fruits are usually eaten raw (uncooked) as whole, such as berries, or peeled, such as bananas and oranges, or chopped into salads. Minimal processing such as washing, peeling and chopping does not interfere with its fresh-like nature (Gil and Kader, 2008), as well as nutritional values (Parrish, 2014) as compared with full processing such as juicing, fermentation, canning in brine or into dried fruits. Many kinds of vegetables can be eaten uncooked as salads, or eaten whole such as carrots or cucumbers, but some are cooked as ingredients in stews or soups. Usually, processing of FV is done to increase their shelf-life and value, as well as taste. However, the FAO's International Year of Fruits and Vegetables for 2021 focused on fresh and minimally processed FV (FAO, 2020).

2.32 Health and nutritional benefits of fruits and vegetables

In addition to malnutrition, unhealthy diets contribute to the top-ten risk factors for disease worldwide (FAO, 2020). Consuming adequate fruits and vegetables can help reduce the risk of acquiring non-communicable diseases, as well preventing malnutrition in all forms, such as micronutrient deficiency, undernutrition, and being overweight and obese (WHO and FAO, 2005; Afshin et al., 2019).

Higher intake of FV has been linked to lower risks of type 2 diabetes mellitus (Li et al., 2014), lower risk of certain cancers (Boffetta *et al.*, 2010), and a healthy heart (Wang *et al.*, 2014). Other benefits of consuming FV in adequate amounts include improved mental health (e.g., lower risk of depression and anxiety) (Conner *et al.*, 2017), improved immunity (Chowdhury *et al.*, 2020), and the promotion of growth and development of children (Xin, 2016). Generally, those who consume more FV were found to live longer than those who do not (Leenders *et al.*, 2013).

2.4 Fruits and vegetables production ~~and marketing~~ in Ghana

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2.4.1 Fruit production in Ghana

The main fruits produced in Ghana are mango, citrus, pineapple, banana, coconut, passion fruits and papaya (Assibey-Yeboah & Koomen, 2019; MoFA-SRID, 2021; Okyere and Nyarko, 2021). In Ghana, mango and citrus fruits have two seasons in a year. In the case of mango, although May to July represents the traditional season, there is an additional season in the Southern parts of Ghana that occurs from December to February (Assibey-Yeboah and Koomen, 2019). The harvest seasons for citrus fruits are between October and March, as well as from April to July. In the case of bananas and pineapple, they are cultivated throughout the year, especially with the support of drip irrigation (Assibey-Yeboah and Koomen, 2019).

Citrus includes oranges, limes, lemons and tangerines but oranges are the main citrus cultivated in Ghana. Citrus fruits in Ghana are cultivated mostly in the southern and middle belts of Ghana, with the main regions where production takes place being Eastern, Volta, Central, Ashanti, Bono-East, Ahafo, and Bono regions. (Pamela Okyere and Hilarion Nyarko, 2021). Food and Agriculture Organisation's statistics (FAOSTAT) figures for Ghana for oranges in 2020 show a production 697,637 metric tonnes cultivated over a total area 17,983 hectares with a yield of 387, 943 hectograms/hectare (about 39 metric/hectare). Productivity is however low, when compared with many other parts of the world such as Asia and Europe, as well some African countries (FAOSTATS, 2020).

About 60% of oranges are sold on the local market and to traders coming from Côte d'Ivoire, Burkina Faso and Mali, with the rest 40% sold to two major citrus processing companies locally, which produce orange juice concentrates, as well as to eight companies for processing into dried citrus peels for export (Okyere and Nyarko, 2021). Orange exports reduced by 69.4% from 10,153 mt in 2019 to 3,213 mt in 2020 (MoFA-SRID, 2021).

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Mango is cultivated in three ecological zones in Ghana, represented by the middle belt, the southern belt and the northern regions (Assibey-Yeboah & Koomen, 2019 ; Okyere and Nyarko, 2021). The Brong Ahafo and Eastern regions dominate among the regions that produce mango with 60% of the produce in Ghana cultivated by small-scale farmers. April to August, and November through January are the two production seasons (GEPA, 2020).

Ghana is among the highest producers of mango in West Africa and ranks higher than Burkina Faso, although lower than Senegal and Mali in that order (FAOSTAT, 2020). Insufficient storage facilities in the local market limits its capacity to absorb fresh mango, and therefore most of the mango produced in Ghana are sold for processing into juices, pre-cuts, and as dried fruit, mainly for exports (Okyere and Nyarko, 2021). Earnings from mango exports increased by 64.00% from US$ 12,527,478 in 2019 to US$ 20,545,410, mainly due to high yields from good agricultural practices and cultivation of more acres of land than before (GEPA, 2020; MoFA-SRID, 2021).

The major areas of ***pineapple*** cultivation in commercial quantities include the Eastern region, Nsawam, Central region, and Swedru areas (Assibey-Yeboah & Koomen, 2019; Okyere and Nyarko, 2021). FAOSTAT figures for pineapple in 2020 indicates a production 668,946 mt cultivated over a total area 10,595 ha with a yield of 631,379 hg/ha (approximately, 63 mt/ha) (FAOSTAT, 2020).

Fresh pineapples are mostly sold to the European Union market as fresh whole and also to companies for processing into juice concentrate, dried fruits and pre-cuts that are exported. There was however a drop in export earnings from pineapple production by 4.80% from US$ 9,228,405 in 2019 to US$ 8,785,492 in 2020 mainly because sand winning activities and expansion of estates developments reduced the acreage of land under cultivation in those areas, coupled with the use of poor quality fertilizers (GEPA, 2020 ; MoFA-SRID, 2021).

Currently, ***banana*** is cultivated on a large scale in Ghana by three companies namely Musahamat Farms Ghana Ltd in the Volta Region, Volta River Estates Ltd and Golden Exotics Ltd, both situated in the Eastern Region, mainly by the use of drip irrigation, ensuring its availability all year

round. These three large companies together cultivate about 2,400 ha of land area, mainly for export into the European Union market. In addition to these three companies, banana cultivation also takes place on smallholder farms in the south, coastal, and middle belt areas of Ghana (Okyere and Nyarko, 2021).

FAOSTAT data for banana in 2020 indicates a production of 87,832 mt cultivated over a total area 7,808 ha with a yield of 112,490 hg/ha (approximately, 11.2 mt/ha), with production ranked low compared to other African countries such as Cote d' Ivoire and Cameroon (FAOSTAT, 2020). About 80t of banana is processed into dried fruit by one company for exports while another 91t is processed as smoothies and sold on the local market by food vendors and restaurants (Okyere and Nyarko, 2021). Export yields from banana production decreased by 36.12% from US$ 63,827,566 in 2019 to US$ 40,771,305 in 2020 due mainly to reduction in demand from Europe as result of lockdowns on account of the Covid-19 pandemic (GEPA, 2020; MoFA-SRID, 2021).

Production of ***coconut*** is mainly in the coastal areas of the western region, and Ghana is among the largest producers in Africa. Coconut can be eaten fresh, as dried coconut chips or processed into coconut oil, and has been a highly-sought commodity in the international, regional and local markets (Okyere and Nyarko, 2021). The 2020 FAOSTAT figures for coconut indicates a yield of 53,567 hg/ha (about 5.4 mt/ha) cultivated over a total land area of 76,999 ha with a total productivity 412,459 mt.

Cultivation of ***papaya*** is mainly in the Eastern, Central and Volta regions with a very low yield of 3.4 t ha^{-1} compared to that of Indonesia (89 t ha^{-1}) and Brazil (43 t ha^{-1}) (FAOSTAT, 2020; Okyere and Nyarko, 2021). Although papaya is in high demand in the domestic market, there is inadequate production to meet the demands of both the local and export market, calling for a need to increase productivity to ensure that Ghana becomes more competitive. Pawpaw exports from Ghana decreased by 24.84% from 962,000 in 2019 to 723 000 in 2020 (MoFA-SRID, 2021).

2.4.2 Vegetable production in Ghana

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About 90% of vegetable farmers in Ghana are smallholder farmers, cultivating less than 2 hectares of the produce (Saavedra *et al.*, 2016). Tomato, onion, okra, eggplant, green pepper and beans are the major vegetables cultivated and consumed in Ghana, with tomato and onion being the two consumed most (Assibey-Yeboah & Koomen, 2019; MoFA-SRID, 2021).

Cultivation of ***tomatoes*** is highly seasonal and geographically-specific. Most of the tomatoes from December through to April-May are supplied by the Upper East region of Ghana and neighbouring Burkina Faso, while the Ashanti, Brong Ahafo, and Greater Accra regions contribute to supply later on at different times. Tomato produced by irrigation from Greater Accra dominates the market towards the end of the year (Saavedra *et al.*, 2016).

FAOSTAT data for tomatoes in 2020 shows a production 368,920 mt cultivated over a total area 47,000 ha with a yield of 78,494 hg/ha (approximately, 7.8 mt/ha) (FAOSTAT, 2020).

In addition, UN Comtrade (2019) estimated that an average of 80,000 mt of tomatoes were imported annually between 2007 to 2017, largely from Burkina Faso, although Asselt et al (2018) indicates a higher figure of about 100,000 mt annually between 2013 and 2015, with the explanation that large quantities of the produce are not accounted for because they enter the country through informal means (Asselt et al., 2018; UNComtrade, 2019).

In the case of ***onions***, the 2020 FAOSTAT figures revealed a production of 144,328 mt cultivated over an area of 8294 ha with yields of about 174,015 hg/ha (about 17.4 mt/ha) (FAOSTAT, 2020). Additionally, Ghana imported averagely about 860,000 mt annually between 2013 and 2015 mainly from Burkina Faso and Niger (Asselt, Masias and Kolavalli, 2018). The Bawku red variety, produced in Ghana, is most desirable for traditional meals, and the Galmi variety, which is imported from Burkina Faso and Niger, is most preferred in the hospitality industry because it is less pungent (Saavedra *et al.*, 2016).

Chillies and green peppers are the third most important vegetables in Ghana after tomatoes and onions, in that order. FAOSTAT data for 2020 for chillies and green pepper cultivation in Ghana

shows an area of 14,400 ha cultivated, amounting to 119,405 mt, with a yield of 82,920 hg/ha (about 8.3 mt/ha) (FAOSTAT, 2020).

2.5 Challenges facing the fruits and vegetable production sector in Ghana

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Major challenges facing the fruits and vegetables sector in Ghana concern input supply, poor agronomics practices, poor food safety and phytosanitary practices, high levels of post-harvest losses, and poor value chain linkages between producers and buyers (Saavedra et al., 2016; FAO, 2020; MoFA-SRID, 2021; Okyere and Nyarko, 2021).

Input supplies necessary to promote vegetable production include the right quantity and quality of seeds and seedlings, fertilizers and pesticides, as well as irrigation and greenhouse equipment. According to the Saavedra et al. (2016), however, most farmers are still relying on old varieties of seeds, and there is also an influx of fake fertilizers and pesticides in the market, hampering production of vegetables in adequate amounts and quality (Saavedra *et al.*, 2016).

In addition also, most farmers in Ghana lack the requisite knowledge and skill in vegetable production (both greenhouse and open fields) culminating in low yield per hectare in some vegetables, such as tomatoes, compared to their counterparts in Kenya and neighbouring Burkina Faso (FAOSTAT, 2020).

Government efforts towards pesticide registration, testing, and enforcement of regulations have been inadequate with substantial traces of banned chemicals such as DDT and some dangerous pesticides still found in some vegetables. Additionally, some reports indicated that some farmers were endangering themselves through poor methods of storing agrochemicals and spraying, leading to serious health consequences. In view of these poor food safety and phytosanitary practices, in 2015, Ghana suffered a ban from the international market on the exports of some vegetables. (Saavedra *et al.*, 2016).

There are also issues of post-harvest losses that challenge the value chain of vegetable production. Post-harvest losses of fruits and vegetables may arise from sun exposure and lack of cooling and storage facilities, physical damage during transport, the use of poor techniques and materials for packing vegetables, or from invasion of fungi, bacteria, insects and other organisms (Kader, 2002; Rathore et al., 2018; Saavedra et al., 2016).

Finally, the nature of the value chain and market also influences vegetable production in Ghana. There are four value chains or markets that have been identified. This includes the export market; supermarkets, hotels, restaurants and small corner shops; the large open markets, constituting about seventy percent (70%) of the vegetable market in Ghana, such as Agbogbloshie, Makola, and Tudu markets in Accra, Abinkyi market in Kumasi, and Techiman market; and the processed vegetables value chain that includes tomato pastes and canned vegetables. Presently, majority of factories that process vegetables are idle because imported processed vegetables, such as tomato pastes and canned vegetables, are cheaper, and supply of raw materials domestically is costly (Saavedra et al., 2016; Asselt et al., 2018).

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2.6 Efforts and innovations to boost FV production and marketing

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Innovations in the value chain of fruit and vegetable production in sub-Saharan Africa has focused on three main areas: enhanced farmer practices and inputs to improve the final quality of the produce; innovations against post-harvest losses, resulting in increased availability of food for Ghanaian consumers; and marketing innovations (Saavedra et al., 2016; FAO, 2020; Okyere and Nyarko, 2021). Such an example of low cost innovations tested in Sub-Saharan Africa, including Ghana, was a collaborative research project, the "Horticulture Innovation Lab research",

conducted by UC Davis and funded by the USAID through their Feed the Future programme, aimed at finding innovative ways to increase yields and assist smallholder farmers to make more profit (UCDAVIS, 2022).

2.6.1 Inputs and farmer practices

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Improving production starts with the right inputs or starting materials. Planting materials include seeds, seedlings, stems cuttings, corms, bulbs and suckers (Indu Priya, 2021). Quality seeds and other planting materials are needed to ensure production of quality FV in the right quantities(FAO, 2020; MoFA-SRID, 2021).

There are two varieties of seeds available in Ghana, namely open-pollinated and hybrid varieties. The open-pollinated seeds are usually saved by small-scale farmers while the hybrid seeds produced by breeders are imported in most African countries, making them not widely available(Saavedra *et al.*, 2016). Hybrid seeds have improved features over the open-pollinated ones in terms of increasing yields, enhanced resistance to diseases and pests and satisfying local market demands, since the breeders of hybrid seeds consider the climatic conditions, soil requirements, and resistance to insects, diseases and pests in the production of these seeds (Saavedra *et al.*, 2016).

Some strategies to obtain improved planting materials include grafting and tissue culture techniques for supplying seedlings and producing cultivars that are disease-tolerant and high yielding (Saavedra *et al.*, 2016). One such effort to improve input supply in Ghana has been a collaborative effort between GhanaVeg, and private companies such as 3As Agri-solutions, Agriseed, Tikola, Agrimat, Dizengoff, and Wienco. The aim of such collaborations are to ensure that farmers are provided with seeds and seedlings from sources that are certified in order to meet the requirements of the target markets (Saavedra *et al.*, 2016).

Other good agricultural practices include appropriate watering, the right use of fertilizers and adopting appropriate pests and diseases management techniques (FAO, 2020). The water requirement of many fruits and vegetables differ and therefore the right amount of water must be delivered at the right time and using the right techniques. When the supply of water is too much, the roots of the crops can rot, and too little water can also lead to the plants wilting.

Although irrigation is necessary to supplement rainfall, and even more needed in greenhouses, majority of small-scale farmers rely on the use of watering cans, which seem only practical in small gardens and greenhouses that are close to the farmers' place of residence. Larger areas call for the use of various kinds of irrigation systems, such as furrows or drip irrigations, or overhead systems (FAO, 2020).

Fertilizer application must rely on soil analysis to decide on the right type and amount, and should not be applied in excess. Synthetic fertilizer supply and availability to farmers can be enhanced when they are procured in bulk by farmer groups, taking advantage of credit schemes and subsidies associated with group and bulk purchases. Aside synthetic fertilizers, compost from farmyard manures can also be used to fertilize the crops (FAO, 2020).

Pest and disease control measures are also areas that require innovative techniques to enhance crop yields. Farmers usually apply more chemicals than is required, yet indiscriminate, as well as excessive use of these chemicals result in environmental and health problems for farmers (Tsimbiri *et al.*, 2015), harm beneficial insects, and also raise food-safety concerns as foods become contaminated (Saavedra et al., 2016; FAO, 2020).

Integrated pest management (IPM) is the best approach to control diseases and pests while ensuring little harm as much as possible to people, the environment, and beneficial organisms (Saavedra et al., 2016; FAO, 2020). It involves a combination of biological measures, enhanced cultural practices, using resistant varieties and habitat manipulation, and there is judicious use of pesticides, only when there is evidence that it is absolutely necessary (Flint, 2012). Different techniques and products are used within IPM, including scouting, monitoring, crop sanitation,

cultural and mechanical measures, the use of beneficial insects and mites, and as a last resort, corrective chemical control measures (Saavedra *et al.*, 2016). In Ghana, for instance, CABI has initiated several innovations to address phytosanitary and food safety concerns (CABI, 2022)

2.6.2 Harvesting and Post-harvest practices

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High temperatures contribute to increased rate of water loss, respiration and deterioration of fresh produce thereby resulting in loss of quality and post-harvest losses (Saavedra *et al.*, 2016). For instance, handling tomatoes at a 35^{o}C will give it a shelf life of 3 days but 14 days when conserved at 15^{o}C. Generally, when the handling temperature of fresh vegetables are reduced to about 20^{o}C to 15^{o}C, the shelf-life could be extended by four times, resulting in the need to reduce temperature after harvesting, as well throughout all the processes involved in handling, storing and the transportation of the produce (Saavedra *et al.*, 2016). In Ghana, however, temperatures can rise to as high as 35^{o}C or even higher, which calls for some innovative cooling techniques. Some low-cost innovative cooling techniques to maintain a cold chain during produce handling include the use of the CoolBot micro-controller and the Zero Energy Cold Chambers (Kitinoja, 2013).

The nature of packaging used can also determine the shelf-life of fresh products. If the volume packed in a sack or crate is too high and there is an increased risk of contamination from the packaging material, post-harvest losses are likely (Barrett et al., 2014). In Ghana, vegetables are packed mostly in wooden crates and traditional sacks. For instance, tomatoes are packaged commonly for transport in large wooden crates of about 20kg and cabbage in sacks containing at least 65 cabbages each (Saavedra *et al.*, 2016). A study conducted in Tanzania revealed that when rough and large wooden creates were replaced with smaller or plastic crates, and crate liners used, damage to vegetables was reduced substantially (Barrett et al., 2014). Plastic crates were found to reduce physical damages, last longer, and were easier to clean and therefore reduced the risk of contamination of the produce.

2.6.3 Marketing

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Domestic consumption of fruits in Ghana represents 70% of the market for fruits and vegetables, relatively more than that for vegetables (Assibey-Yeboah and Koomen, 2019). Fruits and vegetable farmers in Ghana supply the fresh produce to three main kinds of suppliers namely, domestic bulk suppliers, itinerant suppliers and other smaller groups of suppliers (Saavedra *et al.*, 2016). The domestic bulk suppliers supply over 80 percent of the produce to the local markets regularly on the basis of supply agreements with market "queens", but may supply directly to institutions and hotels as well (Saavedra *et al.*, 2016). There are different market queens for each type of fruits and vegetables. These queens negotiate on behalf of the traders under their leadership and also settle disputes among them. They are selected by the traders, then introduced to the district assembly and the local traditional community leaders, and never removed but rather replaced by their deputies when they retire or die (Peppelenbos, 2008).

The local markets, with examples as the Agbogbloshie and Makola markets in Accra, Abinkyi market in Kumasi, and the Techiman market, form about 70 percent of the fruits and vegetables market in Ghana. Most buyers who supply hotels and restaurants, and retail in corner-shops buy from these open markets (Saavedra *et al.*, 2016).

The itinerant suppliers supply close to 15 percent of the produce to the local markets. The main difference between them and the bulk suppliers therefore is that they supply smaller quantities, and in addition do not have special supply arrangements or contracts with the market queens and buyers (Saavedra *et al.*, 2016).

The third group of suppliers have less than 1 percent of the market share of the produce. These include a few local operators and specialised suppliers that serve supermarkets, hotels and corner-shops according to some delivery schedules, pre-determined price, specifications, quality control protocols and specified varieties mainly by some contractual agreements (Saavedra *et al.*, 2016). Imports from Europe are included in this category and account for around 2% of vegetables sold mainly in the supermarkets. Other examples in this category include Eden Tree, which targets the

middle-upper class with quality produce, and Freshmark, the fruits and vegetable procurement and distribution arm of ShopRite, which also serves the middle-upper class and their stores locally in South Africa and internationally across Africa.

Marketing innovations include home or office delivery, offering prepackaged selections, selling directly from farm to consumer, and processing the produce to add value for improved shelf-life and customer satisfaction (Saavedra et al., 2016; Okyere and Nyarko, 2021). For instance, "Wild Organic Foods" is a company in South African that delivers a choice of three bags of fruits and vegetables, namely the Standard bag, the Bigger Better Bag, and the Made-to-Order Bag, where consumers can select preferred fruits and vegetables from a catalogue to be included in a package (WildOrganicFoods, 2022). These packages are delivered usually weekly to convenient collection avenues, homes or offices in or around Cape Town.

Processing of fruits into pre-cuts, dried fruits and juices are also innovative marketing efforts that enhance their shelf-life and promote marketability. Currently, Ghana is underutilising its processing capacity for fruits juices and concentrate as only about 62% of an estimated installed processing capacity of 2,240t/day was used in 2019 (Okyere and Nyarko, 2021). In addition, only 172 out of 316 companies that are into processing fruits were functional, as of 2019. Companies such as Frutiland Processing Company, Blue Skies, and HPW Fresh & Dry Limited process fruits mainly for export into the EU market, while SMEs such as Crescent juice, Kalyppo, Vintage Farms, and Healthy Life serve mainly the domestic market (Okyere and Nyarko, 2021).

In terms of vegetables, tomatoes are mainly the produce of choice used for processing purposes in Sub-Saharan Africa (Saavedra *et al.*, 2016). However there are challenges facing many processing companies in Africa. For instance, a processing company in Rwanda that re-started tomatoes processing in 2003 was forced to close down in 2013 as a result of inconsistencies in the supply of fresh tomatoes, and had to resort to importing semi-processed tomato paste at a point from China as a stop-gap solution (Gathani and Stoelinga, 2013). Inconsistent supply of fresh produce because supply is seasonal, coupled with other high costs of investment, making it difficult for

local processing companies to compete with large imports of cheap tomato pastes and other processed produces from countries like China, Italy and USA, has been the situation observed in many African countries (Saavedra *et al.*, 2016).

2.7 Fruits and vegetables Consumption levels

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Majority of the world's population does not meet WHO's target for daily FV consumption (Hall et al., 2009; Miller et al., 2016; Afshin et al., 2019; Kalmpourtzidou et al., 2020). Averagely, worldwide consumption of fruits and vegetables is about two-thirds of the minimum amount recommended, with consumption varying from region to region (FAO, 2020). For instance, consumption in North Africa, Central Asia, and Middle East is slightly higher than the daily minimum recommendation while that of sub-Saharan Africa is about one-third the recommended amount. FV consumption levels in Ghana have been found to be below the WHO recommended levels. Ruel et al. (2005) indicated that about 87% of Ghanaian households consumed less than the recommended 400g/person/day (146kg/person/year), and average quantity consumed per person was about half (202g/person/day or 73.7kg/person/year) the recommended consumption amount (Ruel, Minot and Smith, 2005). A study conducted by Hall et al.(2009) in 52 countries found prevalence of low FV consumption of more than 70% among men and women in sub-Saharan African countries such as Ghana, Côte d'Ivoire, Senegal, Zimbabwe, Burkina Faso and Zambia (Hall *et al.*, 2009). The 2014 Ghana demographic and health survey also showed that FV consumption pattern was just three out of the seven days in a week among Ghanaians (Ghana Statistical Service ~~et al.~~, 2015). The Global Ageing and Adult Health (SAGE) survey in five countries (India, China, Ghana, Mexico, South Africa and Russia) conducted by Wu et al. (2015), again indicated 65% prevalence of insufficient FV intake among Ghanaian adults above the age of 50 years (Wu *et al.*, 2015).

A study at Cotonou, the largest city in Benin indicated an average daily FV consumption of 97g in school-going adolescents, which was far less than the recommended amount (Nago *et al.*, 2010). A similar study carried out among secondary school students in Lagos, the capital city of Nigeria, also demonstrated that although most of the students had good knowledge on the health and nutritional benefits of FV, intake of the recommended consumption of 400g or five daily servings was observed in only 5.45% of the students (Silva, Ayankogbe and Odugbemi, 2017). In a nationally conducted study in South Africa involving 3,480 adults aged 50 years and above, Peltzer and Phaswana-Mafuya (2012) observed an insufficient intake of FV among 68.5 percent of the respondents, especially in men with low educational level, low socio-economic status, and Black African or Coloured men (Peltzer and Phaswana-Mafuya, 2012).

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2.8 **Determinants of** consumption of fruits and vegetables

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According to FAO (2020) report, determinants of FV consumption include availability, affordability, education and culture, lack of knowledge, competition with alternatives, food safety and national policies(FAO, 2020). The report explained further that seasonal and perishable nature of FV, as well as issues of post-harvest losses, and transport and storage, implies that they will not be available in the same variety, quantity and quality throughout the year. In terms of affordability, FV is considered a luxury by many poor people who spend most of their income on food that are cheap, energy-rich and stomach-filling, such as staple carbohydrates like rice or cassava. Our tastes and food preferences are influenced by our culture and upbringing. Better-educated people have been found to work more outside home and therefore rely more on processed foods out of convenience that contain less fruits and vegetables. Report from the workshop also indicated that lack of knowledge of the health and nutritional benefits of FV influenced consumption level. In addition, aggressive advertisement for unhealthy processed foods make them appear tastier and socially desirable than FV, creating stiff competition for FV for the same amount of money to be

spent on food. Some concerns associated with FV consumption reported from the workshop bordered on its safety, and also hygiene considerations during preparation. FV are recommended to be consumed mostly fresh or minimally processed to preserve their nutritional and health benefits. This suggests that they might not undergo vigorous cleaning and processing that could remove significant amounts of contaminants and microorganisms before consumption. Such perceptions that FV can transmit pathogens and make people ill can discourage their consumption. Lastly the report indicated that governmental policies could favour production of staples crops over fruits and vegetables with very little incentives for local production of FV (FAO, 2020).

A qualitative study using focus group discussion among Beninese adolescents conducted by Nago et al (2010) found that with the exception of food safety concerns, the determinants of FV consumption were similar to those observed in high-income countries (Nago *et al.*, 2010). The researchers classified broadly the determinants most discussed among the participants as socio-environmental, personal, behavioural and other factors. The socio-environmental factors most discussed were availability and accessibility, nutrition education, competition with unhealthy foods and parental influence. Personal factors identified among the adolescents included preferences, as related to taste, smell, colour, or shape of FV or their experiences when eating them, be it good or bad. Taste was the major concern among the preferences. Other personal factors included nutrition and health knowledge of FV, and cultural beliefs that influenced FV consumption. Behavioural factors included eating patterns or habits that they followed routinely that may or may not include FV, and which are influenced by their school or home menu. Other factors that came out of the focus group discussions among the adolescents were the high cost of FV, food safety concerns, convenience and time of preparation of FV, and medical or dietician's prescription as a component of dietary counselling or therapy (Nago *et al.*, 2010).

Mintah et al. (2012) observed among the factors hindering fruits consumption among students in a public university in Ghana that high price and need for satiety were the most important barriers to fruits and vegetables consumption (Mintah *et al.*, 2012). To the students', consumption of fruits,

especially, did not yield the needed satiety and therefore could not alleviate hunger. As a result, 65% of the students consumed less than the recommended intakes. Similarly, Asfaw (2008) found that most poor households or people with low income prioritise satisfying hunger over nutritional and health benefits of food and therefore may prioritise energy-proficient foods over low-energy diets whose health benefits are rather cumulative than immediate (Asfaw, 2008). In this sense, fruits and vegetables are not considered to be energy-proficient and may therefore not be prioritised in household food budgetary allocations. Ruel et al. (2004) also found in a study of 10 sub-Saharan African countries that fruits and vegetable expenditure ranges from 3-13 percent of the overall household budget or between 5 and 16 percent of the household's food budget (Ruel, Minot and Smith, 2005). Kpodo et al (2015) found three top reasons for FV consumption in a study among polytechnic students in Ghana to be known health benefits, taste of the FV, and satisfying hunger, in that order (Kpodo et al., 2015).

2.9 Fruit and vegetable knowledge and intake

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High levels of fruit and vegetable consumption knowledge was found to promote intake in some studies (Worsley, 2002; Dickson-Spillmann & Siegrist, 2011; Appleton et al., 2018; FAO, 2020). However, Nti et al (2011) found in a study conducted in Ghana that although majority of respondents demonstrated fair knowledge of the health and nutritional benefits of FV, and all respondents (100%) agreed to their importance in human diet, the frequency of consumption did not reflect the level of knowledge of the importance of FV consumption (Nti *et al.*, 2011). The researchers blamed this scenario of high FV nutritional and health benefits knowledge, and its associated high perceived importance not significantly increasing consumption levels, mainly on the possibility of the intervening roles of other major determinants such as availability, affordability, or taste preferences. A similar study on FV consumption knowledge and intake among adults in Ghana showed that less than 10% of the respondents were aware of the WHO

minimum recommended amount, and the awareness levels had no impact on FV consumption (Awuni *et al*., 2017). Bawat et al (2012) also demonstrated in a similar study among adults in an urban community in Nigerian that consumption levels of FV did not reflect the high knowledge of health and nutritional benefits observed (Banwat *et al*., 2012).

A study among health professionals in neighbouring Burkina Faso indicated that the situation was not any different in terms of their fruits and vegetable knowledge and intake. The study indicated that only 1.6% of health workers studied demonstrated sufficient knowledge of the benefits of FV, and most (85.5%) of them were not aware of the recommendations of WHO regarding FV consumption (Yewayan *et al.*, 2020). The study also found that consumption was low for both fruits (11/8%) and vegetables (21.8%) with just about 1.4% of the health workers meeting the recommendation of consuming five or more daily portions of FV.

2.10 Methods of determining and measuring intake of FV

2.10.1 Portion size determination and calculation

WHO recommends at least 400 grams of fruits and vegetables consumption in a day (Agudo and FAO, 2005; WHO, 2020a). This translates into 80g each of at least five daily portions of FV. Of this, two servings of fruits totaling about 160g and three servings of vegetables amounting to about 240 g is recommended per day (Striegel-Moore *et al.*, 2006).

What counts as a portion size, serving or 80g of vegetables is a volume of 250mls of raw leafy vegetables such as broccoli, lettuce, spinach, carrots or pumpkin, or half of this amount (125mls) as cooked or chopped vegetables. This volume is what is referred to as a "cup" or "bowlful". (Agudo and FAO, 2005; NHS, 2018; AHA, 2022).

Fruits can be small-sized such as kiwi fruits, apricots or plum. Two (2) or three (3) of such small fruits are considered one portion size. Then there are further smaller fruits such as berries and cherries, half a cup of which counts as a serving or 80gs. One medium-sized fruit such as a banana,

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apple, an orange, a pear, peach or mango makes up one serving. Larger fruits include papaya, melon, and pineapple and a serving of large fruits refers to a slice, for instance a 5cm slice of melon. Finally, one cup diced or canned fruit (with no added sugar) or half cup of fruit juice (with no added sugar) count as a portion (Agudo and FAO, 2005; NHS, 2018; AHA, 2022).

2.10.2 Methods of assessing or measuring fruits and vegetable intake

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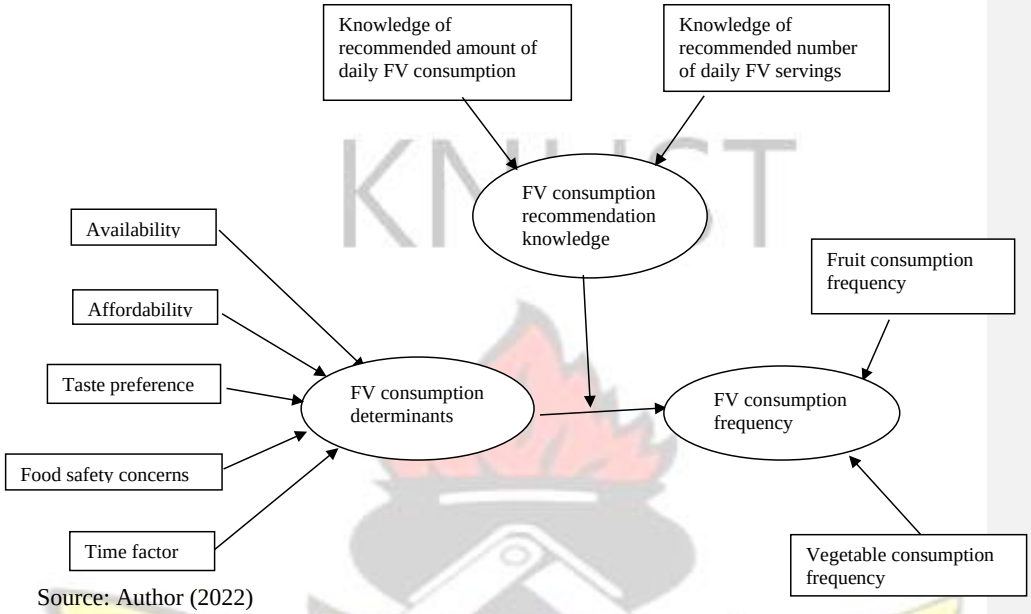
Food measurement involves the use of 24-hr recall, food frequency questionnaire ~~(FFQ)~~, dietary history, weighted food record or diary, and non-weighted food record or diary (Agudo and FAO, 2005). *Food diaries* or food records require subjects to record food intake over a defined period, usually, a week. When additionally the weight of the foods consumed are required, then it becomes a *weighted food record*. The *24-hour dietary recall* method involves reporting all foods taken within the 24- hour period before the subject was interviewed. The recall is usually carried out through a face-to-face interview but can be conducted by telephone or self-administered. *Food frequency questionnaires* contain a list of individual foods or food groups and respondents are required to estimate how frequently they consume each, such as daily, weekly or monthly. In addition, the amount of each food consumed can also be indicated, if required. Food frequency questionnaires are usually self-administered. *Dietary history* requires subjects to report their food intake in a typical week over a specified timeframe, in order to ascertain one's usual food intake (Agudo and FAO, 2005).

The food diaries have the disadvantage of non-compliance of participants and the dietary history also relies too much on the interviewer, such that these two methods are deemed overly complex and therefore not usually recommended for population studies (Agudo and FAO, 2005). The 24-hr recall and food frequency questionnaires are the most commonly used for measuring food intake, including fruits and vegetable intake (Agudo and FAO, 2005). Both involve memory, and that can introduce recall problems that is worse for food frequency questionnaire~~FFQ~~ than 24-hr recall because the former requires a recall of past intakes over longer periods while the latter

requires recall of intakes over a short period that is very close to the interview. A less often used method in assessing food intake involves measuring certain components of foods in body fluids and tissues, such as the use of plasma carotenoids levels as a biomarker for fruits and vegetables consumption (Agudo and FAO, 2005).

2.11 Conceptual framework



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2.12 Hypothesis

1. H0: There is no significant difference in fruits and vegetables consumption recommendation knowledge between health and non-health professionals.
   H1: There is a significant difference in fruits and vegetables consumption recommendation knowledge between health and non-health professionals
2. H0: There is no significant difference between raw fruits and vegetables consumption frequency between health and non-health professionals.
   H1: There is a significant difference between raw fruits and vegetables consumption frequency between health and non-health professionals.
3. H0: There is no significant difference in the determinants of fruits and vegetables consumption between health and non-health professionals.

H1: There is a significant difference in determinants of fruits and vegetables consumption between health and non-health professionals.

4. H0: There is no significant impact of FV consumption recommendation knowledge on the relationship between consumption determinants and consumption frequency.

   H1: There is a significant impact of FV consumption recommendation knowledge on the relationship between consumption determinants and consumption frequency.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses the methodology used for the study. It emphasises the research design, the sampling techniques and sample size determination, the methods of data collection as well as ethical considerations for the study. The chapter also focuses on the main variables for the study.

3.2 Profile of Study Area

The study was conducted in Kumasi, the capital city of the Ashanti Region, and the second largest city of Ghana, after the capital, Accra. Kumasi is made up of a metropolitan assembly (Kumasi Metroplitan Assembly) and 5 municipal assemblies namely, Asokwa, Kwadaso, Oforikrom, Old Tafo and Suame. Kumasi is positioned in the transitional forest zone and is about 270km north of the national capital, Accra, and is located between Latitude 6.35o N and 6.40o S and Longitude 1.30o W and 1.35o E and elevated 250 to 300 meters above sea level.

The city shares boundaries with Kwabre East Municipal and Afigya Kwabre District to the north, Atwima Kwanwoma District and Atwima Nwabiagya North District to the west, Asokore Mampong Municipal and Ejisu Municipality to the east and Bosomtwe District to the south. (KMA, 2022a; KMA, 2022b).

3.2.1 Population

According to the 2021 population and housing census the population of the Kumasi Metropolitan Assembly is 443,981; Oforikrom Municipal Assembly: 213,126; Asokwa Municipal Assembly: 125,642; Kwadaso Municipal Assembly: 154,526; Suame Municipal Assembly: 136,290; and Old Tafo Municipal Assembly: 114,368. The population of the study area was therefore 1,187,933 representing 577,257 males and 610,676 females. (GSS, 2021)

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3.2.2 Vegetation/Climate

The climate is characteristically wet equatorial with the main rainy season ranging from late February to early July and the minor rainy season from mid-September to early November. The dry season mainly spans from December to March. Mostly the vegetation looks like a semi-deciduous forest with a lot of vital trees (Ghana Statistical Service, 2010).

3.2.3 Occupation

Trading and farming are the major occupation of the inhabitants. The main trading centres are the Central Market (The largest open air market in the ECOWAS Sub-Region), Adum business area (the central business area), Suame and Asafo Magazine (trading in automobile spare parts); and Kaase/Asokwa Industrial Area. Other satellite trading centres however exist in the various sub-metros. The communities at the outskirts of the city also engage in some farming activities (Ghana Statistical Service, 2010).

3.2.4 Transportation

Almost all the major roads inside the city are tarred. Public vehicles (Taxis and "trotro") are the major modes of transport. Kumasi has an airport as well (Ghana Statistical Service, 2010).

3.2.5 Economic characteristics

Two-thirds of adults in the Metropolis aged 15 years or more are active economically, out of which about 769,381 (91%) are engaged in a form of employment with the rate of unemployment being about 8.6% (Ghana Statistical Service, 2010).

3.2.6 Education

In terms of schools in the Kumasi Metropolis, pre-schools are 919 in number, primary schools are 967, there are 597 junior high schools and 52 senior high schools, and tertiary institutions are 10

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in number. The Kwame Nkrumah University of Science and Technology, which is Ghana's number one University of Science and Technology, is also situated in Kumasi and provides higher education to Ghanaians, as well as students from other parts Africa and the world.

Senior high schools (SHS) in Ghana are classified as category A, B, and C schools, with the category "A" schools known for their popularity as the best-performing and first-choice schools. There are six (6) category "A" schools in Kumasi namely, Prempeh College, Opoku Ware School, St. Louis SHS, Yaa Asantewaa SHS, T. I. Ahmadiyya SHS and Kumasi High SHS.

Approximately 9.1 % of the population aged 3 years and above have never attended school; 40.5 % are presently enrolled in some school; and 50.3 % represent those who have ever attended some school. Compared to males (5.5%), females (12.4%) form the majority of those who have never attended school (Ghana Statistical Service, 2010).

3.2.7 Health facilities

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Overall, hospitals, clinics and Health Centres in the Kumasi are 114 in number, out of which 25 are public-owned and 89 are privately-owned facilities. The public facilities comprise of 1 Teaching Hospital, 5 hospitals belonging to the Ghana Health Service (GHS), 1 government-owned clinic (GHS), 6 Health Centres (GHS), 7 facilities of the Christian Health Association of Ghana (CHAG) and 5 Quasi-government facilities. There are 42 private hospitals and 47 private clinics. Aside these hospitals, clinics and Health Centres, there are also Community-based Health Services (CHPS compounds) that also serve a small section of the population in the various communities (Kumasi Metropolitan Health Directorate, 2018).

3.2.8 Financial and insurance activities

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The financial and insurance ventures in Kumasi consist of commercial banks, rural banks, saving and loans institutions and Susu collectors. Major commercial banks in the Metropolis include GCB Bank, Consolidated Bank Ghana, Ecobank, ABSA, Standard Chartered Bank, CAL Bank, Zenith

Bank and Bank of Africa. Rural banks include, Atwima, Bosomtwe, Adansi, and Juaben rural banks and so on (Ghana Statistical Service, 2010).

3.3 Research design

~~A cross-sectional descriptive study design was used and a quantitative method was employed to show how the variables were related.~~ The study design can be described as the plan or outline for the study (Akhtar, 2016). It gives an appropriate structure on which the entire study is grounded (Sileyew, 2019). The study design may be qualitative, quantitative, or a mixed method, which is a blend of the two. These methods are discussed as follows:

3.3.1 Quantitative design

Quantitative research design is a study method that relies on numerical data and statistical evaluation to come up with conclusions about a research question or hypothesis (Goertzen, 2017). Collection of data in quantitative research is mostly through surveys, experiments, and other methods to produce data that can be measured and analysed using statistical tools. Quantitative research is commonly used in social science research, such as sociology, psychology, political science and economics, however, it can also find use in other fields, including engineering, education and medicine.

3.3.2 Qualitative design

Qualitative research aims to understand an individual's or a group's subjective experiences and perceptions (Creswell, 2014). It relies on people's interpretation of events and phenomena as they occur naturally in their environments (Aspers and Corte, 2019). Methods of data collection in qualitative research include observation, interviews, focus group discussions and document study. (Busetto et al., 2020). Data analysis in qualitative research may be done by content, thematic, narrative, grounded theory or discourse analysis (Burck, 2005; Vaismoradi et al., 2013).

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3.3.3 Mixed methodology

A mixed-method research design combines both qualitative and quantitative methods in one study to better appreciate a research matter (Shorten and Smith, 2017). This implies the use of varied methods in data collection, analysis and interpretation. This enables researchers to pursue a much wider understanding of their research environment so that phenomena can be viewed from varied perspectives.

3.3.4 Research design Adopted

This research adopted the quantitative approach to research. The quantitative design was chosen because it describes and studies relationships, such as allowing the use of statistical measures of correlation and regression that could be employed to evaluate the interaction between an independent variable and a dependent variable (Watson, 2015). Also, adopting the quantitative approach allowed hypotheses formulation, which were captured in chapter two.

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3.4 Research Purpose

The research purpose brings to light the motive behind the decision to study the moderating role of knowledge on the relationship between consumption determinants and intake of fruit and vegetables. There are basically three ways to clarify the aim of research, namely, exploratory, explanatory, and descriptive. These are explained as follows:

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3.4.1 Exploratory

Exploratory research tend to address new problems that have seen minimal or no preceding research at all (Swedberg, 2020). As such, it usually resort to using research strategies that are interpretive and aims to provide answers to the why, what, and how questions. This type of research is carried out to clarify the nature of the problem in order to improve our understanding

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of the situation (Saunders et al., 2016). It can serve as a preliminary research that can lay a groundwork for a more definitive study.

3.4.2 Explanatory

Explanatory research, also referred to as causal research, is done to determine the scope and nature of cause-and-effect relations by defining the patterns of associations between variables (Bryman, 2016). The primary method of collecting data that is frequently used is the experiment. Analysis done in explanatory research seeks to confirm or refute a prediction or hypothesis by studying likely causes and explanations.

3.4.3 Descriptive

Whereas analytical research aims to establish why things happen, and how they came to be, descriptive studies may simply be concerned about determining, describing, or identifying what is (Krifa and Ethridge, 2004). In other words, it is an expression of present events where by the investigator has no influence over the variables. The three principal aims of descriptive research therefore, are to describe, explain, and validate research results. It is a productive approach to gathering data that can be useful for forming hypothesis as well as suggesting associations.

3.4.4 Research Purpose Adopted

Explanatory together with descriptive study approach were used in this study. The explanatory method was selected to give meaning to the causal association between consumption determinants and intake of fruit and vegetables among health and non-health workers in Kumasi. In addition, the explanatory approach was chosen to explain the moderating role knowledge on fruits and vegetables plays in the relationship between consumption determinants and intake of fruit and vegetables. The study also adopted the descriptive research approach for the purpose of describing the qualities of the sample that was selected for the research.

~~The questions were both close ended and open ended.~~

3.4 Study population

The study population consisted of all health and non-health workers in the formal sector in Kumasi at the time of study.

3.5 Sample size

Recommendations have been made from previous studies on the minimum sample size needed to carry out certain statistical analyses. For instance, a minimum of 50 samples are needed for simple regression analysis and generally 100 samples are deemed adequate for most research situation (Hair et al., 2018). An absolute minimum sample size of 200 is considered adequate for Pearson Correlation analysis (Guilford, 1954). A sample size of 200 was therefore chosen for this study.

3.6 Respondent sampling techniques

The sample size of 200 was shared among the doctors, nurses, SHS teachers and bank workers equally, which translated into 50 per each worker group. To select the teachers, three (3) out of the 6 category "A" government-owned SHS in Kumasi were purposively selected first. These include 1 boys-only SHS; 1 girls-only SHS; and one mixed-sex SHS. These schools were selected over the category "B" and "C" schools because they were more likely to have a good number of teachers with socioeconomic status comparable to that of the other group of workers selected for the study. Government-owned facilities were selected to ensure that the teachers selected had regular income and therefore could afford, to some extent, the purchase of FV. Although a preliminary search revealed that each of the category "A" schools have at least 100 teachers employed, and therefore could produce at least 50 respondents for the study, one each of the three sex-types of schools (boys-only, girls-only and mixed-sex) was selected to ensure a representation of each type of school to avoid gender bias in selecting the teachers. The sample size of 50 was divided among

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the three schools in an almost equal proportions, representing seventeen (17) teachers in two of the schools and sixteen (16) teachers in one of the schools, with allowance for slight variations in this proportional distribution to account for the respondents' willingness to participate in the study.

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By the classification of the Ministry of Health of Ghana, there are three major types of publicly owned hospitals, namely, Teaching Hospitals, hospitals owned by the Ghana Health Services (GHS), and Faith-based Hospitals owned by the Christian Health Association of Ghana (CHAG) in partnership with the government, with monthly salaries of doctors and nurses in these facilities being paid by the government (Controller-accountant generals department). In Kumasi, there is one Teaching Hospital, five GHS-owned hospitals and three CHAG-owned type of hospitals.

To ensure a good representation of each type of public facility, sampling of doctors and nurses took place in these three types of public facilities. Twenty (20) doctors were selected from the only one Teaching Hospital in Kumasi, 15 doctors were selected from two GHS hospitals, and another 15 doctors selected from two CHAG hospitals to make a total of 50 doctors selected for the study. Similarly, 20 nurses were selected from the Teaching Hospital, and 15 nurses each were selected from the GHS and CHAG hospitals respectively to make a total of 50 nurses selected for the study. However, unlike for the doctors, where two GHS and CHAG facilities were selected for sampling of doctors, one GHS and one CHAG hospital each were included for the selection of nurses because of the relatively large number of nurses compared to doctors in these hospitals. More doctors and nurses were selected from the Teaching Hospital than the other two categories of hospitals because of the relatively large population size of doctors and nurses in the Teaching Hospital than these other two categories of public hospitals.

Public facilities, where doctors and nurses are paid by government, were selected over privately-owned counterparts because they may have a good number of representation of doctors and nurses who are guaranteed regular income and therefore could afford FV. Similarly, hospitals were selected over other health facilities such as Clinics and Health Centres on account of hospitals

having larger numbers of nurses and doctors, making it easier to obtain the number required for the study.

Similarly, 5 largest banks in Kumasi, namely GCB, ABSA, Standard Charted Bank, Consolidated Bank Ghana and Ecobank were purposively selected as sites for selection of bank workers. Again, for similar reasons as stated above, largest banks were purposively selected because they have a good representation of branches and bank workers for respondent selection, and also to ensure that the respondents earn a regular and considerable income. Five banks were considered enough to account for a wider representation of banks and also to ensure that enough workers are available for selection. In that case, any worker at any of the branches of the selected banks were qualified to be included in the study. Thus, 10 bank workers were expected to be conveniently selected from each of the 5 banks to make a total of 50 bank workers selected for the study, with allowance for variations in this proportional distribution to take into account respondents' willingness to participate in the study, depending on the bank involved.

3.7 Data collection instrument

A semi-structured questionnaire was employed to collect both close-ended questions and open-ended ones. The questionnaires were captured in both electronic (as Google forms) and printed versions. A pre-test survey was undertaken among selected health and non-health workers to help in the design of the data collection instruments, and also to assess their validity.

3.8 Data collection process

Questionnaires were distributed both electronically by Google forms and also as hardcopies to facilitate the data collection process, and were supposed to be self-administered. At the various facilities, at least one doctor, nurse, teacher, bank worker or a staff of the facility who had access to share information on their group's WhatsApp platforms was located. The questionnaire was

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shared with these lead persons who then in-turn share them on their group WhatsApp platforms. For those who preferred the printed questionnaires to the electronic version, they were handed hardcopies to fill.

The questionnaire collected data mainly on fruits and vegetables consumption recommendation knowledge, consumption determinants and intake. It was made up of four (4) sections.

The first section collected biographical data of the respondents such as age, sex, marital status, educational level, occupation and religion. The second section captured information on the respondents' knowledge on recommended fruits and vegetables consumption amount and frequency. Knowledge of the total daily consumption amount was assessed by asking the respondents to state in grams (g) the recommendation of the World Health Organisation (WHO) on what the minimum adequate daily fruits and vegetables consumption amount is. Similarly, respondents were asked to indicate the total number of portion sizes or servings of fruits and vegetables recommended by WHO to be consumed in a day.

The third section assessed consumption of raw fruits and vegetables in terms of forms of usual consumption (whether processed or raw); frequency of intake; reasons for consumption; and sources of acquiring FV. Respondents were asked to indicate how frequently they had consumed fruits and vegetables in the past one month. The responses were "never", "occasionally", "once a week", "2-6 times per week", "once daily", and "2 or more times per day".

The fourth and final section looked at the determinants of fruits and vegetable consumption among respondents. Respondents were asked to indicate on a 5-point Likert Scale about the level of importance of how much barriers to fruits and vegetable consumption such as availability; affordability; taste preferences; food safety and hygiene concerns; and lack of time for shopping and preparing FV, influenced their pattern of consumption of fruits and vegetables.

3.9 Study variables

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3.9.1 Dependent variable

As shown in table 3.1, the outcome variable was frequency of fruits and vegetables consumption. Consumption frequency was measured on a continuous scale using a Likert Scale with frequency options. Respondents were asked to indicate on a scale of 0 to 5 their frequency of consumption of fruits and vegetables. Two questions were asked; one to asses frequency of fruits consumption and the other on frequency of vegetables consumption. Answers to how often they consumed raw fruits or vegetables in the past one month was to be answered as "Never", "Occasionally", "Once a week", "2-6 times per week", "Once a day" or "2 or more times per day". The answer "Never" was assigned the lowest score of "0", while "2 or more times a day" was assigned the highest score of "5". The others were "Occasionally": 1; "Once a week": 2; "2-6 times per week": 3; and 'Once a day": 4. The scores on the two questions: one on frequency of raw fruits consumption and the other on frequency of raw vegetables consumption were aggregated into one composite mean score to represent both fruits and vegetables consumption frequency.

Although WHO recommends consumption of at least two portion sizes of fruits, and three portion sizes of vegetables per day, such recommendations include processed forms of FV such as juices, canned, and dried, and processed or cooked vegetables such as in soups, stews and ground pepper sauces. Typically, it is less likely for Ghanaians to consume one banana, mango or orange at a sitting than two or more. Meanwhile, these medium-sized fruits each represent a portion. Hence in terms of fruits, a consumption of once a day could account for the recommended two or more portions of fruits consumed at a sitting rather than spread as two separate portions consumed at different times.

Similarly, the usual Ghanaian delicacy or local dish includes a soup, prepared with vegetables that can be eaten with "fufu" or "banku", or a stew, such as "garden egg stew", "Nkontomire stew", or "cabbage stew" that can be eaten with rice or yam, as well as "ground pepper sauce" prepared by

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grinding or blending raw tomatoes, pepper and onions, eaten with "banku" or "kenkey". Any of these combinations of processed or cooked vegetables could be eaten throughout the day and therefore complementing these with consumption of raw forms such as a salad once a day could pass for an adequate total daily vegetable consumption.

However, the researcher was interested in the raw forms of consumption on account of evidence of reaping more nutritional and health benefits than the processed ones. Additionally, people who eat raw vegetables, as whole or as salads, for instance, may be more concerned about their nutritional and health benefits than solely satisfying taste and hunger, compared with those who consume them as stews or soups as essential additions to complete a delicacy.

Hence, responses of *never*, *occasionally, once a week* and *2-6 times weekly* chosen for both fruits and vegetables were captured as *inadequate* consumption while consumption of *once a day* or *2 or more times a day* selected for both raw fruits and vegetables were considered adequate for raw fruits and vegetables. The frequencies were scored as "0" for never; "1" for occasionally; "2" for once a week; "3" for 2-3 times per week; "4" for once a day; and "5" for 2 or more times per day. This implies that a mean score of "3" or less is considered inadequate consumption for both raw fruits and vegetables combined, while that of "4" and above is considered adequate consumption.

Table 3. 1 Dependent variable

Dependent variable	Indicators	Measurement
Frequency of fruit and vegetable consumption)	Frequency of fruit consumption	How often did you consume raw fruits in the past one month? Never - 0 Occasionally - 1 Once a week - 2 2-6 times per week - 3 Once a day - 4 2 or more times per day - 5
	Frequency of vegetable consumption	How often did you consume raw vegetables in the past one month? Never - 0 Occasionally - 1 Once a week - 2 2-6 times per week - 3 Once a day - 4 2 or more times per day - 5

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3.9.2 Independent variable

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From table 3.2, the explanatory variable used in the study was determinants of FV consumption. The determinants of FV consumption was assessed on a continuous scale using 5-point Likert scale responses to five (5) questions. The respondents were to indicate the level of importance of the determinants of FV consumption, namely, availability of FV, affordability, taste preference, food safety concerns, and time for FV shopping and preparation to their consumption. The 5-point Likert Scale comprised of *highly unimportant*, *unimportant*, *neutral*, *important* and *highly important*.

The mean score of each question representing a determinant of FV consumption was calculated and used to rank the determinants from highest to lowest in order to compare the respondents' relative perception of these determinants. In addition, answers to the scores for the five questions were aggregated into one composite mean score used as the overall mean for the independent variable representing the determinants of FV consumption.

Table 3. 2 Independent variable

Independent variable	Indicators	Measurement
Determinants of FV consumption	Availability of FV	Influence of FV availability: 1= Highly unimportant 2= Unimportant 3= Neutral 4= Important 5= Highly important
	Affordability	Influence of FV affordability: 1= Highly unimportant 2= Unimportant 3= Neutral 4= Important 5= Highly important
	Taste preference	Influence of taste of FV: 1= Highly unimportant 2= Unimportant 3= Neutral 4= Important 5= Highly important
	Food safety concerns	Influence of FV food safety concerns: 1= Highly unimportant 2= Unimportant 3= Neutral 4= Important 5= Highly important
	Time for FV shopping and preparation	Influence of time for FV shopping and preparation 1= Highly unimportant 2= Unimportant 3= Neutral 4= Important 5= Highly important

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3.9.3 Moderating variable

The moderating variable under study was fruit and vegetable consumption recommendation knowledge. The World Health Organisation specifies required total daily FV consumption in terms of amount (quantity) or number of portions sizes (servings). Therefore two indicators, namely, *knowledge of recommended daily amount of consumption* and *knowledge of recommended daily number of servings*, measured this variable.

Respondents were asked if they could state accurately in grams (g) the WHO recommended minimum daily consumption quantity of fruits and vegetable, as well as the frequency of consumption per day. It was assumed that knowledge of recommended minimum daily intake could guide consumption in adequate amounts for their health and nutritional benefits.

An answer of "400g" was designated as "correct answer" for recommended amount and "don't know" was used as a designation for wrong answers or those who chose "don't know" as options in the questionnaire. Similarly, a designation of "correct answer" was assigned to an answer of "5" for number of servings and "don't know" for wrong answers or those who chose "don't know" as options in the questionnaire. Respondents therefore were deemed to have answered correctly when they indicated either "400g" for total daily amount of consumption or "5" for the total number of servings (portion sizes), recommended by WHO, or both.

3.10 Data analysis

All analyses were tailored towards achieving the set research objectives. The responses in the questionnaires were coded and captured into SPSS version 22 for analysis. Descriptive statistics showed responses in percentages for categorical variables, and means with standard deviations for continuous variables. For comparison of fruits and vegetable consumption recommendation knowledge between health and non-health workers, a chi-square test was used, and an independent t-test used to compare the means of the determinants, and those of consumption frequencies, between health and non-health workers. Pearson correlation coefficient was used to determine the

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direction and strength of association between the independent and dependent variables, while moderation regression analysis was employed to explain the extent to which the moderating variable influenced the relationship between the independent and dependent variable.

3.11 Ethical Considerations

Approval was secured from the Committee on Human Research, Publication and Ethics (CHRPE) of K.N.U.S.T before starting the study. Respondents were assured of confidentiality concerns and protection of their anonymity. In addition, participants were informed that their participation in the study was completely voluntary and they were at liberty to withdraw their consent at any moment up to the final write up.

3.12 Funding

The research was self-funded.

3.13 Limitations of the study

- Recall of raw fruits and vegetables consumption frequency depends on memory and that could introduce recall bias.
- The study employed a non-probability sampling method that makes it not appropriate to generalise the results.
- A larger sample size than what was employed in this study could further improve its representativeness of the populations under study. But lack of adequate time and resource constraints could not allow larger sample sizes to be studied.
- The study looked at fruits and vegetables consumption frequency and not the amount consumed per serving. In other words portion sizes were not determined and calculated to determine the exact amount of FV consumed by respondents per day.

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- In addition, processed forms of fruits such as dried fruits, canned fruits, and fruit juices with added sugar were not included in assessing frequency of intake, although these processed forms are not entirely devoid of the nutritional and health benefits of FV. Similarly, vegetable consumption as stews, ground pepper sauce or soups were excluded in this study, although these are sources of reaping some health benefits of vegetable consumption. Meanwhile, most Ghanaian dishes are eaten with stews, soups or ground pepper sauces.

3.14 Strengths of the Study

- The study focused on consumption of raw or minimally processed FV, since they are known for their higher likelihood of nutrients preservation, with its associated heightened nutritional and health benefits, as compared with fully-processed or cooked forms.
- The study therefore succeeded in revealing the respondents inclination towards the raw forms of fruits and vegetables, which are usually consumed for their health benefits, as compared with consumption of the processed or cooked forms, which are mainly taken to satisfy taste and hunger.
- Many studies on FV consumption knowledge were mainly concerned about knowledge of nutritional and health benefits. In this study, the researcher assumed that such kind of FV knowledge is common knowledge, especially among educated professionals. In other words, it is likely to be common knowledge that fruits and vegetables consumption have nutritional and health benefits, especially when that knowledge is sought among educated professionals such as doctors, nurses, teachers and bank workers, who were the subjects of this study. What may not be common knowledge is knowledge of the exact amount and frequency of recommended minimum daily consumption to be considered as adequate consumption, the knowledge which could guide consumption in adequate amounts. And

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that was the focus of this study in terms of fruits and vegetables consumption knowledge.

- This study also made it possible to compare health and non-health workers to determine if the educators on and promoters of fruits and vegetables consumption for their health benefits (i.e., health workers), are significantly different from the population they serve, in terms of knowledge of recommended intake of fruits and vegetables, frequency of consumption and the determinants of consumption.

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CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter outlines the results of the study, which include the socio-demographic data, FV consumption recommendation knowledge, FV consumption frequency, determinants of FV consumption, and their comparisons between health and non-health workers, and finally the moderation effect of consumption recommendation knowledge on consumption determinants and consumption frequency. The chapter also includes the discussion of these results according to the set objectives, situated in the context of available literature on the subject, and implications of the findings.

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4.2 Socio-demographic characteristics of respondents

Table 4.1 below shows a detailed description of the background characteristics of the respondents. Out of a total of 200 respondents whose questionnaires were included and analysed for the study, 105 (52.5%) were males, while 95 (47.5%) were females. There is therefore a fairly equal representation of males and females in the study. Majority (47.5%) of the respondents were within the ages of 30-39 years, followed by those within the ages 20-29 years (25.0%), 40-49 years (23.5%), 50-59 years (3.0%), in that order. Only 1(0.5%) respondent each was in the "less than 20 years" and "60-69 years" categories respectively.

Most (51.0%) of the respondents were married; 43.0% were single; and the other categories designated as "Widowed", "Divorced/separated" and Co-habiting, together represented 6.0% of the respondents. First degree holders represented about half (50.5%) of the respondents and certificate holders were only 4(2.0%). Postgraduate holders were 34.0% and those with Diploma qualifications represented 13.5% of the respondents. An equal number of 50 workers each were

represented by each of the 4 groups: doctors, nurses, teachers and bank workers. Majority (83.5%) of the respondents had monthly salaries above 2000 Ghana cedis while 16.5% had monthly salaries less than 2000 Ghana cedis. Christians were in the majority (91.0%), followed by Muslims (8.0%). There was 1(0.5%) Humanist and 1(0.5%) Traditionalist among the respondents.

Table 4. 1 Socio-demographic characteristics of respondents

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Variable	Frequency (200)	Percentage (%)
Sex		
- Male	105	52.5
- Female	95	47.5
Age (in years)		
- < 20	1	0.5
- 20 – 29	50	25.0
- 30 – 39	95	47.5
- 40 – 49	47	23.5
- 50 – 59	6	3.0
- 60 - 69	1	0.5
Marital Status		
- Single	86	43.0
- Married	102	51.0
- Widowed	6	3.0
- Divorced/separated	4	2.0
- Co-habiting	2	1.0
Educational level		
- Postgraduate	68	34.0
- First degree	101	50.5
- Diploma	27	13.5
- Certificate	4	2.0
Occupation		
- Medical doctor	50	25.0
- Nurse	50	25.0
- Teacher	50	25.0
- Bank worker	50	25.0
Monthly income		
- Less than 2000	33	16.5
- 2000 and above	167	83.5
Religion		
- Christianity	182	91.0
- Islam	16	8.0
- Traditionalist	1	0.5
- Humanist	1	0.5

Source: Field data, 2022

4.3 Fruits and vegetables consumption recommendation knowledge

As indicated in table 4.2, 95.0% of the respondents did not know the WHO recommended daily consumption amount of FV, while only 5.0% indicated the correct answer (400g). Similarly, 95.5% of respondents did not know the recommended number of servings (portion sizes), with only 4.5% indicating the correct answer (5), as shown in table 4.3.

Table 4. 2 Knowledge of WHO's recommended total minimum daily consumption amount of FV

	Frequency	Percent	Valid Percent	Cumulative Percent
Don't know	190	95.0	95.0	95.0
Correct answer(Amt)	10	5.0	5.0	100.0
Total	200	100.0	100.0	

Source: Field data, 2022

Table 4. 3 Knowledge of WHO's recommended total minimum daily number of servings of FV

	Frequency	Percent	Valid Percent	Cumulative Percent
Don't know	191	95.5	95.5	95.0
Correct answer(Serv)	9	4.5	4.5	100.0
Total	200	100.0	100.0	

Source: Field data, 2022

4.4 Difference in fruits and vegetables consumption recommendation knowledge between health and non-health workers

As shown in table 4.4, of the 183 respondents who did not answer correctly any of the WHO recommendation on FV consumption, 89 were health professionals while 94 were non-health workers, while those who answered correctly either on the amount of consumption or number of servings were made of 11 health workers and 6 non-health workers. A chi-square test of statistical significance comparing consumption recommendation knowledge between health and non-health workers was not significant (p-value = 0.31).

Table 4. 4 Difference in fruits and vegetables consumption recommendation knowledge between health and non-health workers

Chi-square test					
		Fruits and vegetables consumption recommendation knowledge		Total	(P-value)
		Don't know	Correct answer		
Health workers	Freq	89	11	100	0.31
	Per(%)	89.0	11.0	100.0	
Non-health workers	Freq	94	6	100	
	Per(%)	94.0	6.0	100.0	
Total	Freq	183	17	200	
	Per(%)	91.5	8.5	100.0	

Source: Field data, 2022

4.5 Fruits and vegetables consumption

4.5.1 Form in which fruits and vegetables were consumed

According to table 4.5, 89.0% of the respondents consumed fruits mostly raw, while 11.0 % were more likely to consume them as juices with added sugar, dried or in other processed forms. On the

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other hand, majority (84.0%) of respondents were more likely to consume vegetables in processed or cooked forms, for instance, as ingredients in stews or soups than consume them raw (16.0%) as salads of mixed vegetables, chopped/sliced or eaten whole, as shown by table 4.6.

Table 4. 5 Major form of fruit consumption

	Frequency	Percent	Valid Percent	Cumulative Percent
Raw fruits	178	89.0	89.0	89.0
Processed fruits	22	11.0	11.0	100.0
Total	200	100.0	100.0	

Source: Field data, 2022

Table 4. 6 Major form of vegetable consumption

	Frequency	Percent	Valid Percent	Cumulative Percent
Raw vegetables	32	16.0	16.0	16.0
Processed vegetables	168	84.0	84.0	100.0
Total	200	100.0	100.0	

Source: Field data, 2022

4.5.2 Fruits and vegetables consumption frequency

As shown in table 4.7, most of the respondents (34.0%) indicated that their usual consumption of *raw fruits* in the immediate previous one month was 2-6 times per week, followed by those who consumed occasionally (33.5%); once a week (20.5%); and once a day in that order. Two (2) respondents indicated they never consumed raw fruits in the previous one month while 3 respondents reported that their average consumption was 2 or more times per day. Generally therefore, 89.0% of the respondents consumed 2-3 times per week and below, while those who consumed raw fruits once a day and 2 or more times a day combined, represented 11.0% of the respondents.

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According to table 4.8 also, majority (31.0 %) of the respondents indicated that they consumed *raw vegetables* occasionally in the previous one month, followed by those who consumed 2-6 times per week (27.0 %); once a week (23.0%); and once a day (12.0%) in that order. Eleven (11) respondents never consumed raw vegetables in the last one month and 3 respondents consumed 2 or more times a day. Combined therefore, 73.0% of the respondents consumed raw vegetables 2-3 times per week and below in the previous one month, while those who consumed once a day and 2 or more times a day combined, represented 27.0 % of the respondents.

Table 4.9 indicates the mean consumption frequencies of fruits (2.22) and vegetables (2.14) and a combined mean of 2.18, each of which represents a consumption frequency of respondents in the past one month of approximately *once a week*.

Table 4. 7 Frequency of raw fruits consumption

	Frequency	Percent	Valid Percent	Cumulative Percent
Never	2	1.0	1.0	1.0
Occasionally	67	33.5	33.5	34.5
Once a week	41	20.5	20.5	55.0
2-6 times per week	68	34.0	34.0	89.0
Once a day	19	9.5	9.5	98.5
2 or more times per day	3	1.5	1.5	100.0
Total	200	100.0	100.0	

Source: Field data, 2022

Table 4. 8 Frequency of raw vegetables consumption

	Frequency	Percent	Valid Percent	Cumulative Percent
Never	11	5.5	5.5	5.5
Occasionally	62	31.0	31.0	36.5
Once a week	46	23.0	23.0	59.5
2-6 times per week	54	27.0	27.0	86.5
Once a day	24	12.0	12.0	98.5
2 or more times per day	3	1.5	1.5	100.0
Total	200	100.0	100.0	

Source: Field data, 2022

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Table 4. 9 Mean consumption frequency

	N	Min	Max	Mean	Std. Dev
Vegetables consumption	200	0.00	5.00	2.1350	1.18482
Fruits consumption	200	0.00	5.00	2.2200	1.08974
Combined F&V consumption	200	0.00	5.00	2.1775	1.02101

Source: Field data, 2022

4.5.3 Difference in fruits and vegetables consumption frequency between health and non-health *workers*

From table 4.10, an independent t-test indicates that there was no significant difference (p-value = 0.90) in the mean FV consumption frequency of health workers, which was 2.30 (0.94) from that of non-health workers, which was 2.06 (1.09).

Table 4. 10 Differences in fruits and vegetables consumption frequency between health and non-health workers

T- test for equality of means				
Health workers and Non-health workers	**N**	**Mean**	**Std. Deviation**	**p-value**
Health workers	100	2.30	0.94	0.90
Non-health workers	100	2.06	1.09	

Source: Field data, 2022

4.5.4 Major reason for consuming raw fruits and vegetables

Table 4.11 indicates that the health benefits of raw fruits are the major reasons why most (65.0%) respondents consume them, followed by satisfying taste (25.5%) and satisfying hunger (9.5%).

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Similarly, most (62.5%) respondents consume raw vegetables for their health benefits, followed by satisfying hunger(20.0%) and satisfying taste (17.5%), as shown in table 4.12.

Table 4. 11 Reasons for raw fruits consumption

	Frequency	Percent	Valid Percent	Cumulative Percent
For health benefits	130	65.0	65.0	65.0
To satisfy taste	51	25.5	25.5	90.5
To satisfy hunger	19	9.5	9.5	100.0
Total	200	100.0	100.0	

Source: Field data, 2022

Table 4. 12 Reasons for raw vegetables consumption

	Frequency	Percent	Valid Percent	Cumulative Percent
For health benefits	125	62.5	62.5	62.5
To satisfy taste	35	17.5	17.5	80.0
To satisfy hunger	40	20.0	20.0	100.0
Total	200	100.0	100.0	

Source: Field data, 2022

4.5.5 Major source of acquiring fruits and vegetables

From table 4.13, most (54.0%) respondents acquired their fruits from the market, followed by corner shops/nearby stands or shops (34.5%), and supermarkets (10.0%) in that order. Only 3 (1.5%) acquired their fruits from their own farms or gardens.

Similarly, table 4.14, indicates that most (75.0%) respondents acquired their vegetables from the market, followed by corner shops/nearby stands or shops (15.5%), and supermarkets (7.0 %) in that order. Those who acquired their fruits directly from farmers or from their own farms or gardens combined were just 2.5%.

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Table 4. 13 Major source of acquiring fruits for consumption

	Frequency	Percent	Valid Percent	Cumulative Percent
Market	108	54.0	54.0	54.0
Cornershops/nearby stands	69	34.5	34.5	88.5
Supermarket	20	10.0	10.0	98.5
own farm/garden	3	1.5	1.5	100.0
Total	200	100.0	100.0	

Source: Field data, 2022

Table 4. 14 Major source of acquiring vegetables for consumption

	Frequency	Percent	Valid Percent	Cumulative Percent
Market	150	75.0	75.0	75.0
Cornershops/nearby stands	31	15.5	15.5	90.5
Supermarket	14	7.0	7.0	97.5
Direct from farmers	2	1.0	1.0	98.5
own farm/garden	3	1.5	1.5	100.0
Total	200	100.0	100.0	

Source: Field data, 2022

4.6 Determinants of fruits and vegetables consumption

Table 4.15 indicates the mean values of respondents' answers to questions assessing the level of importance of determinants as relates to their consumption of FV. In decreasing order of importance of the determinants, food safety ranked highest (2.91), followed by time for FV

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shopping and preparation (2.76); affordability (2.51); taste preference (2.15); and availability of FV (2.01), in that order.

Table 4. 15 Determinants of FV consumptions

	N	Min	Max	Mean	Std. Deviation
Food safety concerns	200	1	5	2.91	1.187
Time for FV shopping and preparation	200	1	5	2.76	1.269
Affordability	200	1	5	2.51	1.190
Taste	200	1	5	2.15	1.138
Availability/ geographical accessibility	200	1	5	2.01	1.005
Total	200				

Source: Field data, 2022

4.6.1 Difference in fruits and vegetables consumption determinants between health and non-health workers

From table 4.17, on an interval of 1-5 (indicating least to the highest level of importance), a mean score of 1.91 and 2.1 was recorded for health and non-health workers respectively, regarding the importance of availability of FV as determinant. This difference between health and non-health workers regarding the effect of availability on the FV intake is not statistically significant (p-value = 0.18). Similarly, regarding the importance of affordability, mean score for health workers was 2.41 and that of non-health workers was 2.60, with no statistically significant difference found (p-

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value = 0.26). In terms of taste preference also, mean scores were 2.12 and 2.18 for health and non-health workers respectively, and the difference was not statistically significant (p-value= 0.71). No statistically significant difference (p-value = 0.29) was found between the mean scores of health workers (2.82) and that of non-health workers (3.00), regarding food safety concerns also. Means scores for time for FV shopping and preparation as determinant was 2.71 and 2.81 for health and non-health workers respectively, and this difference between health and non-health workers regarding the effect of time for FV shopping and preparation on the FV intake is not statistically significant (0.58).

Table 4.18 captures the overall mean score of determinants of FV consumption among health workers as 2.39 (0.81) and that of non-health workers as 2.54 (0.64), with no statistically significant difference recorded (p-value of 0.17).

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Table 4. ~~161617~~ Differences in determinants of fruits and vegetables consumption between health and non-health workers

T- test for equality of means					
Determinants of FV	**Health worker and Non-health worker**	**N**	**Mean**	**Std. Deviation**	**P-value**
Availability of FV	Health workers	100	1.91	.996	0.18
	Non-health workers	100	2.10	1.010	
Affordability of FV	Health workers	100	2.41	1.198	0.26
	Non-health workers	100	2.60	1.181	
Taste preference	Health workers	100	2.12	1.225	0.71
	Non-health workers	100	2.18	1.048	
Food safety concerns	Health workers	100	2.82	1.218	0.29
	Non-health workers	100	3.00	1.155	
Time for FV shopping and preparation.	Health workers	100	2.71	1.320	0.58
	Non-health workers	100	2.81	1.220	

Source: Field data, 2022

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Table 4. 171718 Differences in determinants of fruits and vegetables consumption between health and non-health workers

T- test for equality of means				
Health workers and Non-health workers	**N**	**Mean**	**Std. Deviation**	**p-value**
Health workers	100	2.39	0.81	0.17
Non-health workers	100	2.54	0.64	

Source: Field data, 2022

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4.9 Moderated regression analysis of the influence of FV consumption recommendation knowledge on the relationship between consumption determinants and consumption frequency.

From table 4.19, the moderated regression analysis was significant (p-value= 0.02), indicating that consumption recommendation knowledge had a significant influence on the relationship between consumption determinants and consumption frequency. The regression coefficient (b) of the interaction was positive (b= 1.02), indicating that the moderating variable (consumption recommendation knowledge) had a positive impact on the effect of the independent variable (consumption determinants) on the dependent variable (consumption frequency). Figure 1 also corroborated this finding; showing that consumption recommendation knowledge increased the effect of consumption determinants on consumption frequency.

Table 4. ~~181819~~ Moderating effect of FV consumption recommendation knowledge on consumption determinant and consumption frequency

Model Summary						
R	R-sq	MSE	F	df1	df2	p
.2274	.0517	1.0037	3.5613	3.0000	196.0000	.0152

Model						
	coeff	se	t	p	LLCI	ULCI
Constant	1.8901	.3639	5.1938	.0000	1.1724	2.6078
FVconDe	.0843	.1016	.8298	.4076	-.1161	.2848
FVconKn	-4.0389	1.4193	-2.8457	.0049	-6.8380	-1.2398
Int_1	1.0204	.3664	-2.7848	.0059	.2978	1.7430

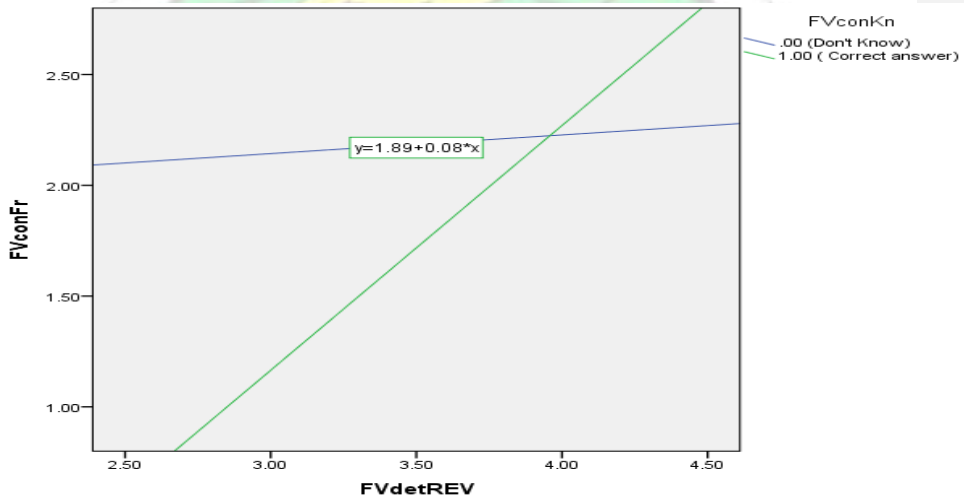
Test(s) of highest order unconditional interaction(s)					
	R2-chng	F	df1	df2	p
X*W	.0375	7.7553	1.0000	196.0000	.0059

Conditional effects of the focal predictor at values of the moderator(s):

FVconKn	Effect	se	t	p	LLCI	ULCI
.0000	.0843	.1016	.8298	.4076	-.1161	.2848
1.0000	1.1047	.3520	3.1381	.0020	.4105	1.7990

Source: Field data, 2022

Figure 4. 1 Moderating effect of FV consumption recommendation knowledge on consumption determinant and consumption frequency



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4.10 Comparison of fruits and vegetables consumption recommendation knowledge between health and non-health workers

Out of the 200 respondents, 183 (91.5%) did not know either the recommended amount or the number of portion sizes as against only 17 (8.5%) respondents who could state correctly either the recommended amount or the number of daily servings or both. This result is corroborated by a similar research done in an urban area in Ghana indicating only 9% of the respondents were able to correctly state the WHO's daily recommendation on FV consumption (Awuni et al., 2017). This has implications on consumption of FV as studies have established a positive influence of fruits and vegetables knowledge, including consumption recommendation knowledge, on consumption levels (Worsley, 2002; Dickson-Spillmann & Siegrist, 2011; FAO, 2020; Appleton et al., 2018; Hill et al., 2020). In other words, as people get to be aware of the health and nutritional benefits of FV, they could put in more efforts to overcome barriers to consumption. Similarly, an awareness of the minimum recommended target of FV consumption could create a consciousness and a guide to meet that target, resulting in increased consumption. Unfortunately, this study, as well as other similar studies (Yewayan et al., 2020; Awuni et al., 2017; Shaikh et al., 2008; Grimm et al., 2010), have shown generally low levels of FV consumption-related knowledge among the population.

Again, there was no significant difference in consumption recommendation knowledge between health and non-health workers (p-value = 0.31), with 89.0% of health professionals compared with 94.0% of non-health workers being unable to state correctly the daily recommended amount of 400g or the recommended portion sizes (servings) of five(5) in a day. Only 11 (11.0%) health workers out of a total of 100 and 6 (6.0%) from a total of 100 non-health workers stated correctly the daily recommended FV consumption amount or serving. A similar study among health workers conducted in neighbouring Burkina Faso, in its capital city Ouagadougou noted that 85.5% of them were not aware of WHO's recommendations concerning FV consumption (Yewayan et al., 2020). This situation suggests that in counselling clients on healthy eating compromising of FV

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consumption, most health workers may not refer to available recommended values to guide the consumption of their clients. They might resort to using vague statements such as, “eat more of this” or “eat less of that”, without guiding healthcare clients to actually calculate or estimate consumption to achieve adequate levels. It also indicates that such healthcare workers themselves may not resort to these recommendations as references to guide their own consumption of FVs. Without regard for or knowledge of a known recommended reference point, members of a population will face the challenge of conclusively estimating their consumption of FV to determine whether they consume enough or not.

4.11 Comparison of fruits and vegetables consumption frequency between health and non-health workers

Generally, 89.0% of the respondents consumed raw fruits 2-3 times per week and below (i.e 2-3 times per week, once a week, occasionally and never), while 11.0% of the respondents indicated a usual consumption of raw fruits in the past one month of once a day and 2 or more times a day**,** combined. The mean consumption frequency of raw fruits was 2.22(1.09), corresponding to an average consumption frequency of raw fruits of approximately once a week.

According to WHO’s recommendation, two (2) portion sizes or servings of fruits are recommended per day (Striegel-Moore et al., 2006). For fruits, as expected, majority (89.0%) of respondents consumed them in their raw forms rather in processed forms (11.0%) such as juices with added sugar, canned fruits or dried fruits. Since fruits are consumed mostly raw, corroborated by the findings of this study, with just about 11.0% of respondents consuming at least *once a day***,** with a mean consumption frequency of *once a week*, it can be concluded that majority (89.0%) of the respondents did not meet the WHO’s recommendation of consuming at least two (2) portions of fruits in a day.

Similarly, 73.0% of the respondents consumed raw vegetables *2-3 times per week and below* in the previous one month, while those who consumed *once a day* and *2 or more times a day*

combined, represented 27.0% of the respondents. The mean consumption of raw vegetables was 2.14 (1.18), representing an average raw vegetables consumption frequency of approximately *once a week.*

Again, in terms of vegetables consumption, WHO recommends three (3) portions or servings per day (Striegel-Moore et al., 2006). However, unlike fruits where consumption was mostly in the raw forms (89.0%), vegetables consumption in this study was mostly in the processed or cooked forms (84.0%) as stews, soups, and ground pepper sauce taken as part of a meal or a local delicacy, as compared to consumption in the raw forms (16.0%), such as raw salads. Since consumption in stews, soups and ground pepper sauces were not accounted for in this study, it cannot be concluded that majority of the respondents did not meet the WHO's consumption of three(3) portion sizes of vegetables in a day. Concerning consumption of vegetables, conclusions from the study only suggest that most (73.0%) of the respondents consumed raw vegetables at most *once a week* (mean =2.14).

The mean consumption of raw fruits and vegetables combined was 2.18 (1.02), and corresponds to raw fruits and vegetables consumption frequency of respondents in the past one month of approximately *once a week*. Generally therefore, without the processed forms added, respondents were likely to consume fruits and vegetables once in a week. This situation may be of concern when seen from the perspective that evidence suggests that FV retain more of their nutritional and health benefits when consumed raw and minimally-processed than in their fully-processed or cooked forms (FAO, 2020; Gil & Kader, 2008; Parrish, 2014). In addition, respondents were more likely to consume cooked vegetables in stews and soups to satisfy hunger and taste than for their health benefits. Probably, consumption in the raw forms were more indicative of consumption for the health benefits of FV than for hunger satisfaction since fruits and vegetables have been labelled mainly as expensive sources of energy (Ruel et al, 2005; Livingstone et al., 2020).

These findings are supported by other researches indicating that FV consumption levels in Ghana have generally been found to be below the WHO recommended levels. Ruel et al (2005) showed

that approximately 87% of Ghanaian households consumed less than the recommended 400g/person/day (146kg/person/year), and averagely, quantity consumed per person was about half (202g/person/day or 73.7kg/person/year) the recommended consumption amount (Ruel et al., 2005). Hall et al.(2009) also found in a study conducted in 52 countries that prevalence of low FV consumption was more than 70% among men and women in sub-Saharan African countries such as Ghana, Côte d'Ivoire, Senegal, Zimbabwe, Burkina Faso and Zambia (Hall et al., 2009). The 2014 Ghana demographic and health survey also indicated that FV consumption pattern was just three out of the seven days in a week among Ghanaians (Ghana Statistical Service et al., 2015). Unfortunately, in this study, just as for consumption recommendation knowledge, there was no significant difference in FV consumption pattern between health and non-health workers (p-value = 0.9). This suggests that the low consumption frequencies of FV observed in this study was equally prevalent among health and non-health professionals. Low FV consumption pattern among health workers was also observed in a study among health professionals in neighbouring Burkina Faso, indicating that just about 1.4% of the health workers studied met the recommendation of consuming five or more daily portions of FV **(**Yewayan et al., 2020). This has implications on maintaining a healthy healthcare workforce, as well as the likelihood that healthcare professionals are not leading by examples in some areas of health promotion efforts among the populace.

4.12 Comparison of fruits and vegetables consumption determinants between health and non-healthworkers

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According to a report from a workshop organised by Food and Agriculture Organisation (FAO) and WHO in 2020, possible factors that influence FV consumption included their availability, affordability, competition with other alternatives, education and culture, lack of knowledge, food safety and hygiene concerns, and national policies (FAO, 2020). Li et al (2020) also reported tastes and preferences, convenience, storage life, accessibility, availability, affordability, socio-economic and socio-cultural factors as determinants of FV consumption (Li et al.,

2012). Livingstone et al (2020), also reported barriers to not meeting recommended FV consumption levels as lack of time, perception that guidelines were not achievable, high cost of FV, availability, taste preference, and competition from other foods (Livingstone *et al.*, 2020).

Determinants of FV consumption assessed in this study included availability of FV, affordability, food safety concerns, taste preferences, and time for FV shopping and preparations. The respondents' rating of the determinants could be used as their perception of the determinants as possible barriers to their FV consumption, where lower rated determinants (determinants with lower means) could be perceived more as possible barriers compared to higher rated ones.

In decreasing order of positive perception of the determinants, availability of FV (4.00) ranked highest, followed by taste perception (3.85); affordability (3.50); time for FV shopping and preparation (3.24); with food safety rated lowest (3.09). This implies that even though respondents believed that FV were geographically available and accessible to them, they were also concerned about their source and wholesomeness. This may not be much of a concern if the FVs were processed, such as vegetables cooked as stews and soups, or fruits dried, canned or juiced, but once they were being asked about consumption in the raw form, they were concerned about its source and wholesomeness. A study conducted in neighbouring Benin among adolescents also indicated that with the exception of food safety concerns, determinants of FV consumption were similar to those of high income countries (Nago *et al.*, 2012). In other words, food safety concerns is more of a barrier to FV consumption in low-and-middle income countries than in high-income countries.

Wholesomeness of raw fruits and vegetables in Ghana has become a controversial issue as some studies in its two largest cities, Accra and Kumasi, have produced contradictory reports concerning the presence of significant levels of pesticide residues in FV. A study conducted by Bempah et al (2011) monitoring pesticide levels in FV purchased from various markets in Kumasi reported that none of the pesticides studied exceeded the reference dose in FV (Bempah *et al.*, 2011). However, Fosu et al (2017) found significant levels of pesticide residues in a study monitoring pesticide

residues in fruits and vegetables within a 3 year period (2010-2012) in the Accra metropolis (Fosu *et al.*, 2017). It should be emphasised however that once food safety concerns were raised by respondents, they could hinder consumption of raw FV in adequate amounts despite the conflicting reports, and therefore must be addressed with all seriousness by stakeholders involved within the supply chain of FV.

Several current innovations have been put in place to improve the wholesomeness of FV. Integrated pest management (IPM) is one of such approaches to control diseases and pests while ensuring little harm as much as possible to people, the environment, and beneficial organisms (Saavedra et al., 2016; FAO, 2020). It involves a combination of biological measures, enhanced cultural practices, using resistant varieties and habitat manipulation, and there is judicious use of pesticides, only when there is evidence that it is absolutely necessary(Flint, 2012). Different techniques and products are used within IPM, including scouting, monitoring, crop sanitation, cultural and mechanical measures, the use of beneficial insects and mites, and as a last resort, corrective chemical control measures (Saavedra et al., 2016). In Ghana, for instance, CABI has put in place several measures to address phytosanitary and food safety concerns (CABI, 2022).

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Lack of time for FV shopping and preparation was the next important possible barrier of concern to FV consumption after food safety issues in this study. This is supported by a study conducted in a city in Australia by Livingstone et al (2020) indicating lack of time as one of the barriers to meeting the recommendations for FV consumption (Livingstone *et al.*, 2020). As expected, respondents in this study were medical doctors, nurses, teachers and bank workers, who have specific working hours at their various work places, and might struggle to find time for food shopping and preparation. The implication is that they might resort to foods that are ready-to-eat, such as fast foods or processed foods mainly, with their attendant negative consequences on their health.

Affordability was the third most important possible barrier to FV consumption in this study. Fresh fruits, and vegetables, unless consumed as stews, soups and ground pepper sauce for the purposes

of completing a meal to satisfy hunger, are considered luxuries. They are perceived mainly as expensive and a luxury that many with low incomes cannot afford (Livingstone *et al.*, 2020). Many people in LMIC prioritise energy-rich foods over FV in order to satisfy hunger because they consider FV as an expensive source of energy (Ruel et al, 2005).

There was generally however a –positive perception (mean= 3.05) of the respondents on these determinants, although just slightly above average. There was also no significant difference between FV consumption determinants among health and non-health workers (p-value =0.17). This may be expected because, aside health knowledge, which may create health-consciousness, respondents were generally comparable in terms of their educational and income levels, which have also been shown to be positively correlated to FV consumption (Li et al., 2012; FAO, 2020). However, the similar consumption pattern observed for both health and non-health workers implies that health knowledge of health practitioners, which was the major differentiating factor separating respondents into health and non-health workers, did not significantly influence their level of FV consumption compared to that of non-health workers. In other words, other determinants, apart from health knowledge associated with being a health worker, with its attendant health consciousness, had more influence on FV consumption among respondents.

One of such major influencers of FV consumption could be cultural influence on dietary choices and eating patterns of a people. We usually eat what our culture and upbringing describe to us as food, with very minimal variations from this reality. If respondents were raised to eat vegetable as stews, soups or ground pepper sauce, they may not likely eat much of it in raw forms as salads. Another possible explanation why respondents generally disagreed with barriers as having much influence yet consumed little of raw FV may be because of their ~~scepticism~~skepticism about the extent of the health benefits of raw FV consumption to warrant going the extra mile to consume them often in their raw states. Probably, they might consider FV consumption in processed or cooked forms to be enough to reap their health benefits.

Probably also, the low knowledge of recommended targets of consumption, as generally observed in this study could imply that many of the respondents had no objective means to determine and assess their adequate consumption of FV, without being bothered about this reality. They may not be bothered about their lack of knowledge of a recommendation to guide their consumption because most of the respondents probably consume FV to satisfy hunger but not to reap their health benefits. If consumption was mostly meant to satisfy health benefits of FV, majority of the respondents may have been interested in knowing about a recommendation to guide their consumption in adequate quantities.

4.13 Moderating role of fruits and vegetables consumption recommendation knowledge on the relationship between consumption determinants and consumption frequency

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Although there was no significant correlation (p-value = 0.12) between consumption determinants alone and consumption frequency, the moderating effect of fruits and vegetables consumption knowledge on the relationship between consumption determinants and consumption frequency was significant (p-value = 0.02). The regression coefficient (b) for this interaction between consumption recommendation knowledge and consumption determinants was 1.02. This implied that consumption recommendation knowledge increased the effect of consumption determinants on consumption frequency. In other words, respondents who were aware of consumption recommendation knowledge were more likely to overcome barriers to consumption, in order to increase their intake of FV. Other studies also have found a link between increased consumption knowledge, including consumption recommendation knowledge and increased FV consumption, even in the presence of possible barriers to consumption (Worsley, 2002; Dickson-Spillmann & Siegrist, 2011; FAO, 2020; Appleton et al., 2018; Hill et al., 2020).

The implication of this is that the more one knows about the benefits of FV consumption, as well as recommended minimum daily consumption amount or portion sizes that is required to achieve these health benefits, the more one is likely to put in effort to overcome barriers to FV

consumption. Knowing about the recommended intake levels also provide a guide to consumption, as one may not know if they consume adequate amounts of FV unless they know of a target to work towards. This significant influence of consumption recommendation knowledge on the effect of consumption barriers on consumption frequency, presents a good opportunity to address the issue of low consumption of FV.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the conclusions of the study results and recommendations to address these findings, in the context of the objectives of the study.

5.2 Conclusions

The main objective of this study is to assess the moderating role of fruits and vegetables consumption recommendation knowledge on the relationship between consumption frequency and intake; comparing health and non-health professionals in the Kumasi metropolis. A sample size of 200, comprising of health and non-health workers was used for the study. Explanatory together with descriptive methods were adopted to study numerical data that were collected from participants. The findings of the research are summarised as follows:

5.2.1 Comparison of fruits and vegetables consumption recommendation knowledge between health and non-healthworkers

Generally, consumption recommendation knowledge was low among respondents and there was no significant difference between that of health and non-health workers. This suggests that most of the respondents were not consulting the WHO recommendations on FV consumption to guide their consumption. Meanwhile, associated with the knowledge of recommended targets of

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consumption is the knowledge on calculation of the portion sizes that translate into meeting these targets. It presupposes that lack of knowledge of recommended targets of consumption will inadvertently result in a lack of knowledge on how to calculate the portion sizes that constitute these targets. Therefore, unless respondents rely on some other evidence-based recommendations unknown to the author to guide their consumption, they may not be using an evidence-supported target of FV consumption to guide their intake. This could mean that most respondents did not employ standard calculations to help them decide on how much FV to take in a day in order to achieve adequate consumption levels of FV for their health benefits. In that sense respondents may not have a good basis to conclude that they either consumed adequate FV or not, since they may not use recommended objective ways to determine and assess adequate intake.

The implications are more serious when health workers involved in counselling clients on the need for adequate FV consumption do not know about recommended targets of consumption and possibly how to calculate portions sizes to meet these targets. It suggests that these health workers themselves may not adopt objective methods to determine and assess their intake of FV in adequate amounts. This situation could contribute to a challenge in maintaining a healthy healthcare workforce to serve the nation. In addition, such kinds of knowledge, once it is not present in health workers, are not likely to be passed on to healthcare clients.

5.2.2 Comparison of raw fruits and vegetables consumption frequency between health and non-healthworkers

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Raw fruits and vegetables consumption were each once a week respectively. When combined therefore, raw fruits and vegetables consumption frequency for the respondents was averagely once a week, and there was no significant difference in the consumption frequency of health workers from that of non-health workers. In terms of fruits consumption, most respondents consume them in raw forms rather than processed as juices with added sugar, canned or dried. Therefore raw fruits consumption of once a week may closely represent the overall picture of fruits

consumption as both processed and raw. The WHO recommends eating at least two portion sizes of fruits in a day. This implies that consumption must at least be once a day to be considered adequate consumption of fruits. However, since fruits consumption was on average about once a week, it can be concluded that most respondents did not consume enough fruits according to the WHO recommendations.

In terms of vegetables consumption, the WHO recommends eating at least three (3) portion sizes in a day. Usually, raw vegetables are used in deciding on what these portion sizes are, without a complete disregard for consumption in processed or cooked forms. In this study, most respondents consume vegetables them in cooked forms such as in stews, soups and ground pepper sauces as necessary additions to complete a meal or a local delicacy, than in their raw forms, such as salads. Once the contribution of the intake of the cooked forms of vegetables consumption was not accounted for in determining the frequency of vegetables consumption in this study, it is not realistic to conclude on the actual consumption levels of vegetables among the respondents. Therefore consumption of raw vegetables once a week did not represent the actual picture of the overall vegetable consumption levels of the respondents. The following two important conclusions can however be drawn concerning vegetables consumption among respondents in this study:

Firstly, vegetable consumption in cooked forms as stews, soups and ground pepper sauce are important accompaniments to complete a meal or a local delicacy. Consumption of vegetables in these forms are for the purposes of satisfying hunger, as well as taste acquired through one's cultural upbringing. Consuming FV for their nutritional and health benefits, which is the major emphasis of this study, may not be the major reason among respondents for consuming vegetables as stews, soups and ground pepper source. Probably those who go the extra mile to overcome culturally-acquired taste, concerns of satisfying hunger, affordability issues, food safety concerns, and other barriers to raw FV consumption, in order to consume vegetables in their raw forms, may be consciously eating them for their health benefits.

Secondly, evidence indicates that FV consumption in their raw forms are more beneficial in terms of their health and nutritional benefits than in their processed or cooked forms. Therefore although respondents' consumption of vegetables in cooked forms complemented consumption in raw forms, once a week consumption of raw vegetables is inadequate, considering the nutritional and health benefits of the raw forms.

5.2.3 Comparison of fruits and vegetables consumption determinants between health and non-health workers

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Determinants of raw FV consumption used in the study were availability of FV, affordability, taste preference, food safety concerns, and time for FV shopping and preparation. Food safety concerns, time for FV shopping and preparation, and affordability, were the top three barriers of concern to the respondents, in decreasing order of importance. Tastes preferences and availability were considered of least concern in determining FV consumption, in that order. There was no significant difference between consumption determinants among health and non-health workers.

Although respondents raised food safety concerns about fresh fruits and vegetables, two studies done in Ghana, one in Accra and the other in Kumasi, gave conflicting reports on the presence of significant levels of pesticide or chemical residues in FV. Regardless of these conflicting reports, once respondents indicated that they could not trust the source and wholesomeness of the FV they consumed, their concerns ought to be taken seriously and addressed. Lack of time for FV shopping and preparation was respondents' second most important barrier to raw FV consumption. This situation could result in them consuming more of ready-to-eat foods, processed foods or fast-foods, out of convenience, which could result in negative implications on their health.

Respondents' general disagreement on the listed determinants as barriers to their FV consumption, although their health-related FV consumption pattern was poor, suggests that there were other weightier barriers to their consumption than these. For instance, respondents may have adopted an

eating style that corresponded to that of their cultural upbringing with only little variations from this norm. As a result, even their awareness of the health benefits of fruits and vegetables was probably not enough influence on them to alter this eating pattern significantly, so as to encourage them to increase their consumption of raw FV. Respondents were also likely to prioritise satisfying hunger over the health benefits of their diet, and since fruits and vegetables are expensive sources of energy, they probably prioritised energy-rich foods over them.

Respondents' poor knowledge on FV consumption recommendation targets, and possibly what goes into achieving these targets could be one of the important barriers that accounted for most of them not meeting these recommendations. Once they did not know what adequate consumption of FV was, most of the respondents most likely had no standardised objective method for determining and assessing their level of FV consumption in adequate quantity to reap the health benefits. What could be worrying is whether the respondents saw a need or not to assess their FV consumption levels against a minimum evidence-based recommended target that supports the health benefits of FV.

5.2.4 Moderating role of fruits and vegetables consumption recommendation knowledge on the relationship between consumption determinants and consumption frequency

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Fruits and vegetables consumption recommendations knowledge had a significant impact on the relationship between determinants of consumption and consumption frequency. From the study results, the effect of the determinants of consumption on frequency of consumption increased under the influence of knowledge of consumption recommendation knowledge. In other words, respondents who were aware of the recommended targets of consumption were more likely to put in more efforts to overcome consumption barriers in order to consume FV, compared to those who did not know these recommendations. It may be the case that knowledge of FV recommended consumption target created a consciousness in the respondents to meet this target. The implication of this finding is that efforts can be directed towards promoting FV knowledge in the area of

recommended consumption targets and showing people how to achieve these targets, rather than just focusing on discussing the health benefits, as is commonly done.

5.3 Recommendations

From the findings, discussions and conclusions drawn from the study, the following recommendations have been made to various stakeholders that could influence the consumption of FV in adequate amounts for their health benefits:

1. The Ministry of Health of Ghana (MOH) should emphasise FV consumption knowledge in their policies on health promotion, especially in the area of knowledge of recommended consumption targets and how to achieve these targets. Recommended daily amounts, servings and how to calculate portion sizes must be clearly specified in this policy documents on health promotion.
2. Health professionals, as part of their training, must be taken through various practical sessions that promote fruits and vegetables consumption recommendation knowledge and how to calculate portion sizes. This is to encourage them to use this knowledge to guide their consumption in adequate amounts and pass it on to their clients.
3. The MOH, together with its healthcare agencies, facilities and health professionals must embark on fruits and vegetables consumption campaign for the general public with emphasis on consumption targets and how to achieve these targets, rather than promoting only knowledge on the health and nutritional benefits of FV.
4. Since the most important barrier to consumption noted in this study was food safety concerns, the Ministry of Food and Agriculture of Ghana (MoFA) must take major steps to address the issues of possible pesticide or chemical residues in FV among farmers. They must engage all stakeholders throughout the supply chain of the produce, to ensure the safety of FV to the public. They must also engage the public continually about the

progresses they make in that regard, in order to alleviate people's fears and assure them of the safety of the FV they consume.

5. MoFA, together with the government, must also take steps to address issues that can increase the prices of FV and make them affordable to the final consumer. This may include making it possible for farmers to acquire the right agricultural inputs, including the right varieties of seeds, training farmers in good agricultural practices, addressing issues such as post-harvest losses, and addressing transportation costs.
6. Entrepreneurs and marketers can also see an opportunity in promoting fruits and vegetables consumption in a business sense. Once there is evidence supporting the benefits of a produce, a business opportunity presents itself. Entrepreneurs can study carefully the supply chain of fruits and vegetables and find innovative ways to make them accessible and affordable to consumers. Marketers are skilled in delivering value to satisfy consumers. Lack of time for fruits and vegetables shopping and preparation was the second most important FV consumption barrier of concern to the respondents. A marketing strategy where FV are packaged as ready-to-eat, chopped or even whole, and delivered to the homes and offices of these busy professionals, or to other convenient collection points, can also help improve FV consumption among the populace.
7. The general public, including health professionals, must develop the habit of eating FV for their health benefits rather than for satisfying taste and hunger. This requires them to know the minimum recommended consumption targets that support significant reaping of the health benefits of FV, and how to calculate the portion sizes to achieve these targets. It will also demand of them to increase their consumption of vegetables in their raw forms, even as they consume them in their cooked forms as stews, soups and ground pepper sauce mainly, since the raw forms preserve their nutritional benefits more than the fully-processed and cooked forms. They must however do due diligence in the process of

acquiring, and also in preparing them for consumption, in order to address food safety concerns.

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APPENDIX

ASSESSING THE MODERATING ROLE OF KNOWLEDGE ON THE RELATIONSHIP BETWEEN CONSUMPTION DETERMINANTS AND INTAKE OF FRUIT AND VEGETABLES: A COMPARATIVE STUDY OF HEALTH AND NON-HEALTH WORKERS IN KUMASI

~~**TITLE: RELATIONSHIP BETWEEN FRUIT AND VEGETABLE CONSUMPTION KNOWLEDGE AND RAW FRUIT AND VEGETABLE INTAKE: A COMPARATIVE STUDY AMONG HEALTH AND NON-HEALTH WORKERS.**~~

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The purpose of this questionnaire is to collect data for academic purposes as a partial fulfillment for the award of a Master's Degree in Business Administration (MBA). This is not a project of a government, political party, or a commercial entity. You are required to provide the most appropriate answer in your opinion. Your identity and responses will be kept confidential. Thank you.

PLEASE READ THE FOLLOWING CLARIFICATIONS BEFORE ANSWERING THE QUESTIONS BELOW:

Fruits and vegetables consumption being assessed in this study are raw fruits and vegetables. This include only raw or fresh fruit and vegetables eaten whole or chopped/sliced (e.g cucumber, carrots, etc.), mixed fruits and vegetables salads, or fruit juices/smoothies (with no added sugar). Processed fruits and vegetables as canned, dried, chips, as well as vegetable consumption as stews, soups or "ground pepper sauce" are not included.

SECTION A: RESPONDENT'S BACKGROUND INFORMATION

1. **Age:** [ ] < 20 [ ] 20-29 [ ] 30-39 [ ] 40-49 [ ] 50-59 [ ] 60-69yrs [ ] 70 and above

2. **Sex:** [ ] Male [ ] Female

3. **Marital Status:** [ ] Single [ ] Married [ ] Divorced/separated [ ] Widowed [ ] Cohabiting

4. **Educational level:**

[ ] Postgraduate [ ] 1st Degree [ ] HND [ ] Diploma [ ] Other……..……..(specify)

5. **Occupation:** [ ] Medical Doctor [ ] Nurse [ ] Teacher [ ] Bank worker

6. **Institution of work** …….

7. **Monthly income (Ghana cedis)**: [ ] Less than 2000 [ ] 2000 or more

8. **Religion**: [ ] Christian [ ] Muslim [ ] Traditionalist [ ] Other……...(specify)

9. **Place of residence** ……

SECTION B: FRUIT AND VEGETABLE CONSUMPTION RECOMMENDATION KNOWLEDGE

1. State in grams(g) the total minimum daily consumption amount of fruits and vegetables recommended by WHO

   a. Answer …….
   b. Don't know [ ]

2. State the total minimum daily number of servings or portion sizes of fruits and vegetables recommended by WHO

   a. Answer …….
   b. Don't know [ ]

SECTION C: FRUITS AND VEGETABLES CONSUMPTION

1. In what forms do you consume ***fruits*** mainly? *Tick one answer only*

   [ ] Processed (juice, dried, canned etc)
   [ ] Raw (eaten whole, chopped/sliced or as salads of mixed fruits)
   [ ] Other (specify)……..

2. In what forms do you consume ***vegetables*** mostly? *Tick one answer only*

   [ ] Processed or cooked (e.g stews, "ground pepper source", or soups)
   [ ] Raw (eaten whole, chopped/sliced, salads of mixed vegetables)
   [ ] Other (specify)…….

3. In the past one month, on average, how often did you take ***raw fruits***, as whole or chopped/sliced (e.g orange, apple, banana, pineapple, etc.), mixed fruit salads or fresh juice (*do not include fruits juices with added sugar, dried fruits, dried fruits in cereals)* :

Tick one answer only

[ ] Never
[ ] Occasionally
[ ] Once a week
[ ] 2-6 times a week
[ ] Once a day
[ ] 2 or more times per day

4. In the past one month, on average, how often did you take ***raw vegetables*** as whole or chopped/sliced (e.g carrots, cucumber, etc) or as mixed vegetable salads *(do not include vegetable consumption as stews, "ground pepper sauce ", and soups):*

Tick one answer only

[ ] Never
[ ] Occasionally
[ ] Once a week
[ ] 2-6 times a week
[ ] Once a day
[ ] 2 or more times per day

5. On occasions that you have consumed ***raw fruits*** in the past, what was the major underlying reason? *Tick one answer only*

[ ] For health benefits
[ ] To satisfy taste
[ ] To satisfy hunger
[ ] Other……(specify)

6. On occasions that you have consumed ***raw vegetables*** in the past, what was the major underlying reason? *Tick one answer only*

[ ] For health benefits
[ ] To satisfy taste
[ ] To satisfy hunger
[ ] Other……(specify)

7. From where do you acquire your ***fruits*** mostly? *Tick one answer only*

[ ] Market
[ ] Supermarkets
[ ] Corner shops/nearby stands or shops
[ ] Direct from farmers
[ ] Own farm/garden
[ ] Other (specify) ……..

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8. From where do you acquire your ***vegetables*** mostly? *Tick one answer only*

[ ] Market
[ ] Supermarkets
[ ] Corner shops/nearby stands or shops
[ ] Direct from farmers
[ ] Own farm/garden
[ ] Other (specify) …….

SECTION D: DETERMINANTS OF FRUITS AND VEGETABLES CONSUMPTION

1. How much does ***availability*** of fruits and vegetables influence your consumption?

[ ] Highly unimportant [ ] Unimportant [ ] Neutral [ ] Important [ ] Highly important

2. How much does ***affordability*** of fruits and vegetables affect your consumption?

[ ] Highly unimportant [ ] Unimportant [ ] Neutral [ ] Important [ ] Highly important

3. How much does ***taste*** of ***raw*** fruits and vegetables influence your consumption?

[ ] Highly unimportant [ ] Unimportant [ ] Neutral [ ] Important [ ] Highly important

4. How much does raw fruits and vegetables ***safety concerns*** influence your consumption?

[ ] Highly unimportant [ ] Unimportant [ ] Neutral [ ] Important [ ] Highly important

5. How much does ***time*** for fruits and vegetables shopping and preparation affect your consumption?

[ ] Highly unimportant [ ] Unimportant [ ] Neutral [ ] Important [ ] Highly important

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