KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

KUMASI, GHANA

ASSESSING DIETARY PATTERN AND ITS ASSOCIATION WITH HYPERTENSION AMONG THE ELDERLY IN THE TANO NORTH DISTRICT IN THE BRONG AHAFO REGION, GHANA

BY

HELINA GYAMEA

(B.ED. HEALTH SCIENCES)

JUNE, 2018

KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

KUMASI, GHANA

ASSESSING DIETARY PATTERN AND ITS ASSOCIATION WITH HYPERTENTION AMONG THE ELDERLY IN THE TANO NORTH DISTRICT IN THE BRONG AHAFO REGION, GHANA

BY

HELINA GYAMEA

(B.ED. HEALTH SCIENCE)

ATHESIS SUBMITTED TO THE DEPARTMENT OF BIOCHEMISTRY AND BIOTECHNOLOGY, COLLEGE OF SCIENCE, IN PARTIAL FULFILLMENT OF REQUIREMENT FOR THE DEGREE OF MASTER OF SCIENCE IN NUTRITION AND DIETETICS.

JUNE, 2018

DECLARATION

I,Helina Gyamea hereby do declare that this work is the results of my own research work and that the sources that I used have been acknowledge by means of references and neither in whole nor in part has this work been presented for the award of a degree in this University or elsewhere.

Helina Gyamea	……..	……..
PG 4430315	Signature	Date

Certified by:

Dr. Charles Apprey	……..	……..
Supervisor	Signature	Date

Certified by:

Dr. P.Twumasi	……..	……..
Head of Department	Signature	Date

ACKNOWLEDGEMENT

I am most grateful to the lord for seeing me through this piece of work after having gone through series of challenges. My acknowledgement will not be worth mentioned if I fail to recognize the contributions of some honourble personalities: I say a very big thank you to my supervisor, Dr. Yaa KafuiKlu and Dr Charles Apprey, Special thanks to Mr. Gideon Tia and all other colleague staff from College of Health, Yamfo for their support and encouragement. I also say a big thank you to Mr. Nicolas Appiagyei and Mr. Anane Adobasom Austin, for their motivation. My hearfelt gratitude also goes to all individuals who have in one way or the other contributed immensely towards the success of this work.

Lastly my warm gratitude to my greatest and lovely friend and Sister Ophelia Achiaa Frimpong who has always been there for me.

May God bless you all.

DEDICATION

This thesis is dedicated to my family Godfred Tutu (husband), Isaac Desmond Tutu, Heinz Adams Tutu and Ayeyi Frimpong (Children)

DEFINITION OF TERMS

Ageing: It is Process by which persons or adults are attaining chronological ages that are classified as old ages such as 60 years and above.

Aged/elderly: They are used interchangeably for persons who are 60 years and above.

Dietary Patterns: They are defined as the combinations of different foods items in diets, and the frequency with which they are habitually consumed.

Deoxyribonucleic acid: It is the basic building block of the human body.

Fertility: It is the ability to reproduce

Food Consumption Score: It is a composite score based on dietary diversity, food frequency, and relative nutritional importance of different food groups.

Food Security: It exists when there is certainty of availability or getting access to sufficient food to meet the nutritional requirements of individuals or using socially unacceptable means to attain food.

Hypertension is defined as increase in blood pressure to the point of doubling the long term risk of developing cardiovascular disease.

Malnutrition: It occurs as a result of the insufficiency or excess of essential nutrients consumed.

Mid-upper Arm: This measurement takes place between the acromion process of the shoulder and the tip of the elbow used to determine fat distribution which is useful in the diagnosis of protein-energy malnutrition

Migration: It is the movement of people from one place to another

Mortality: It indicates the number of deaths at a place

Nutrients: They are substances needed for growth, metabolism and normal body functions.

Nutrient density is a term used to subjectively describe a food group's quality in terms of caloric density, macro and micro content, and actual quantities typically eaten.

Waist Circumference: This measurement is used to ascertain the distribution of abdominal fat content in adults [WC; >102cm (men), >88 (female)]

Waist-to-Height ratio: This is used as an indicator most frequently among adults to ascertain central obesity patterns and an increased risk of cardiovascular disease [WHtR; (men= >0.90 female = >0.85)]

ABBREVIATIONS/ACRONYMS

AI	Adequate Intake
BARHD	Brong Ahafo Regional Health Directorate
BMI	Body Mass Index
CVDs	Cardiovascular Diseases
DASH	Dietary Approaches to Stop Hypertension
DBP	Diastolic Blood Pressure
DNA	Deoxyribo Nucleic Acid
EAR	Estimated Average Requirement
EER	Estimated Energy Requirement
FAO	Food and Agricultural Organization
FCS	Food Consumption Score:
GSS	Ghana Statistical Service
GHS	Ghana Health Service
ICN	International Conference on Nutrition
IoM	Institute of Medicine
KNUST	Kwame Nkrumah University of Science and Technology
LEAP	Livelihood Empowerment Against Poverty
LLFS	Long Life Family Study
LLS	Leiden Longevity Study
MOH	Ministry of Health
NCEP	National Cholesterol Education Programme
NECS	New England Centenarian Study
NICUS	Nutrition Information Centre of the University of Stellenbosch
PHC	Population and Housing Census
PRB	Population Reference Bureau
RDA	Recommended Dietary Allowance
SBP	Systolic Blood Pressure
SPSS	Statistical Package for Social Sciences
UN	United Nations
UNFPA	United Nations Population Fund
WC	Waist Circumference
WHtR	Waist-to-Height Ratio
WHO	World Health Organization
WFP	World Food Programme

ABSTRACT

Hypertension has become a major contributor to the burden of cardiovascular related morbidity and mortality in the world. Diet has been identified as one of the key modifiable risk factors in the development of hypertension especially among the elderly in low and middle income countries due to changes in dietary patterns. This study investigated dietary patterns and determined their correlation with hypertension among the aged in Ghana. A cross-sectional survey was conducted among six communities (three urban and three rural) in the Tano North district in Brong Ahafo Region of Ghana. Anthropometric measurements including height, weight, Waist-to-height ratio, Body Mass Index, together with clinical assessments (systolic and diastolic blood pressure) were also taken. Habitual pattern of dietary intake was measured using the Food Consumption Score. The FCS was measured based on eight classified major food groups. In all, 198 individuals were enrolled from 205 households visited. Participants were 55 years and above. Analysis revealed 12.6%, 27.3% and 60.1% of food consumption being the prevalence for poor, mild and acceptable dietary patterns respectively. The results also revealed 10.1% and 46.0% prevalence of mild and high blood pressure levels, respectively, among the respondents. A chi square test revealed an association between dietary pattern and high blood pressure level (X^2_2=12.777, p=0.012). Multinomial regression analysis was conducted and associations were measured using crude and adjusted ratios at the 0.05 level of significance. The odds of elderly with poor dietary pattern (food insecure) having mild hypertension was 5.989 (CI, 1.661, 21.598; P=0.006) with association persisting even after controlling for cofounders. No association was however found between acceptable dietary pattern and high blood pressure level after controlling for other potential factors in the regression model. Family History of BP, poor dietary pattern and locality predictedblood pressure status among the study population. Higher diet score (representing healthy diet or food secured) remains a significant protective factor for hypertension (60.1%), attempts should therefore be made to improve upon the living standards of the aged for an improved life. In conclusion, dietary pattern, when modelled with appropriate control is associated with an increased risk of hypertension among the aged.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE

INTRODUCTION

1.0 Introduction to Chapter

This chapter gives a brief overview of the topic under discussion to enable readers appreciate the scope of the work done. It comprises of the following: background, problem statement, justification, main objective, specific objectives, research questions, hypothesis, and organization of the study.

1.1 Background

Hypertension has become a major contributor to the burden of cardiovascular related morbidity and mortality in the world (Gaziono *et al*.,2010, Kearny *et al*., 2005).Report reveals that, of the 17 million cardiovascular related deaths annually, hypertension alone accounts for about 9.4 million of this death toll(WHO, 2008; Lim *et al*., 2013). It is also said to be responsible for at least 45% and 51% of heart and stroke related deaths respectively among the adult population (WHO, 2008; Lim *et al*., 2013). It is estimated that, about 40% of the world's adult population from 25 years and above are living with hypertension (WHO, 2011; WHO, 2013). It is equally worth noting that, of the 40% worldwide estimates, the African region alone accounts for the highest of about 46% (WHO, 2011; WHO, 2013). Some studies have been made in reducing or stabilizing the incidence of hypertension in most developed countries through various lifestyle interventions (Kearny *et al*., 2005, Pereira *et al*., 2009). This however, cannot be said about low and middle-income countries (Mittal and Singh, 2010). In Ghana for instance, a review on the prevalence of hypertension among the elderly reported about 19.3% and 54.6% in rural and urban settings respectively (Addo*et al*.,2012). The continuous of threat hypertension and other cardiovascular

related diseases pose worldwide, especially among the aged calls for public health attention and further research to unravel its associated factors amidst those that have been proposed.

1.2 Problem Statement

Previous research estimates that about 85% of non-institutionalized elderly people face one or more chronic conditions such as hypertension, a condition that could be improved with adequate nutrition (Dwyer *et al.*,1991;Chernoff, 1994). Furthermore, half of the identifiable clinical problems associated with hypertension required nutritional intervention (Morley 1986, Douglass *et al*., 1993).Other researchers have also identified diet as one of the key modifiable risk factors in the development of hypertension especially among the elderly (Appel *et al*., 2009). The prevalence of hypertension in low and middle-income countries including Ghana has been attributed to the changes in the dietary patterns of the populace(Kotchen, 2010; Popkin *et al*., 2012).However, there is little information on the dietary patterns and their nutritional status of the aged in most developing countries including Ghana (Steiner-Asiedu *et al*., 2010; Aganiba *et al*., 2015). Thus, this study therefore seeks to investigate dietary patterns and to determine its correlation with hypertension among the aged in the Tano North District of the Brong Ahafo Region of Ghana.

1.3 Justification

Globally, the aged population is estimated to be 810 million people representing about 11.5% of the total 7 billion population (Gazion*oet al*., 2010; Lim *et al*., 2013; WHO, 2013). In Ghana, the aged population is said to have increased about seven and half times from 213,47 in 1960 to 1,643,381 in 2010 (GSS, 2013). Currently, the aged

population constitutes about 6.7% of the total population in Ghana (GSS, 2013), suggesting a shift in population age structure. Aging however, comes with its associated psychological, physical and immune function challenges (Lesourd, 1997) thus making the aged vulnerable to rapid degeneration and diseases such as hypertension (Apt, 1999;Wardlaw, 2003). Hypertension is reported to be the second leading cause of morbidity among the aged in Ghana (MOH, 2006). To a greater extent, the functional ability and health of the aged depend on their current and usual diet. Adequate nutrition therefore remains a very critical component of enhancing healthful and active aging (Bartali *et al*., 2003). In Ghana, however, it appears almost all the nutritional intervention programmes and research are geared towards improving maternal and child wellbeing with very little attention paid to the elderly (Solomons, 1997; Charlton and Rose, 2001). Probably due to lack of established institutions and care homes for the aged in the country (Steiner-Asiedu,*et al*., 2010).Considering the increasing trend of hypertension among the aged, its linkage with diet and the paucity of related research in the study area, it is therefore imperative to delve into this area of research to contribute to existing literature within the Ghanaian context. Hence the need for this study.

1.4 Main Objective

The main aim of this study was to assess dietary patterns and their associations with hypertension among the elderly in the Tano north district in the Brong Ahafo Region of Ghana.

The specific objectives of the study were:

- To assess dietary patterns among the elderly in the study population
- To determine the prevalence of hypertension among the study participants

- To ascertain the correlation between dietary patterns and the prevalence of hypertension among the study participants
- To assess the cofounding effects of location(rural and urban), education, family history and physical activity level

1.5 Research Questions

1. What are the dietary patterns among the study participants?
2. What is the prevalence of hypertension among the study population?
3. Is there an association between dietary pattern and hypertension among the elderly in the study population?
4. Does the association persist after controlling for location, income status, education, family history and physical activity level?

1.6 Hypothesis

Dietary patterns would increase the risk of hypertension among the elderly even after accounting for other potentially important risk factors.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents a theoretical framework and provides the rationale for conducting a research on the topic, by critically analyzing and drawing conclusions from previous research findings pertinent to the current research study. In order to produce a comprehensive review on the said topic, literature published in English in various data bases and websites including; reports, citations and abstracts were thoroughly searched. The reference lists including publications were also scanned for other relevant references leading to other eligible studies not captured in the searched databases. Filter for publication year (from 1971 to 2013) was used. A search strategy employing text words, thesaurus headings and research questions relating to the aged or elderly, dietary patterns, hypertension, blood pressure, cardiovascular diseases, trend, epidemic, determinants, interventions and the list of high, middle and low income countries was used with Ghana being the primary focus.

2.2 Aged Defined

The term elderly and aged or older people are normally used interchangeably.

'The concept of ageing is an associated word that refers to the process by which persons or adults are attaining chronological ages that are classified as old ages (GSS, 2013). Although the concept of the ageing population is gradually being experienced in the developing part of the world, the ageing phenomenon seems to be conspicuously seen in most developed countries for a longer time compared to developing countries (UNFPA, 2012). Studies on population dynamics reveal that, a population is said to be an aged population when the proportion of such categories

exceed 10 or15 percent of the total population. By this, a young population, on the other hand, is one that has about 35 percent or more of its population being less than 15 years. Research continues to predict even a much more ageing population around the world. This is evident in the numerical growth of the aged persons in both developed and developing countries. Unlike most developed countries who have had this phenomenon over a long period, developing countries equally continue to show a greater tendency of having an appreciated aged population.

Some argue that, nutritional improvement, decrease in parasitic and infectious diseases, improved education, income status, and health care provision in addition to the much preached possible factor which is reductions in fertility rate could account for this gradual shift most especially within the developing world. In buttressing the role fertility rate plays in a population in the developed world, research reveals a decline in the live births per woman from 5.0 live births between in 1955 to 2.7 live births in 2005 (Mba, 2010). Holding all other factors constant, it is projected that, by the year 2050 the total live birth per a woman will be 2.2 (UN, 2000; UN, 2004; UN, 2006). Expressing this further in terms of age limits, life expectancy is said to have augmented from 46.5 to 66.0 years from 1955 to 2005. This figure is likely to upsurge to 76 years by 2050. The developing world especially within the Sub Saharan African region, research reports a corresponding fertility value of 6.7 live births per woman between 1950-1955 to 5.5 live births in 2005. Also, the projections of live birth per woman by 2050 are estimated to be 2.4. Life expectancy rate is projected to be 68.4 years by 2050 compared to 48.4 years in 2005. Empirical evidence from various studies conducted on population dynamics indicates the likelihood of most countries

experiencing an appreciable rise in the ageing population over the next decades (Mba, 2004; Mba, 2005; Mba, 2007; Mba 2010).

2.3 Aged Population in Ghana

The population 60 years and above is said to have increased from 1950 to 600 million in 2000. Further investigations suggest an increase from 600 million in the year 2000 to over 700 million in 2006, with a further projections of 2 billion older persons by the year 2050 (UN, 2006). Several surveys conducted in Ghana reveals a population dominated by the youth category. According to UN (2006) the population of Ghana could still be categorized at youthful; The Ghana Statistical Service, 2005 observed that, there have however been decreases in fertility and mortality resulting in a rise in the ratio and total number of the aged population (age ≥ 60 years) as demonstrated by the outcomes from the tally (GSS, 2005a; GSS 2005b) and estimates from other sources (UN, 2006; PRB, 2006). In the spirit of minimizing fertility and mortality, it is anticipated that the ratio of the aged group will increase in the near future. However, what is not known is the country's readiness to effectively respond to such demographic transition (gradual shift from high mortality and high fertility to low mortality and low fertility).

2.3.1 Reasons for this Pattern of Population Ageing in Ghana

The structure of a population's age is said to be centered on three fundamental procedures of a population: fertility, mortality, and migration. The stability of the age structure is determined by how constant these processes would be. By default, it therefore means that, if fertility, mortality and migration rates remain the same, there would be a reduction in the youthful or younger population thereby promoting the aged population over a long period of time (Coale, 1964). In Ghana, and for most

countries, the age structure is mostly influenced by fertility and mortality rates than migration does. The impact of migration is however felt greatly in the town, city, or regional level, as people move into the bigger towns from the villages especially in search of so called 'greener pastures'. In Ghana, findings on mortality still remain moderately high with a corresponding life expectancy at birth still below 60 years. Report also indicates a declined level of fertility from 6.4 in 1988 to 4.4 children per woman in 2003 and then to 4.0 in 2008 (GSS *et al*., 2009).

2.3.2 Research Gaps, and the Way Forward

Due to the expected changes in age structure Ghana's population toward the older age group, some have recommended that, the government should take advantage of the available time left now to make preparations for a future aging society through the formulation and effective implementation of policies and programs before population ageing becomes a substantial public and private burden. Mba (2010) in their study on population transition in Ghana have shown that, majority of the concentration of the elderly are within the younger age category (60-69 years). Implying that, maximum proportion of the aged population in Ghana will entail persons belonging to the younger portion of that aged category. If this assertion is anything to go by, it therefore could suggest that, the older proportion of Ghana's population could be harnessed to become a resource for development economically (Treas and Logue, 1987). It is however conceded that care must be taken when dealing with population related projections due to inconsistencies in population dynamics. These assessments must be accepted with care based on the uncertainties of human and reproductive behavior. That notwithstanding, their findings give an indication of what might happen in future. Such projections may be useful in providing a stage for increasing

awareness on aging as a policy and research issue in Ghana (Mba, 2010). Research has shown a relationship between the ageing process and an increased risk of illness and disability.

Lifetime exposure to health problems in Ghana considering the nature of our health systems suggesting that several Ghanaians may go into old age already in chronic ill-health. For the aged personal health and material security remains a major priority. This is mostly valued in the rural settings, indeed, physical health remains a valuable asset to the aged in the rural settings. To them, ones' ability to work in the farms which is their major occupation, to function independently, and to maintain a reasonable standard of living is dependent on their physical health. The most effective way of assessing the conditions of the aged current and making accurate forecasts and prospects of the aged persons in the future depends on such related research. Relative to developed countries the speed of aged population seems to be quicker in developing countries. Consequently, if adequate measures are not put in place, there will be less time to correct the effects of this phenomenon in developing countries. In developing countries, the aged population seems to however take place at lower levels of socioeconomic development compared to their counterparts in the developed world. Furthermore, it is also argued that, population ageing has consequences for all surfaces of human life.

Arguing from the economic point of view, some have equally emphasized on the economic implications of ageing, in terms of investment, pensions, savings, labour markets, and intergenerational transfers. Also arguing from the social point of view, some have emphasized on the impact of the ageing population on family systems in

terms of living arrangements, housing and health care services. The above presentation points to the need to address the issue of population ageing in the country. In developed countries, this phenomenon has occurred over more than a century (Caldwell, 1982; Olson, 1994; Angel and Angel, 1997). Thereby giving them the space to make some adjustments aimed at improving the aged conditions. Likewise, in Ghana and most African countries, this transition process has occurred over few years. Even countries with a high economic and social developmental levels as seen in most developed countries still struggle adjusting rapidly to the aged population in such a short period how much more undeveloped countries. Various governments within the sub Saharan region should be aware of this impending challenge. Adequate resource committed into research in this area will help in pointing out these challenges and proffering possible solutions.

2.4 The Process of Ageing

Arguably, the mechanisms underlying normal aging can be said to be not fully understood. It is however undeniably proven that, elderly may experience various forms of changes such as physiological and increase exposure to chronic diseases (McKevith, 2005). More importantly, these occurrences are usually mentioned as major factors that could have an impact on appetite and hunger, as a result leading to variations in diet composition (Lahmann and Kumanyika, 1999; McBee *et al*., 2001) and energy consumption (Wakimoto and Block, 2001). According to McBee *et al*. (2001), the most common nutrition-related concern among the aged is nutritional deficiency. It is also asserted that, the ageing may perhaps take-in less energy containing beverages in addition to rarely relying on fast foods, but they eat more grains, fruit, and vegetables, which have positive dietary effects when compared with

their younger counterparts (Haan, 2000). The complexity of ageing is outlined by several researchers. Bromley (1988), also emphasizes on the complexity of ageing and thus states that 'ageing is a complex order of variations noticeable by a progressive reduction of body weight and functioning of the body systems'. Chou (2008), also has it that, the ageing phenomena coupled with the quality of life one lives is largely dependent on factors such as genes, food, reproduction, cellular damage accumulation, and the ability to repair. De Magalhães and colleagues also further discuss the environmental influences on the degenerative changes that accompany aging. They further explain that, the physical development of the body surges the rate of catabolic change rather than anabolic cell regeneration hence, decreased and impaired organ function (De Magalhães *et al*., 2009).

2.4.1 Factors that Influence the Ageing Process

The process of maturing remains inevitable in the life of every individual, its occurrence however varies from individual to individual. Irrespective of the individual variations, research has identified various factors which include: biological, sociological and psychological as the major factors affecting the ageing population. Genetic, Nutrition and Environmental factors and life style factors such as: Smoking, Alcohol consumption and physical inactivity, and Socio-economic factors.

2.4.1.1 Genetic Influence

Genetic factors represent the transfer of basic building blocks of the human body known as the Deoxyribonucleic Acid (DNA) from one generation to another. (IoM, 2001).Studies into the gene age relationship is described as a complex interaction and therefore needs further research. It is also argued that, though genes play a role in the

ageing process, the process itself is not genetically programmed which means that, there are no genes specifically assigned for ageing but ageing occurs as a result of accumulation of cellular defects resulting from random molecular damage, with genes influencing cellular repair (Kirkwood, 2005; Kirkwood, 2008). Human genetic also plays a role by predisposing individuals to certain conditions and also influence resistance to diseases and promote general wellbeing. The interaction between gene action and the ageing process have been investigated. Example remains the Longevity Gene Study (Barzilai *et al*., 2001), the New England Centenarian Study (NECS) (Terry *et al*., 2004), the Long Life Family Study (LLFS) (Newman *et al*., 2011) and the Leiden Longevity Study (LLS) (Mooijaart *et al*., 2011), others also include Atzmon *et al*., (2004) and Newman *et al*. (2011). Amidst the numerous studies conducted on the gene effect on ageing, there still exist more inconsistencies with few consistent results probably due to differences in ethnic orientations, population stratification and the interference of confounding factors (Brooks-Wilson, 2013). Although there is no 'death gene', most population genetics investigations have shown that about 25% of the variation in lifespan among different individuals can be accounted for by hereditary for. The remaining 75% of the variation is due to other factors such as environmental (Kirkwood, 2008), lifestyle, physical activity, nutrition and social circumstances (IoM, 2001; Green, 2005)

2.4.1.2 Nutrition and Environment

Nutrition plays a significant role in enhancing cell in organisms to repair or cope with the damage caused as a result of accumulation of damage to the cells. Over a long period, there have been consistent reports on the influence of nutrition in health and the ageing process. Nutrition therefore remains critical for health and well-being at all

stages of life. There is also evidence to prove the influence of nutritional intake on DNA repairs (Tyson and Mathers, 2007), and these nutritional factors may explain some of the variations in DNA repair capacity among different individuals (Caple *et al*., 2010). This relationship is however not without challenges; one major challenge has been with difficulties in exposure measurement (Fave *et al.,* 2009; Penn *et al*., 2010) and the possible interference of confounding. The more recent focus on dietary patterns in the area of public health seems to bring some clarity in that field. For instance, The EPIC-Norfolk studies by researchers from Cambridge University revealed a reduction in the prevalence of cardiovascular related diseases and similar percentage for mortality over the period of eight years. Furthermore, there is evidence linking Mediterranean dietary pattern and ageing. This dietary pattern is characterized by high consumption of plant-based foods, low consumption of dairy foods, meats and meat products and moderate consumption of fish (Trichopoulou *et al*., 2005). Moreover, a meta-analysis has also reiterated the influence of Mediterranean diet in the reductions of several major age-related diseases including cancers, cardiovascular and neurodegenerative diseases (Sofi*et al*., 2010) and also supported by (Estruch *et al.,* 2013) in their studies.

2.4.1.3 Life Style

Life style activities such as smoking, physical inactivity, excessive alcohol consumption in addition to the over dependent of refined and fatty foods have been linked to several health conditions such as obesity, hypertension and other cardiovascular diseases. Also, the effects of various diseases on the aged and how it speeds up the ageing process have also been established (Haan, 2000). It is also argued that, advancing age attracts certain diseases due to weakened physiological status hence affecting the total body function. What is however of interest in this

review is the relationship between one's life style and the ageing process. In a longitudinal study conducted on the aged from 70 to 75years in 9 European countries to ascertain the impact of dietary and lifestyle on the ageing process, unhealthy lifestyle habits, low-quality diet, smoking and physical inactivity were associated with increased mortality risk (hazard ratios ranged from 1.2 to 2.1), (Haveman-Nies *et al*., 2003). It was further propound that the rate of decline in health was more pronounced in persons who smoked and lived sedentary lifestyle compared with the active and non -smoking individuals. Consequently, health deterioration was delayed in those who did not smoke and engaged in physical activity. They therefore concluded that, the overall effect of living a healthy lifestyle on the ageing process has the tendency of going together with a compressed morbidity. Previous studies conducted to equally ascertain the effects of healthy lifestyle on the ageing process yielded similar results (Davis *et al*., 1994; Trichopoulou *et al*., 1995;Ruigomez *et al.,* 1995;Huijbregts*et al.,* 1997). From the discussions, it can be deduced that, if lifestyle related diseases such as hypertension, type 2 diabetes and obesity can influence the ageing process due to ill health, and then it means that indirectly unhealthy lifestyle can play a significant role in the ageing process. Green (2005), further propounds that although individual responses to health status is influenced by gene activities. Various lifestyle choices made such as using tobacco, alcohol, physical activity and diet play a much more significant role in determining the overall health of people as well as the ageing process.

2.4.1.4 Socio-economic factors

It is argued that, those who live alone have the tendency of having a reduced dietary consumption compared to their counterparts who live in the company of others (Davis

et al., 1985). Social networks provide partnerships associated with food, include shopping, meal preparation and companionship. It is also said that, the elderly in a higher class live much longer compared to their counterparts in the deprived areas (McCornack, 1997) due to a much more improved nutritional status (Barasi, 2003), medical resources and safer environment (Haan, 2000). Moreover, the aged have few opportunities to re-enter the labour market after their retirement thereby placing a higher burden on their income status, especially when prices of food and goods go up. The consequences of this are to resort to cheaper foods for sustenance thereby affecting the ageing process (Bohman *et al.*, 2007 and Cherchye *et al.*, 2008).Social integration also plays a significant role in the ageing process. Pope (2008), suggests that strong social associates, through family, friends and community members has the tendency of helping to preserve elderly brain health. This implies that, cognitive decline in the aged may be caused by social isolation. Zunzunegui (2003), further reiterates the importance of social relations and integration in promoting mental and physical health among the elderly and further asserts that, socially active individuals havefewer likelihood to undergo depression and other diseases like cancer. By implication, it can therefore be argued that, poor social integration can lead to an increased consumption of alcohol, sedentary lifestyle and poor nutrient intake.

2.5 Hypertension

2.5.1 Definition and Classification

Hypertension is mostly defined as increase in blood pressure to the point of doubling the long term risk of developing cardiovascular disease (Kaplan, 2002). The classification of hypertension rests on the mean of two or more properly measured seated blood pressure readings on two or more consistent measurements. A person is

said to have normal blood pressure if the blood pressure level falls below 120/80 mmHg. Systolic blood pressure of 120–139 mmHg or diastolic blood pressure 80–89 mmHg is referred to as prehypertension. A person who is said to be pre-hypertensive is at increased risk of further developing hypertension if not properly managed. Any person whose systolic blood pressure is greater or equal to 140mmHg and a diastolic blood pressure of greater or equal to 90mmHg is said to be hypertensive. Systolic blood pressure of ≥140 mmHg with a corresponding diastolic blood pressure <90 mmHg is classified as Isolated systolic blood pressure (WHO, 2005). Hypertension is further classified into two stages

- Systolic blood pressure 140–159 mmHg or diastolic blood pressure 90–99 mmHg.
- Systolic blood pressure ≥160 mmHg or diastolic blood pressure ≥100 mmHg.

Table 2.1Classification of Blood Pressure for Adults

Category	Systolic Blood Pressure	Diastolic Blood Pressure
Optimal	< 120	<80
Normal	120-129	80-84
High Normal	130-139	85-89
Grade 1 hypertension (mild)	140-159	90-99
Grade 2 hypertension (moderate)	160-179	100-109
Grade 3 hypertension (severe)	≥180	≥110
Isolated systolic hypertension	≥140	<90

Source: WHO, 2005

Determination of hypertension in adults is made by taking the average of two or more diastolic or systolic blood pressure measurements or at least two times is≥90 mmHg

or≥140 mmHg respectively. It should however be noted that, single elevated reading of blood pressure does not constitute a diagnosis of hypertension but is an indication for further examination.

2.5.2 Burden of Hypertension

Hypertension or high blood pressure remains a major contributor to the burden of cardiovascular related morbidity and mortality across the world (Gaziano *et al.*, 2010; Kearney *et al.*, 2005). Hypertension alone accounts for about 25% of morbidity among adults in the world (Kearney, *et al*., 2004; Pereira *et al*., 2009) and is ranked as the third cause of disability (Kearney *et al*., 2005). Although hypertension remains a public health challenge globally, its impact is however more felt in the developing world compared to their counterparts in the developed world (Mittal and Singh, 2010). In Ghana for instance, hypertension was reported to be the second leading cause of outpatient morbidity in adults older than 45 years (Kotchen, 2010). This phenomenon has been attributed to factors such as obesity, consumption of refined sugar and starchy foods, fatty foods, family history of hypertension, urbanization, physical inactivity as well as other lifestyle such as alcohol consumption and smoking(Kearney *et al*., 2004; Kearney *et al.*, 2005, Pereira *et al*., 2009).

2.5.3 Prevalence of Hypertension

The current prevalence of hypertension in many urban cities and towns within Sub Saharan Africa is reported to be already as high as seen in developed countries (Jafar *et al.*, 2005; Mittal and Singh, 2010). A Chinese study reported hypertension prevalence of 56.5 % among the aged (Wu *et al*., 2008). There is a very high possibility of an increase prevalence of hypertension especially in the low and middle

income countries (Popkin *et al*., 2012). A study on hypertension among older adults in several African countries revealed high prevalence of hypertension. For example, study conducted in Zimbabwe revealed 72% prevalent rate (Mufunda *et al*., 2000), Dakar in Senegal revealed prevalent rate of 65% (Macia *et al.*, 2012), Ghana 42.4% prevalence (Duda *et al.*, 2011) and 77 .3 % prevalence in South Africa (Peltzer *et al*., 2013). It is estimated that, about 90% of all hypertensive patients have no idea regarding a specific cause of the disease. (Coody *et al*., 1995). A study conducted in Ghana revealed that, only 32.3 % of the participants had previous knowledge about their condition. This buttresses the assertion made by Addo *et al., (*2012). They stated that, the rise in morbidity associated with hypertension does not only show a high prevalence of hypertension, but also suggests inadequate detection rates, treatment and control. According to the World Health Organization, this phenomenon could be as a result of increased population coupled with a fragile health care system to match the growing population (WHO, 2013). Previously, hypertension was conceived as a condition reserved for those living within the affluent societies but not the poor. This assertion was supported based on previous survey conducted in the northern part of Ghana which revealed a very low prevalence of hypertension (Addo *et al*., 2012). On the contrary, review on hypertension among rural communities in Sub Saharan-Africa reveal prevalence ranges from 2.3% to 41.1% (Agyeman *et al*., 2006; Kuller, 2007; Addo *et al*., 2007). Addo *et al.*, (2006) in their study among four rural communities in Ghana found a prevalence of hypertension to be 25.4%. Also, in a recent study in Bongo, a rural community in the Upper East Region of Ghana revealed a very high prevalence of hypertension of 38.3% among adults in that area (Dare *et al*., 2016). In that report, there was a linear relationship between hypertension and past smoking status (OR=2.541, p=0.043), high salt intake

(OR=3.839, p=0.037), high alcohol intake (OR=1.657, p=0.040), and physical activity (OR= 0.804, p=0.032),) low socioeconomic status (OR=2.211, p=0.029) and obesity (OR=2.311, p=0.019). Other researchers have also reiterated the influencing effect of age (WHO, 1999), gender (WHO, 1995) and urbanization (Van Rooyen *et al*., 2000) on hypertension occurrence. There is also a possible relationship between hypertension and family history of high blood pressure but not a linear relationship between physical activity and hypertension (Ranasinghe *et al*., 2015). Moreover, it is believed that the rate of hypertension increases with socio-economic status (Steffen *et al*., 2005). Addo and colleagues (2012) however disagree with that assertion and suggested that the subject of socio-economic status and hypertension is inconclusive and requires further research.

2.6 Diet and Hypertension

2.6.1 Introduction

Nutrition is referred to as the intake of food substances, considered in relation to the body's dietary needs (WHO, 2013). Others may also describe nutrition as the effect of any consumed substance found in food on the human body (Mann and Truswell, 2017). The process begins with the physiological and biochemical processes involved in nourishment. The term nourishment refers to how substances in food are converted into nutrients for the body to function properly. Malnutrition occurs as a result of the insufficiency or excess of nutrients. Nutrition has become a major topic for discussion in today's research world due to its association either directly or indirectly with the development of chronic degenerative disease like hypertension, cancers, coronary heart diseases, etc. There has been a growing advocacy to research the interactions between nutritional science and molecular biology, to ascertain information on the

influence of food components on human cells and other biochemical responses (Mann and Truswell, 2017). That notwithstanding, investigations on nutrition in our world today especially in Ghana should also be focused on why people choose to eat the foods they eat and the understanding of the implications of what they do. What constitutes a healthy diet might be interpreted differently by different groups. For example, the understanding of a healthy diet in an affluent society might be different from those in poor communities.

2.6.2 Concept of Food Insecurity.

Food insecurity exist when there is uncertainty of availability or getting access to sufficient food to meet the nutritional requirements of individuals or using socially unacceptable means to attain food (Wunderlich and Norwood, 2006).

Food insecurity could sometimes precede hunger but it is not in all cases that food insecurity leads to hunger. Hunger is defined as the uncomfortable or painful experience caused as a result of lack of food. Food insecurity is said to be very severe when people in households experience a reduced intake of food and hunger (Bickel *et al*., 2000). It is however important to note that the term 'food insufficiency' is normally used interchangeably to depict food insecurity, however, food insufficiency is described as the reduction in adequate food intake as a result of financial or resource constrains. Food insufficiency therefore has to do with accessibility. Food insecurity on the other hand covers a broader scope that encompasses food insufficiency, the quality of food supply and intake together with its associated psychological effects (Casey *et al*., 2001).

Determinants of food insecurity: An analytical framework

Food insecurity has been described as a complex phenomenon attributed to several factors such as, environmental, political, social and economic determinants. The order of importance of these factors however vary across countries, regions, groups and time (Bashir and Schilizzi, 2013). The concept of food insecurity is described in this study using the food security frame work developed by Bashir and Schilizzi (2013).

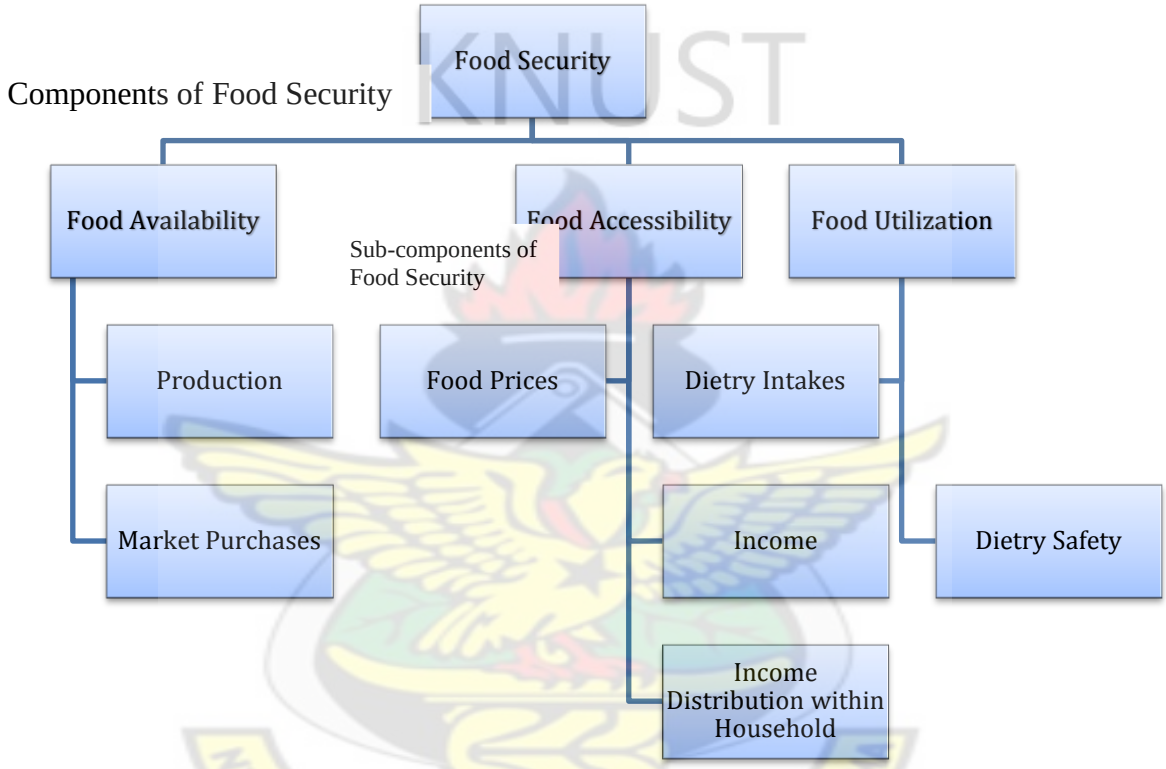

Figure 2.1 Framework Explaining the Concept and Determinants of Food Insecurity

Conceptual framework of rural household food security in developing countries (Bashir and Schilzzi, 2013)

Food insecurity as well as food security encompasses three major elements namely: Accessibility, Availability, and Utilization (Ericksen, 2008; Bashir and Schilizzi,

2013).Food accessibility refers to the individual being able to comfortably purchase or acquire food without any financial barrier or having to compromise on other basic needs: Food availability draws its basic principle from the concept of sustainability, that is having adequate food being produced at all times taking into consideration both present and future either through domestic production, food aid, imports and other forms of trade. Food utilization, this explains the nutritional knowledge as well as the biological use of food for effective metabolic activities (Bashir and Schilizzi, 2013). These elements appear to be linked hierarchically in the sense that, food must be available before one can access, utilized or consumed. Attaining all these factors depict food security status. Food insecurity on the other hand is therefore said to occur if any of these arms is taken away (Deitchler *et al*., 2011).

2.6.2.1 Food Availability

This component in the framework consists of two elements: Production and market purchases. Production simply refers to all local activities involved in producing food materials in its raw form, this is however influenced by the amount and the type of food consumed (Ericksen, 2008). Several factors affecting food production are enumerated in existing literature which include; human capital, land size and ownership, livestock, crops, input prices and political support on subsidy (Bashir and Schilizzi, 2013). Market purchases involve distribution and exchange. Distribution refers to an area of the food system chain activities which involves physically moving food from the area of production to the consumer. Transportation, adequate storage facilities, trade regulations and governance remain some of the identified determinants of food distribution. Exchange explains the amount of food made available to the consumer through mechanisms such as trade, purchase, imports, aids

and other forms of transaction other than producing the food locally. This is influenced by factors such as trade terms and market purchases as well as subsidies (Ericksen, 2008). However, one's ability to negotiate a better trade terms as well as purchasing power imperatively depends on the income level and available resources.

2.6.2.2 Food Access

Household income, food prices and household capacity are some of the key determinants of individual and household food accessibility in the framework. Income remains pivotal to people's ability to remain food secure due to its influence on purchasing power. Rose (1999), propounds on the importance and influence of income on food insecurity and does agree with the assertion that, food insecurity decreases with an increase in income. It has however been cautions that, the concept of food insecurity is not only attributed to only households with low income and therefore, care must be taken in generalizing this statement. Household income distribution is equally affected by household size and the number of productive people in the house in terms of earnings (Bashir and Schilizzi, 2013). Education and employment also remain key determinants of household and individual income status. Food prices determine the quantity and quality of food consumers can access. This also affects the management, allocation and budgeting components of household practices. Increase in food prices have been attributed to unfavourable policy atmosphere and weak market systems. This in a long run has rippling effect on productivity, food supply and income (Mehra-kerpelman *et al.,* 2003). Household composition and capacity also dictates where, when and how consumers can purchase food. This encompasses conditions that make it easier for individual or household members to access food conveniently. Factors such as; transport, time, shop proximity, household storage capacity and one's physical condition and the number of

productive persons determine household capacity to access food (Dowler, 2008; Ericksen, 2008).

2.6.2.3 Food Utilization:

The determinants of utilization are put under two broad categories which include Dietary intake and food safety. Dietary intake is influenced by nutritional knowledge and practices. This is further influenced by, the information people receive, education and socio-cultural beliefs. The information people receive through various personnel, food labelling and advertisements could also influence people's dietary intake either positively or negatively. For example, some advertisements about food products or supplements as well as food labelling could be misleading without the individual knowing its long term consequences. Dowler (2008) identifies the link between socio-cultural values, household practices (managing, allocating and budgeting for food) and choice and dietary intake. Food safety is influenced by health, sanitation and food modification. Adequate food consumed without sanitation and hygienic practices will affect its utilization. Poor health could also have rippling effect on household income and resources, thereby influencing the amount of diet consumed at a time. Poor health could also be a contributory factor for food insecurity .This interaction seems to be more prominent among individuals in deprived communities in most developed countries (Ramsey, 2012). Food modification encompasses processing and packaging for consumption. Improper processing and handling food could lead to loss of nutrients thereby affecting utilization.

From this frame work, it can be deduced that, food insecurity encompasses accessibility, availability and utilization. The absence of any of these components is

what results in food insecurity. It therefore contributes significantly to giving this current study a better understanding of the concept of food insecurity and the factors worth considering in tackling food insecurity among the elderly in Ghana. It is believed that, the food environment in the world today is characterized by high consumption of sugar and fat related diets popularly known as "fast foods" predominantly seen in most deprived communities which affect the utilization component of food security. This framework has revealed that, food insecurity does not revolve around only access but utilization, but the income and resources made available to the individual determines which diet and environment he/she chooses. This corroborates findings reported by Bu, (2004) which indicated that, the availability of food at all levels remains an important component of people's wellbeing, the tendency of people underfeeding or overfeeding however depends on their income status. It is therefore not far-fetched that researchers have attributed food insecurity to people living in deprived communities characterized by low income status in developing countries and ethnic minorities in developed countries. (Kaiser *et al*., 2007; Willows *et al*., 2009), large household size (Bartfield and Dunifon, 2006) and lower education (Bartfield and Dunifon, 2006; Kaiser *et al.*, 2007). Therefore measures that seek to enhance the social and economic status of individuals especially the elderly will greatly alleviate food insecurity.

2.6.2.4Food Security and Hypertension

Study conducted by Irving and colleagues did show positive relationship between food insecurity and hypertension having controlled for socio-demographic status. They further outlined a strong relationship between food insecurity related stress and hypertension (Irving *et al.*, 2014). Research have also highlighted on the significance

of stress on one's health status. For example, a study conducted by Hamelin and colleagues did reveal that, food insecurity related stress could lead to changing eating patterns, disruption of household dynamics such as; (parents not relating to their children well due to their inability in providing sufficient food, anger, selling of properties, poaching and other forms of coping strategies) among others (Hamelin *et al.,* 1999). This implies that, such coping strategies could alter one's dietary pattern thereby leading to the onset of lifestyle related diseases such as hypertension. Also, study conducted by Seligman and colleagues to ascertain the relationship between food insecurity and chronic disease among low income participants did report a positive relationship (Seligman *et al.,* 2010). Although both studies (Seligman *et al.,* 2010; Irving *et al.,* 2014) reported a positive relationship, Socio-economic status however played a role in the relationship observed in that of Seligman and colleagues unlike the study conducted by Irving and colleagues where socio-economic status was insignificant. Another study conducted to ascertain the association between food insecurity and chronic disease among working adults also reported a strong association between the former and latter (Christian and Alisha, 2017).Food insecurity has been attributed to low intake of fruits and vegetables, lean meats and other quality diets seen as less expensive with a corresponding high intake of cheap processed foods made of sugar and fat (Tingay, 2003; Drewnoski, 2004; Jetter and Cassady, 2006). These modifications may lead to metabolic changes in individuals resulting in the onset of various forms of chronic diseases such as hypertension, diabetes and poor health in general (Scheier, 2005; Tanumihardo, 2007).

2.6.3 The Nutrition Situation of the Elderly in Ghana

Adequate nutrition and good health play major role in a nation's development. Same can be said of the elderly population who vary greatly in their social, lifestyle, physical and economic capacities. According Frankle and Owen(1993) these differentiating factors to a large extent influence the ageing process at a varying rate within cells and organ systems. Krinke (2008) asserts that, determining the ageing process chronologically remains a poor indicator of physiological age, and that, it is not always a measure of physical health. Aging however, can't be stopped but can be decelerated by various ways of healthy life activities and behaviors (Ahluwalia and Ahluwalia, 2005; Reese, 2007). The ability of the elderly to effectively perform their functional abilities and living a healthy life largely depends on their nutritional status. Research reveals that, the ageing are normally susceptible to food insecurity as a result of their low earnings and physical abilities compounded with the onset of chronic diseases associated with ageing. These factors put together further predispose the aged to poverty. Food security is simply said to be household's ability to access food by all people at all times needed for a healthy life (Pinstrup-Andersen, 2009). It is an undeniable fact that, the onset of advanced medicine and technological sciences has over the years improved upon the aged condition (Roberts and Rosenberg, 2006), nutrition however remains a major component in delaying morbidity and as well as increasing the life expectancy of the aged (Bartali *et al*., 2003). Achieving the nutritional independence of most aged population in developing countries especially in Ghana needs to be considered critically because they are most likely not to meet the nutritional needs of their physiologically changing bodies.

It is argued that, the aged feed on inadequate diet since income status of most of the aged population is low due to reduced work capacity. Several of them therefore, survive under the generosity of family and relations, as well as donation from community and charitable organizations. A study conducted to ascertain the nutrition situation of the elderly in Ghana revealed that, most aged in Ghana are severely food insecure and this is predominant among women who are widowed (Steiner-Asiedu *et al*., 2010). Heuberger (2009) propounds that, women normally become widows early compared to men and therefore struggle through life with greater number of such women living without any assistance or company of companion. This confirms earlier report by Waite (2004) stating that, older men who are challenged with the issue of companionship are much better off compared to older women, because, most men get married again before they die whereas most women live without married till death. In their report, most of the aged population who appeared to be food secured received support by way of food transfer from families and relations mostly their children. This observation therefore outlines the significance of social support system towards enhancing food security and calls for the need to promote social support systems among the aged. It is also said that, these systems were effectively practiced in the past through the extended family system in Ghana. This is however not the case in our modern world because, these responsibilities have been shifted to the nuclear family system due to urbanization and many other factors(Asenso-Okyere *et al*., 1997).

2.6.4 Factors Determining the Dietary Pattern of the Elderly

Steiner-Asiedu *et al*., (2010) report revealed that, most of the elderly investigated lived with one or two chronic conditions with most of them not seeking frequent medical care but patronized over the counter drugs. The study further revealed a daily

minimum drug intake of three times by the participants mostly the women which was consistent with findings from other studies (Mitchell *et al.,* 2004; Bales *et al*., 2004). Reasons attributed to this observed pattern could be due to financial constraints and most likely could also be the reason for their food insecurity status because they will have to prioritize how they utilize the little money they have on them as to whether to buy food or seek medical attention. Whereas literature attributes dietary patterns to economic factors, others are of the view that, the relationship between economic status and dietary pattern among the elderly still remains unclear and therefore needs further research (Conklin *et al*., 2013). Differences in findings could be due to variations in study areas. That notwithstanding, there exist several research findings especially in developing countries linking poor economic status to poor dietary pattern (Leather, 1992; Drewnoski *et al*., 1997; Darmon *et al*., 2002;Denny, 2008; Booker and Sacker, 2011).Apart from the age and financial factors, other observed factors from studies affecting the nutritional status of the elderly, include; gender, poor appetite, loneliness, regular consumption of fast foods, chronic disease condition, dental conditions making it difficult for chewing, regular medications, and inability to seek proper medical care were the factors influencing dietary consumption of the aged. Some participants who mostly skipped meals or reduced their dietary intake were also because of chewing difficulties. Those who however had the opportunity of using dentures were food secure and could possibly be ascribed to the increase in their chewing capability due to the use of the dentures (Appollonio *et al*., 1997; Steiner-Asiedu *et al*., 2010). Studies in other jurisdictions also underscore the importance of physical and mental health status on dietary consumption pattern. It is stated that those who have no pain and minimal or no emotional problems have the

tendency of eating more varied diets compared to those living in pain(Hendy *et al.*, 1998; Dean *et al.,* 2009) .

In further expounding on the impact of loneliness on dietary patterns among the elderly, it is argued that, loneliness influences one's desire to cook that is those found to be alone lack the desire to cook for themselves (McIntosh and Shifflett, 1984; Walker and Beauchene, 1991; Sahyoun and Zhang, 2005; Dean *et al.*, 2009). Furthermore, other studies have also observed that, effective dietary consumption depends on the presence and influence of others (McIntosh and Shifflett, 1984; Walker and Beauchene 1991; Paquet *et al*., 2008) such as eating in community centers (other hand have argued that there exist no relationship between people's social (De Castro, 2002; Stroebele and De Castro 2004).Walker and Beauchene (1991) on the contact and dietary pattern in giving further explanation to the assertion made by Walker and Beauchene (1991), Revenson and Johnson(1984) claimed that, dietary pattern of the elderly only diminishes because of the dissatisfactions realized in relationships and not necessarily having social contacts in that, there can be contacts without relationships therefore it is the perception of the quality of the relationship that matter rather than social contacts. Findings also suggest that, increased dietary knowledge among the elderly also determines their dietary pattern (McDonald and Webster, 1998; Sharpe *et al*., 2003; Baker and Wardle, 2003; Dean *et al*., 2009). Also, the decline in one's ability to smell and taste also affect dietary pattern of the elderly (Fanelli and Stevenhagen 1985; Rolls and McDermott, 1991; Westenhoefer, 2005). Duffy *et al*. (1995) in a study conducted among elderly women, observed a higher intake of sweets and fats related diets with a reduced interest in food related activities like cooking. These findings therefore call for the need to take

necessary steps to addressing food and nutrition insecurity among the elderly in the country to promote healthy ageing. Dietary pattern among the elderly in most developing countries are also influenced by seasonal variations as well as cultural and religious believes (Herne, 1995)

2.6.5 Nutritional Requirements of the Elderly

Ageing is attributed to changes in body mass and composition as well as decline in organ function which consequently influence the nutritional requirements of the aged (Garrow *et al*., 2000). As such Wellman and Kamp, 2008 stated that it calls for the requirement for exceptional nutritional needs since maturing disturbs absorption, use and excretion. The role of diet and nutrition in disease prevention and health maintenance among the aged cannot be overemphasized. Knowledge about this will therefore help in managing the aged in our homes and communities (Garrow *et al*., 2000). Garow *et al*., (2000) however argued that, there is a low prevalence of malnutrition among the aged in non-institutionalized homes compared to those who are institutionalized (Garrow *et al*., 2000). On the contrary, many others also estimated that, about 85% of non-institutionalized elderly people rather face one or more chronic conditions such as hypertension, with malnutrition being a major contributory factor (Dwyer *et al*., 1991, Chernoff 1994).

The arguments however point to a single factor which is nutrition. Garrow *et al.* (2000) made some observations with various reasons why there is a change in the nutrient requirement of the elderly in their report. Some of such reason includes;

- A decline in energy requirements due to decreased muscle mass.

- Higher circulation required due to slower uptake of Vitamin A in peripheral tissues.
- Increased vitamins and minerals consumption due to deterioration in immune function with augmented vulnerability to infection.
- Vitamin D Synthesis by the Skin deteriorates.
- Efficacy of Vitamin B_6usedeclines.
- About one third of aged population has an inadequate discharge of stomach acid. This in effect affects the absorption of nutrients such as; calcium vitamin B_{12}, zinc folic acid and iron which partially clarifies the propensity for rapid reduction and the probable food supplementary requirement of these nutrients

2.6.5.1 Macro Nutrient

Elements required for normal body functions are defined as nutrients.

Nutrients are classified into two main categories which include: macro nutrients and micro nutrients. As the name suggests, macro nutrients are needed in larger quantities with a corresponding intake of minimal micro nutrients for normal cell function (Wellman and Kamp, 2008). Macronutrients include: carbohydrate, fat and protein. The functions of macronutrients in the elderly are well outlined in literature (Olivares, *et al.*, 2000). Primarily macronutrients provide the body with energy for normal cellular function. Energy requirements occur continually throughout the adult life cycle due to age-related transformations (FAO, 2001). It is however, important to maintain energy balance among the elderly at all times to match energy expenditure. For every individual, there is an estimated amount of energy that is required based on a given age, weight, gender, height and physical activity level (NICUS, 2003) for optimum cellular function. Going beyond the threshold of Estimated Energy Requirement would result to nutrient imbalance which might not be good for the body

(IoM, 2000). Calculation of EER for the elderly is well outlined in literature (NICUS, 2003).

2.6.5.1.1 Carbohydrate

Energy requirements of the aged decline with age possibly due to a reduction in physical activities (Shetty, 2002). The recommended dietary allowance (RDA) for men and women who are 60+ years is estimated to be 100g per a day (IoM, 2000). Foods like; bread, rice, cereals and tubers remain the major source of carbohydrate. Ageing is characterized with inadequate occupational activity due to retirement and elderly incapacities may also have an impact on consumption of energy. An equilibrium between food consumption and energy outflow therefore allows the upkeep of optimum body mass and structure (NICUS, 2003; Wellman and Kamp, 2008). Food consumption and energy metabolism control hinge on hormonal and metabolic signs regulated by the main and outlying nervous systems (Schwartz *et al*., 2000; Bray, 2000). Research shows a reduced or impaired satiety and energy metabolism functions among the aged (Poehlman and Toth, 1996; Poehlman, 1998), may probably influence food consumption control (Donini *et al*., 2003; Hays and Roberts, 2006).

2.6.5.1.2 Protein

Sufficient protein consumption maintains gluconeogenesis and guarantees healthy cellular function such as enhanced immunity and wound healing (Wellman and Kamp, 2008). The RDA/AI for protein is 56g per day 46g per day for men and women respectively (IoM, 2000). Protein is obtained from both animal and plant sources. Animal sources include meat and dairy products, poultry and poultry

products as well as fish and fish products (NICUS, 2003; Wellman and Kamp, 2008). Plant sources include; soya, lentils, legumes, and nuts. Animal protein however serves as an excellent source of amino acids compared to that of plants. The intake of protein in the aged is however restricted due to cost and decreased mobility. Protein apart from its role in building and repairing body tissues, it also plays a major role in muscle maintenance. Research estimates an average muscle loss of 250g in the elderly (60+ years) every year (Dawson *et al.*, 2008). Adequate protein intake therefore helps decrease rapid muscle loss and weakness or physical frailty (Hickson, 2006; Dawson *et al.*, 2008).

2.6.5.1.3 Fat

Fats remain the main energy source from food and also enhance the feeling of satiety after intake. Fats carriers' fat-soluble vitamins and adds to the deliciousness of foods (Wellman and Kamp, 2008). Research conducted among some elderly on their perception of what constitutes healthy weight revealed that, the ageing associated healthy weight with a decrease in muscle mass with a corresponding rise in fat mass mostly in the core area (Ritz, 2001). The RDA/AI for fat is 20-35 percent for men and women. A consumption of this percentage is estimated to produce energy of 2204 energy kcal and 1978 energy kcal for men and women respectively (IoM, 2000). Main sources of fat involve; vegetable oils, butter, margarine, whole milk, shellfish, fat on meat, fat in fish, seeds and nuts from plants, (Ritz, 2001; Wellman and Kamp, 2008). Rapid accumulation of intra- abdominal fat remains a prevailing feature for the increase in bodily fat mass which significantly impacts age-related metabolic changes, most especially insulin resistance which is an important influence in type II diabetes, and as well associated with cardiovascular diseases (Wellman and Kamp, 2008).

2.6.5.1.4 Fibre

Research emphasizes on the significance of fibre to the elderly. Fibre helps reduce constipation among the elderly due to the sluggish nature of their digestive systems (Remig, 2002). The Institute of Medicine (2000) recommends RDA/AI of 30g and 21g of fibre for men and women respectively. It is therefore recommended that, the elderly should consume more fibre-rich foods, combined with regular activity with a corresponding adequate intake of water to enable regular bowel movement (Brauer *et al.*, 1981). Consumption of grains, whole fruits and vegetables also assist in minimizing constipation. It is therefore recommended that, the consumption of 5 – 6 serving of fruit and vegetables per day among the elderly will greatly improve upon their health status (NICUS, 2003).

2.6.5.1.5 Water

Water is an essential solvent, and plays a major part in transferring important nutrients to the cells and also enhances reaction of chemicals of cellular metabolism (NICUS, 2003). 1500 ml day^{-1} of water is needed by the aged (Wellman and Kamp, 2008). Water in the body also maintains fluid balance which is essential in the prevention of dehydration caused by decreased fluid intake, decreased kidney function, and increased urine output from medication (Toffanello *et al*., 2010). Conscious efforts must be made by the elderly to take in more fluids due to the tendency of limited fluid intake because of impaired sense of thirst, reliance on others to get beverages and fear of incontinence. Symptoms of dehydration among the ageing include: changed drug influences, electrolyte imbalance, change in blood pressure, headaches, dry mouth and nose, dizziness and constipation.

2.6.5.2 Micronutrients

Micronutrients are referred to as essential elements needed in smaller amounts for normal body function (WHO, 2010). They facilitate the normal functioning of enzymes and hormones and it is essential for adequate growth and development. As ageing takes place, trace elements in the body also reduces due to physiological and environmental modifications (Richard and Roussel, 1999). Decreased pancreatic function, frequent lesions caused by gastritis, modifications of the gastrointestinal tract, changes in intestinal pH resulting in decreased absorption, loss of appetite all form part of the physiological changes (Richard and Roussel, 1999). It is also stated that, the onset of chronic diseases among the elderly affect absorption and bioavailability of micro elements, largely as a result of drug treatment (Richard and Roussel, 1999). Elderly people are generally considered to be deficient in vitamin A, D, iron, folate and calcium alongside trace elements (Biesalski *et al*., 2003). Reduced energy expenditure, inadequate food intake, loss of metabolically active body cell mass and the onset of chronic disease among the elderly could account for these deficiencies (Biesalski *et al*., 2003).

2.6.5.2.1 Minerals

Minerals are inorganic compounds originating from the earth and cannot be made by living systems. They are grouped into macro and micro minerals. The macro minerals are also referred to as bulk elements and micro minerals also referred to as trace elements (IoM, 2000). As the name suggests, macro means they are needed in larger quantities compared to the micro minerals which are needed in smaller quantities (IoM, 2000).

Minerals are also considered essential diet because of their roles in maintaining normal body function. The conversions of minerals into ions when dissolved in bodily fluids also assist in regulating various body processes. Inadequate minerals in the elderly could be attributed to alterations in the diet due to factors such as medication, change in taste and smell sensitivity (Wood *et al.*, 1995).

The table below outlines the sources and functions of the macro and micro minerals.

2.6.5.2.2 Vitamins

Vitamins are nutrients needed in small amounts which aid in normal body metabolism, growth and wellbeing (Wellman and Kamp, 2008). Most vitamins are obtained from diets consumed. The Institute of Medicine (2000) outlines 13 major vitamins which are found in foods needed for body function. Each of these vitamins however has their unique functions they play. They may either be soluble in fats known as fat soluble vitamins or soluble in water known as water soluble vitamins. Vitamins are mostly not stored in the body and therefore are needed in a daily supply from our diets. The list of these vitamins and their functions are well outlined in literature (IoM, 2000)

2.7 Malnutrition in the Elderly

Hickson (2006) defines malnutrition as a term used to describe lack or excessive nutrient consumption. Lacking the required nutrients for body nourishment is referred to as under nutrition whiles excessive nutrient intake is referred to as over nutrition. Louisa Marais *et al.*(2007) reported about 60 percent of malnutrition in the aged population globally. Presently Ghana is going through a nutritional evolution which

holds the co-existence of below and above nutrition which is seeming among people and through age categories. Malnutrition among the elderly however appears to be on the rise among rural populations in Ghana (Aganiba, *et al*., 2015; Dare *et al*., 2016).Hickson (2006), reported that malnutrition remains a negative consequence on the aged, variations in the ageing process itself can as well encourage malnutrition. WHO (2007), has developed a policy framework, aimed at addressing malnutrition among the aged. In addition to the nutrition complications associated with the aged, psychosocial and chronic illnesses all play part in the ageing process thereby influencing the dietary pattern of the aged leading to malnutrition (Salva and Pera, 2001).

2.7.1 Causes of Malnutrition

Wakimoto and Block (2001) attribute the causes of malnutrition among the elderly to three main factors which include: social, medical and psychological factors. Hickens (2006) on the other hand, attributes poor appetite or anorexia nervosa as the main source of malnutrition among the elderly. Apparently, taste and smell also play a role in the decline in appetite by seemingly deterioration in the food niceness (Hetherington, 1998). Moreover, taste equally remains the most important element of the cephalic phase response in the digestion process, as well moderate food selection by increasing satiety and the pleasure (Schiffman, 1997). Loss of taste and smell however remain a major characteristic feature among the elderly which is further compounded with disease and drug interaction. Inadequate nutrient intake can also result in decreased muscle mass, metabolic malfunction leading to a compromised immune system (Morley, 1986; Rudman, 1989; Fischer and Johnson, 1990). Poverty, loneliness, and social isolation together with other factors such as: depression,

gastrointestinal disease, acute and chronic infections, poor dentition, malabsorption syndromes, medication use among others may result in deficient food consumption and low energy intake leading to malnutrition (Roberts, 2000).

2.7.2 Nutritional Assessment in the Elderly

Methods used in nutritional assessment include: physical examination, anthropometric measurements, laboratory measurement and medical history. This research focuses on the anthropometric measurements to assess the nutritional status of participants. Nutritional assessment assists in the planning for the prevention of a specific nutrition related health challenge.

2.7.2.1 Anthropometric Measurements

Anthropometric measurements remain one of the widely used significant indicators of an individual's nutritional status. It is less expensive and non-invasive compared to other measures like laboratory measurements. Body composition changes vary in men and women and in the various phases of ageing. Age, gender, height and weight remain the four basic measures used to undertake anthropometric assessment (Schwartz, 1998; Dey *et al.*, 1999; Perissinotto *et al.*, 2002). Mid-arm circumference and triceps skinfold thickness measures are also used to attain further nutritional information about an individual (Blackburn *et al.*, 1977; Tayie *et al.*, 2004; Wellman and Kamp, 2008).

2.7.2.2 Waist Circumference

Waist circumference measurement is used to ascertain the dissemination of abdominal fat content in adults (Gibson, 1990). According to Charlton *et al*. (2008) this measure

remains an enhanced determinant of cardiovascular risk, other than BMI measurements. Waist circumference measure is done a non-stretchable tape to measure the distance around the smallest area below the rib cage and above the navel (Han *et al.*, 1995). Details of the measurement and cut offs can be obtained from World Health Organization (2000) and National Cholesterol Education Programme Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (NCEP, 2001).

2.7.2.3 Mid-upper Arm Circumference

This measurement takes place between the acromion process of the shoulder and the tip of the elbow. The mid-upper arm circumference measurement together with the triceps skinfold measurement are used to determine fat distribution which is useful in the diagnosis of protein-energy malnutrition (Gibson, 1990). Mid-upper arm circumference can also be used for individuals who cannot be weighed and especially for elderly experiencing severe oedema where the BMI or percentage weight loss is misleading (Charlton *et al.*, 2008).

2.7.2.4 Waist-to-Height Ratio (WHtR)

The location of the body where fat accumulates translates into an individual's health and not necessarily the accumulation of fat. The elderly with observed weight gain around their hips and buttocks are said to be generally having a pear shaped body. Those on the other hand who tend to gain weight mostly around the abdominal region have more of an apple body shape. Research however revealed that, those with apple shaped body have a higher tendency of becoming obese, diabetic and other cardiovascular related risk compared to those with pear shaped body (Gibson, 1990). The WHtR is therefore used as an indicator most frequently used among adults to

ascertain central obesity patterns and an increased risk of cardiovascular disease (Gibson, 1990; Perry *et al.,* 1998). WHtR is said to be a more effective determinant of mortality in aged individuals than waist circumference or BMI (Wellman and Kamp, 2008). WHtR is determined by dividing waist size by height. A WHtR< 0.5 is generally considered healthy.

2.7.2.5 Body Mass Index (BMI)

Generally, definitions and classifications given to overweight and obesity vary, due to the various measures and references used, making it difficult to provide reliable prevalence estimates (Wang and Lim, 2012). WHO defines overweight and obesity as "*abnormal or excessive fat accumulation that presents a risk to health*" (WHO, 2013; p.1). Body mass index (BMI) still remains the most widely used indirect method of checking for adiposity (Lobstein *et al.,* 2004; WHO, 2013), with its determination being weight (Kg) divided by height squared (m^2). It however does not always give a true picture, because muscle weight could be misinterpreted as body fat (Naidoo and Wills, 2008). The cut off points for overweight and obesity using this measurement remain 25 and 30 or more (Kg) respectively (WHO, 2013). Currently, there exists two internationally recognized references postulated by WHO and the International Obesity Task Force (IOTF) well discussed in literature (Wang and Lobstein, 2006; Wang and Lim, 2012) to help bridge cross country reference gaps. The table below shows the WHO classification of BMI.

Table 2.2 BMI Classifications

CLASSIFICATION	BMI (kg/m2)
	Principal Cutoff point
Underweight	<18.50
Severe thinness	<16.00 <16.00
Moderate thinness	16.00 - 16.99
Mild thinness	17.00 - 18.49
Normal Weight	18.50 - 24.99
Overweight	≥ 25.00
Pre obese	25.00 - 29.99
Obese	≥30.00
Class I	30.00 - 34-99
Class II	35.00 - 39.99
Class III	≥40.00

Source: WHO, 1995

2.8 Dietary pattern and Hypertension

Several diverse dietary factors have been made known to have a linear relationship with hypertension, together with animal protein consumption (Altorf-van der Kuil, et al. 2010), low fish fatty acid, low magnesium, high coffee consumption, low potassium, inadequate calcium and high alcohol consumption (Geleijnse *et al.,* 2005). The reports of Reedy and Krebs-Smith (2008) states that high consumption of fruits, vegetables, whole grain, legumes and low saturated fat have been associated with normal blood pressure. Salt consumption has also been connected to blood pressure levels and hypertension prevalence in varying peoples. A study involving 52 population sample dubbed 'the INTERSALT Study' to ascertain the relationship between food consumption and blood pressure revealed a significant positive relationship between urinary sodium excretion and blood pressure (Elliott *et al*., 1996). High fiber consumption from cereal sources was found to have a negative correlation with hypertension in another study (Rimm, *et al.,* 1996). According to Appel *et al*. (1997) and Sacks *et al*.(2001) the influences of dietary interferences on levels of blood pressure have been comprehensively explored in clinical trials.

Individuals consume food that contains thousands of components, which may perhaps have an impact on health. It is therefore important to study the impact and significance of the effects of dietary patterns on health as it has been acclaimed by some researchers (Jacobs and Steffen, 2003; Jacobs and LC, 2007). It is further argued that, food items that are consumed contain numerous constituents which may equally affect health but the impact of single constituents might not be felt much compared with dietary patterns (Hu, 2002). Moreover, foods are not consumed in isolation, there is likely to be important inter food and intra food interaction, where the overall effect of the diet's constituent parts greater and dominates over the individual effects of single foods and nutrients (Jacobs and Steffen, 2003). Different studies have used dietary score to represent dietary pattern (Fung, *et al*., 2001; Steffen, *et al*., 2005; Nettleton, *et al*., 2006).

The Dietary Approaches to Stop Hypertension (DASH) intervention study (Appel, *et al*., 1997) and the Oxford Fruit and Vegetable study (John, *et al*., 2002) have both associated both lower systolic and diastolic blood pressure with adequate consumption of fruit, vegetables, reduced saturated fat and low-fat dairy products. Same can be said of Mediterranean diet which comprises of: high consumption of olive oil, moderate-to-high consumption of fish, low consumption of meat and meat products, legumes, cereals, vegetables, fruits, beans, moderate consumption of wine, and dairy products (mostly as cheese and yogurt) (Kokkinos, *et al*., 2005). Several studies conducted cross sectionally (Gracia-Palmieri, *et al*., 1984; Ruidavets, *et al*., 2006) and prospectively (Pereira, et al. 2002; Alonso *et al*., 2005; Steffen *et al*., 2005; Ruidavets, *et al.*, 2006; Wang, *et al*., 2008; Toledo, *et al.*, 2009) have reported an inverse relationship between dairy intake and hypertension. Similarly, higher intake of

low fat dairy products was found to be associated with lower risk of hypertension in the Seguimien to Universidad de Navarra (SUN) study (Alonso *et al*., 2005). Wang, *et al.,* (2008) reported similar results in a study among 28,886 middle aged and older women in the Netherlands. In another trial, twenty-three hypertensive adults of mean age 45.3 (SD=2.0) years were randomized into 3 dietary groups: fruits and vegetable diet, a dairy rich and an average western diet. SBP and DBP were significantly reduced by 2 mm Hg among those who consumed dairy, fruit and vegetable diet at the end of a 5 weeks follow up period compared with those who consumed average western diet. ($P<0.05$) (Hilpert, *et al,* 2009). The relationship between blood pressure and meat proteins have also been investigated in several trials and yielded negative correlation. (Kestin, *et al*., 1989; Moran, *et al*., 1993). A systematic review of 46 published scientific journals on both plant and animal proteins also provided no evidence of a relationship between animal protein and blood pressure (Altorf – van der Kuil, *et al.*,2010).

CHAPTER THREE

METHODOLOGY

3.1 Study Design

A quantitative cross sectional survey approach wasused to collate information for this research.

3.2 Study Site

Study was conducted in the Tano North District of the Brong Ahafo Region. It is one of the newly established districts carved from the then Tano District with its capital being Duayaw-Nkwanta. Farming remains the major occupation in the district. St. John of God Physiotherapy Hospital remains one of the major land marks in the district. It has a total population of 91,664. It is bounded to the north east by Ahafo Ano South district, Asutifi district to its south west and north west is Sunyani municipal.

3.3Study Population

The United Nation's definition of the elderly also referred to as the aged, starts from 60 years and above (UNFPA, 2012). Studies conducted on life expectancy rate in low and middle income countries like Ghana projected 55 years and then further projected to be 65 years by 2045-2050(Waxman *et al*., 2004; UN, 2006). Although the UNFPA definition of the aged captures 60 years and above, considering the life expectancy rate in this part of the world, this study therefore captured the aged from 55 years and above. The study population used for this study was from 55 years and above in the Tano north district in the Brong Ahafo Region of Ghana. This age limit was also considered to allow for a greater representation of households. Males and females in

both the urban and rural settings of the study population were recruited. The Tano North District was considered because, it remains one of the districts with high prevalence of hypertension cases recorded among the aged in the Brong Ahafo Region of Ghana (BARHD, 2016). In 2013 for instance, the district recorded about 502 new cases of hypertension among the aged (BARHD, 2016).

3.4Sample Size

To estimate the sample size, the number of participants is given as: n =

$n = [z^*/ 2m]^2$(Moore and McCabe, 1993)

Where :**n** = number of participants;

Z = a constant set at a value of 1.96

m = margin of error

At 5% significance level (95% Confidence Interval) and a 7% (0.07) margin of error (m) with an assumption of 5.3% of the elderly (60^+ years) in Ghana. I have reduced the aged here (from 60 to 55 years) because I wanted to compare the dietary pattern from "early aged" to the "late aged"

$\mathbf{n = [1.96 / 2(0.07)]^2} = 196$

Therefore, a sample size of **196** aged populations was used for the study.

3.5 Inclusion Criteria

Those within the age of 55 and above and have the ability to stand on their own without any known underlying condition were included in the study. In some houses, those who attained 55 years were equally captured to allow for comparism between early, mid and late adulthood.

3.6 Exclusion Criteria

Those who were unable to stand on their own were excluded from the study because of the weight and height measurement components introduced in the data gathering process. Those with known underlying conditions were also excluded from the study. In houses where more than one eligible candidate was present, one person was selected randomly through a ballot. This process continued until the required sample size was obtained.

3.7 Sampling Procedure and Recruitment

A multi-staged sampling method was used in selecting the study participants. This involved stratifying the participants into Urban and Rural settings. Some settlements or communities from the urban and rural stratification were further sampled to attain the study participants. For all the stages, simple random sampling technique was then used. The district was stratified based on the three major selected sub-districts namely: Duayaw Nkwanta (the district capital), Tanoso and Yamfo out of five. Within each selected town, a corresponding rural settlement around the towns were also chosen to form a total of six settlements for the study (3 urban and 3 rural) using simple random sampling technique. This was to allow fair distribution and representation of different people from different background and settings. Purposive sampling method was used in entering various houses in the selected places visited. For every house visited, an enquiry was made if there were any individuals who met the age criteria (55years and above). Exception was made for those who attained 55 years and above due to the life expectancy rate in this part of the world and also to allow for comparism between early, mid and late adulthood. Those found to be eligible were taken through standard protocol of explaining the purpose of the study

and seeking their consent voluntarily before commencing the investigations in the presence of community health volunteers. Participants were also given the opportunity to freely opt out in the process of the interviewing.

3.8 Instrumentation

A pre-tested questionnaire was used to gather participants' bio data, socio-economic status, health status and lifestyle habits mainly through interviews. Information on lifestyle habits such as smoking, alcohol intake, regular exercise were captured using the developed questionnaire. Digital blood pressure apparatus, stadiometer and Secca-880 digital floor weighing scale were also used to gather information on blood pressure, height and weight respectively. Information on their dietary patterns, were also captured using a modified food consumption score template designed by the World Food Programme was adopted for the study.

3.9 Weight Measurement

The weight of the individual participants were taken and recorded repeatedly to the nearest 0.1kg using the Secca-880. In taking their weight, participants were asked to be in minimum clothing that is, doing away with other extra clothings such as: shoes, bracelets, headgears, wrist watches and other accessories. This was to enable the researcher minimize errors in the process.

3.10 Height

Using the stadiometer set up against a vertical wall and on a flat surface, height of the participants' were measured by standing upright with their heels, shoulders, back and

buttocks leaning against the stadiometer. The headpiece of the stadiometer was then lowered to touch the crown of their head and readings duplicated to the nearest 0.1cm.

3.11 Body Mass Index (BMI)

Body mass was computed using the formula weight (kg)/ height (m^2) and classified according to the WHO cut off ranges (WHO, 2013). Using the formula w/ m^2 (kg/ m^2).Underweight was defined as any figure below 18.5kg/$m^{2,}$ Normal was any figure between 18.5 and 24.9kg/ m^2, Overweight was any figures between 25 and 29.9kg/ m^2 Obese was classified to be 30kg/ m^2 and above.

3.12 Blood Pressure

Using the digital blood pressure apparatus, participant's blood pressure were also taken repeatedly in a resting position for a period of five minutes interval and recorded to the nearest 2.0mmHg (Kirkendall *et al*. 1967). Blood pressure levels were defined using the American Heart Association's classification. Systolic blood pressure of less than **80** millimeter mercury (mmHg) over Diastolic blood pressure of less than **60**mmHg was considered low blood pressure; between **80/60mmHg and 120/80mmHg** were considered normal blood pressure; Between **120/80 and139/89mmHg** were considered mild or prehypertension and above **140/90** were considered high blood pressure or hypertension (de Lima Santos *et al.*, 2011; American Heart Foundation, 2017).

3.13 Dietary Pattern

Information on dietary patterns and consumption were gathered using a sample Food Consumption Score (FCS) sheet designed by the World Food Programme to gather

information on food security (WFP, 2008).The weights for the FCS were determined based on an interpretation by a team of analysts of nutrient density. In using the FCS, the interviewees were asked to give the frequency of consumption of specific food items placed in their respective food groups over a recall period of the past 7 days. Seven days was used because, they are older people and I wanted to prevent recall baises. The food items were grouped into 8 standard food groups consumed within a maximum period of 7 days/week (refer to the table below)

Table 3.1 Classification of Food Items

No.	Food Items	Food Group	Weight
1.	Plantain, Cassava, Millet, Banku, Fufu,Yam ampesi, Kenkey, Plain rice, Tuozaafi (de3huo), Waakye, Jollof rice, Maize porridge (hausa or akankooko), Wheat/millet porridge, Cereals oat,, Tom brown,, Wheat bread	Main Staples	2
2.	Fried egg, fried/smoke fish, Salmon/frozen fish, Herrings Meat (goat, cow, sheep), Boiled egg, Sausage Chicken (boiled or fried) Sardines, Canned tin fish (tuna, mackerel, obaapa, vega) e.t.c.	Animal protein	4
3.	Milk, milk products	Milk	4
4.	Pulses, lentils, tofu, beans, groundnuts, cashew nuts	Pulses	3
5.	Carrot, Kontomire, Garden eggs, Kwansosaa (abedru), Tomatoes, Green or red pepper, Lettuce, leafy vegetables	Vegetables	1
6.	Pawpaw, Watermelon, Orange, Banana etc.	Fruits	1
7.	Oils, fats, and butter, Palm oil, Vegetable oil (frytol)	Oils	0.5
8.	Sugar and its products: Soft drinks (coke ,fanta sprite), Cowbell Coffee tea, Royal cocoa powder, Milo	Sugar	1

Source: WFP, 2008

The consumption frequency of each food group is multiplied by its assigned weight based on its nutrient content .FCS is obtained by summing up the values. Using the formula below:

FCS = *a*staple*x*staple (wt.) + *a* animal *x* animal(wt.) + *a* dairy *x* dairy(wt.) + *a*pulse*x*pulse(wt.)+ *a*veg*x*veg(wt.) + *a*fruit*x*fruit(wt.) + *a* oil *x* oil(wt.) + *a*sugar*x*sugar(wt.).

Where:

FCS = Food Consumption Score

a = Number of times a particular food group is consumed within a period of one week

x = multiplication sign

+ = addition sign

Wt. = the weight each dietary group carries.

The summed values enable the attainment of certain thresholds which classifies the various dietary patterns as poor; borderline and acceptable. The table below gives the cutoff point or the various thresholds.

Table 3.2 Thresholds for Dietary Pattern Classification

Thresholds	Profiles	Thresholds with daily consumption of Oil and Sugar (up to 7 days in a week)
0-21	Poor food consumption	0-28
21.5-35	Borderline food consumption	28.5-42
➢ 35	Acceptable food consumption	➢ 42

Source: WFP, 2008

3.14 Data Collection Methods

Research assistants were trained on how to administer the questionnaires and also undertake the various measurements using appropriate protocol for the research before going to the field. The lead researcher also randomly sampled the filled questionnaires brought and conducted interviews for some selected individuals within

the study areas by way of auditing the work done by the research assistants to help minimize errors/ bias.

3.15 Data Analysis

SPSS (Statistical Package for the Social Sciences) version 21 was used for the data analysis. Research questions one and two were answered using descriptive statistics to summarize the frequency of the parameters measured (dietary patterns and hypertension). The frequency distribution of their sex, age, educational status, physical activity level, family medical history and habits such as smoking and alcohol intake were also tabulated. Questions three and four employed the use of exploratory statistical data analyses to establish associations for a deeper understanding. Using a chi-square test analyses, the correlation between dietary patterns and hypertension was determined.

The Pearson's chi-squared test was used. Logistic regression analysis was then carried out to determine the association between dietary patterns and hypertension taking into account potential confounders (sex, age category, education, occupation, marital status, physical activity, smoking, family medical history and alcohol intake). A forward stepwise approach was used to allow for confounding variables to be controlled in order to assess the main effects of dietary pattern on hypertension. These covariates (confounders) were considered because consistent literature report on their influencing effects on hypertension and other form of non-communicable diseases. All statistical analysis were done using p-values at a significance level of 95%.

3.16 Validity and Reliability

To ascertain research validity, the questionnaires were used to measure the intended purpose for which they were designed. The questionnaires were however modified slightly to suit the study location. For example, the dietary classifications under the food consumption score were substituted with the diets mostly consumed in the study area and then pre-tested to ascertain understanding by the participants. To enhance reliability, the designed questionnaires were not entirely new because related studies have employed the services of such questionnaires in other jurisdictions. It therefore yielded similar responses obtained from other jurisdictions, thereby enhancing consistency. All tools/equipment used were also checked thoroughly for accuracy.

3.17 Ethical Considerations

Ethical approval was obtained from the Committee on Human Research, Publications and Ethics of the Kwame Nkrumah University of Science and Technology (KNUST) and the Tano North district health directorate before commencement of the research.

CHAPTER FOUR

RESULTS

4.1 Introduction

The table below presents the socio-demographic characteristics of the study population which includes: gender, age category, educational background, the nature of their occupation and the location of where they live being urban or rural.

Table 4.1 Socio-Demographic Characteristics of the Study Population

Demographic Characteristics	Frequency(n)	Percentage (%)
Gender		
Male	74	37.4
Female	124	62.6
Age Category		
55-59	41	20.7
60-64	46	23.2
65-69	34	17.2
70^{+}	77	38.9
Educational Status		
None	106	53.5
Basic	77	38.9
SSCE	7	3.5
Above SSCE	7	3.5
Nature of Occupation		
Education	6	3.0
Trade/sale	31	15.7
Office related	1	0.5
Manpower/manual	137	69.2
Other	19	9.6
Location		
Urban	132	66.7
Rural	66	33.3
Total	198	100

Source: Survey, 2017

A total of 198 participants participated in the study. The differences in the total number in the various characteristics were due to incomplete information captured on some of the characteristics.

The frequency table above (Table 4.1) illustrates the distribution of socio-demographic characteristics of the study population. A total of 198 respondents were captured in the survey with female respondents (62.6%, n= 124) being the dominant group compared to their male counterparts (37.4%, n= 74). The age distribution shows a greater number of respondents within the age group of 70 and above years (38.9%, n= 2796) followed by the 60-64 age category (23.2%, n= 46) and the least being the 65-69 age group (17.2%, n= 34).

Majority of the respondents (53.5%, n=106) indicated they had no formal education. About 77 respondents representing 38.9% also had basic education followed by both SSCE and Above SSCE respondents being 3.5% each. The survey recorded a very high level of manpower or manual related work like farming (69.2%, n= 137) followed by trade or sales related work (15.7%, n=31). Office related work recorded the least frequency (0.5%, n=1). Sixty-six point seven percent (66.7%) of the population surveyed were living within the urban setting whiles those living in the rural settings were 33.3%.

Health and Lifestyle Characteristics

These characteristics were obtained by simply asking the respondents whether they smoked, drank alcohol of any kind. History of other cardiovascular related diseases was obtained by asking participants whether they or any family member have been

hospitalized, diagnosed, died or taking medications as a result of such conditions. Physical activity was determined using a minimum walking or farming for at least 30 minutes each day. See results in table 4.2.

Table 4.2 Health and Lifestyle Characteristics of the Population

Component	Frequency (n)	Percentage (%)
History of High Blood pressure		
Yes	49	24.7
No	149	75.3
History of Other CVDs		
Yes	12	6.1
No	186	93.9
BMI		
Underweight	15	7.6
Normal	124	62.6
Overweight	39	19.7
Obese	20	10.1
Smoking Status		
Yes	13	6.6
No	185	93.4
Alcohol intake Status		
Yes	41	20.7
No	157	79.3
Physical Activity		
Yes	193	97.5
No	2	1.0
TOTAL	198	100

Data Source: Survey, 2017

Differences in the total frequency for the individual variables were due to incomplete information given by respondents.

4.3 Summary of Results (Table 4.2)

Of the 198 respondents, 24.7 % reported having the history of blood pressure running through the family with the remaining 75.3% respondents reporting no history of

blood pressure in their family. Majority of the respondents reported having no history of any other cardiovascular related diseases in the family (93.9%, n = 186).Majority of the respondents were reported to be normal in terms of body mass index status (62.6%, n = 124). About 19.7% of the study population was reported to be overweight with a corresponding 10.1% being obese. Majority of the respondents said they have never engaged themselves in any smoking activity (93.4%, n =185) with about 6.6% responding yes to smoking status. About twenty one percent (20.7%) of the respondents responded yes to consuming alcohol with the remaining 79.3% responding no to alcohol consumption. Almost all the respondents indicated their involvement in undertaking physical activities in their daily lives (97.5%, n = 193).

4.4. Dietary Pattern among study Participants

Table 4.3 Dietary Pattern

Pattern	Frequency (n)	Percentage (%)
Poor	25	12.6
Borderline	54	27.3
Acceptable	119	60.1
24 HR. Dietary intake		
Frequency	2	1.0
Once	81	40.9
Twice	107	54.0
Thrice	8	4.0
Above three times		
Factors Influencing Dietary Intake		
Regular Habit	172	86.9
Sickness/Health reasons	5	2.5
Economic reason	15	7.6
Other	4	2.0
Time of Dietary intake		
Good	25	12.6
Average	93	47.0
Poor	76	38.4

Data Source: Survey 2017.

Good(6-8/12-2/5-7); Average (9-11/2-4/9); Poor (Anytime beyond average) (www.menshealth.com/nutrition/best-schedule-for-when-to-eat) Poor food consumption (0-28), Borderline (28.5-42), Acceptable (42 and above).

About 60% of the respondents were said to be in the food secure group and their dietary intake pattern considered to be acceptable using the world food programme module of dietary pattern. 27.3% of the population was reported to be mildly food insecure and their dietary pattern considered to be on the borderline. 12.6% of the population reported being food insecure with a corresponding poor dietary pattern. A little above half of the population responded honouring three square meals a day (54.0%, n = 107). About 40.9% of the population reported taking meals twice in a day. 4% of the respondents said they eat more than three times in a day. Less than 15% of the respondents (12.6%, n = 25) reported eating within stipulated time for breakfast, lunch and supper. 47 % of the respondents reported going a little beyond the recommended time for dietary intake especially during supper, with about 38% of the respondents reporting eating late in the night.

4.5. Prevalence of Hypertension among the Study Population

Table 4.4 Blood Pressure level

Level	Frequency (n)	Percentage (%)
BP level		
Normal Hypertension	87	43.9
Mild Hypertension	20	10.1
High Hypertension	91	46.0
Total	198	100.0

Data Source: Survey, 2017
Normal (80/60 mmHg and 120/80 mmHg); Mild (120/80 and 139/89 mmHg);High(above 140/90)

There appears to be a slight difference between those who recorded having normal blood pressure level (43.9%, n =87) and High blood pressure (46.0%, n =91). The proportion of the respondents who recorded having mild blood pressure were about 10%.The results therefore indicates a greater proportion of the respondents recording high blood pressure.

4.6 Association between Dietary Pattern and Hypertension among the Elderly in the Study Population

In answering this question, two different analyses were conducted: Chi square analysis was requested in order to first of all ascertain whether there is a level of statistical significance for the interaction between dietary pattern and blood pressure level. Again a cross tabulation was also computed to ascertain the pattern existing between dietary intake and blood pressure level.

Table 4.5 Chi square Analysis

	Value	**Df**	**Asymp. Sig.**
Pearson	12.777[a]	4	**0.012**
Likelihood Ratio	10.599	4	0.031
Linear-by-Linear Association	2.442	1	0.118
Number of valid Cases	198		

1 cells (11.1%) have expected count less than 5. The minimum expected count is 2.53.

Source: Survey, 2017

The overall association between dietary pattern and blood pressure level among the elderly in the study population was statistically significant. The chi square results (X^2_2=12.777, p=0.012) suggest a positive correlation between dietary pattern and blood pressure level among the elderly.

Table 4.6 Relationship between Dietary Pattern and Blood Pressure Level

Blood Pressure Level vrs. Dietary Pattern.								
BLOOD PRESSURE	Poor		Borderline		Acceptable		TOTAL	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Normal	9	36.0	27	50.0	51	42.9	87	43.9
Mild	7	28.0	6	11.1	7	5.9	20	10.1
High	9	36.0	21	38.9	61	51.3	91	46.0

Source: Survey, 2017

The proportion of respondents who are mildly food insecure (borderline) and have normal blood pressure (50%) are more than the food secure (42.9%) and Food insecure (36.0%) respectively. On the contrary, the proportion of respondents who are severely food insecure (poor) and have Mild Hypertension (28%) are more than the mildly food insecure (11.1%) and Food secure (5.9%) groups respectively. The proportion of respondents who are food secure (51.3%) and reported high blood pressure are higher than the mildly food insecure (38.9%) and severely food insecure (36.0%) groups respectively.

4.7. Existence of Association between Blood Pressure and Dietary Pattern after Controlling for Location, Age, Family History of High Blood Pressure and other CVDs, Lifestyle Habits, and BMI

In answering this question, two different analyses were conducted. Chi square analysis was requested in order to first of ascertain whether there is a level of statistical significance between the interaction between the factors mentioned above and blood pressure level. Logistic regression analyses were also computed to control for the influence of other variables and to also establish the odds ratio between the predictor variables and blood pressure level.

Table 4.7 Chi square Analysis showing relationship between variables used and Blood Pressure Level

Variable	Summary		Sig. (p-value)
	Freq. (n)	%	
Age Category			
55-59	41	20.7	**0.165**
60-64	46	23.2	
65-69	34	17.2	
70+	77	38.9	
Family History of blood pressure	49	24.7	**0.007**
Yes	149	75.3	
No			
Family history of other CVDs			
Yes	12	6.1	**0.037**
No	186	93.9	
Location			
Urban	132	66.7	**0.014**
Rural	66	33.3	
Smoke status			
Yes	13	6.6	**0.75**
No	185	93.4	
Alcohol consumption status			
Yes	41	20.7	**0.22**
No	157	79.3	
Physical activity status			
Yes	193	97.5	**0.46**
No	2	1.0	
Daily Dietary frequency			
Once	2	1.0	**0.93**
Twice	81	40.9	
Thrice	107	54.0	
Above three	8	4.0	
Time of Dietary intake			
Good	25	12.6	**0.17**
Average	93	93	
Poor	76	38.4	
BMI Status			
Underweight	15	7.6	**0.59**
Normal	124	62.6	
Overweight	39	19.7	
Obese	20	10.1	
Dietary pattern			
Acceptable	119	60.1	**0.012**
Borderline	54	27.3	
Poor	25	12.6	

Source: Survey, 2017

The chi square results for the individual variables suggest a linear trend in the association between blood pressure level and family history of blood pressure(X^2_2=10.036, p=0.007), family history of other cardiovascular diseases (X^2_2=6.575, p=0.037),locality (X^2_2=8.487, p=0.014) and dietary pattern (X^2_2=12.777, p=0.012) among the elderly. The relationship between blood pressure level and BMI status, time and frequency of dietary intake, physical activity status, alcohol intake, smoking and age were all statistically insignificant.

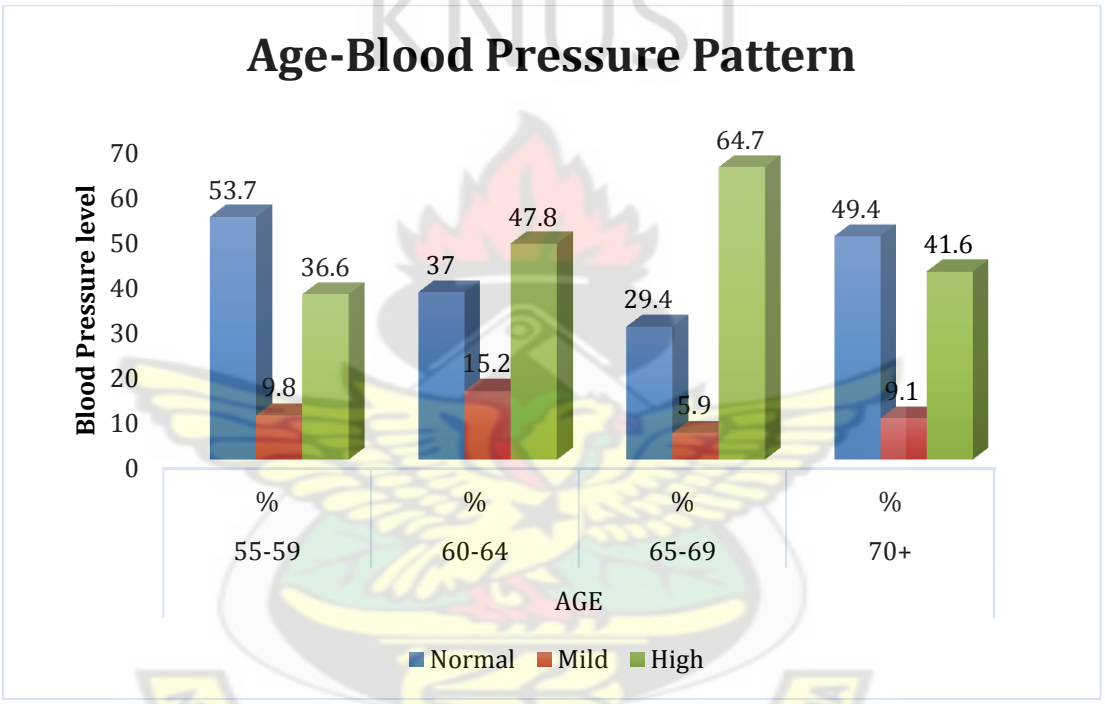

Figure 4.2 Age-Blood Pressure Pattern

Source: Survey, 2017

Those in the 55-59 age group seem to have normal pressure (53.7%) compared to the other age groups. High blood pressure (64.7%) seems to be rampant for those in the 65-69 age category compared the other age categories. Mild blood pressure appears to be low across all the age categories compared to high blood pressure and normal blood pressure. From the table, it does appear as if blood pressure increases with

increasing age from 55- 59 (36.6%), 60-64 (47.8%), 65-69(64.7%) and then sharply reduces at age 70 and above (41.6%)

Table 4.8 Significance level of the Logistic Test

Model	Model Fitting Information			
	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	115.122			
Final	85.456	29.666	8	.000

Table 4.9 Results of Multivariate Logistic Regression Analysis of Predictor Variables on Blood Pressure Status after Controlling for Covariates.

Predictors	B	Odds ratio	95% Confidence Interval	P-value
Family History of HBP				
No	(Reference)			
Yes	1.182	3.261	1.588-6.697	0.001
Food Consumption Score				
Poor	(Reference)			
Borderline	0.079	1.083	0.373-3.144	0.884
Acceptable	0.859	2.361	0.891-6.257	0.084
Locality				
Rural	(Reference)			
Urban	0.927	2.527	1.299-4.917	0.006
Age				
55-59	(Reference)		-	0.016
60-64	0.770	2.160	0.841-5.547	0.110
65-69	1.452	4.270	1.509-12.083	0.006
70+	0.113	1.119	0.479-2.614	0.795
Constant	0.007	1.007	-	0.991

Source: Survey, 2017

Logistic regression test conducted (table 4.9) revealed that, having family history of blood pressure is more likely to influence high blood pressure status referenced to a person with no family history of high blood pressure (p-value =0.001) with odds ratio of 2.261. This indicates that, the chance of a person having family history of blood

pressure getting high blood pressure is 2 times more likely than a person who has no family history of blood pressure.

One's locality may also influence one's high blood pressure status (p-value = 0.006) the odds ratio is 2.527 which shows that, been located in the urban area is twice more likely to have high blood pressure referenced to rural.

Controlling for Covariates

Using a stepwise method in the logistic regression model, an association between dietary pattern and blood pressure level was requested controlling for; *locality*, *family history of high blood pressure and other CVDs*. The stepwise method makes provision for the exclusion of any variable that does not significantly contribute to the variance in the dependent variable (blood pressure level). Overall, the regression was significant (P = 0.001, table 4.9). Among the predictors investigated, history of HBP (p = 0.002), Poor Dietary Pattern (P =0.006) and locality contributed to the prediction (table 5.0). All the others did not contribute significantly to the variance in blood pressure status. The model excluded family history of other cardiovascular diseases.

CHAPTER FIVE

DISCUSSION

5.1 Main Findings of the Study

The main findings of this study suggest that, poor dietary patterns when modeled with appropriate controls is associated with increased risk of hypertension among the aged in Ghana. This research corroborates with conclusions emerging from several studies on dietary pattern and increased risk of hypertension (Kotchen, 2010; Popkin *et al.*, 2012). Interestingly, there appears to be a higher proportion of high blood pressure (46.0%, n =91) among the aged in the study. This study also was predominantly made up of females compared to their male counterparts (62.6%). It is argued that, more female participation compared to their male counterparts could reflect the fact that openly express their needs (Schlenker, 1992) and also live longer than men (Brown *et al*., 2008). Although, the survey included a greater number of people from the urban settings, majority of the respondents had no formal education (53.5%). Greater proportion of the respondents appeared to be food secured (60.1%).

5.2 The Ageing Population

The age groups were also placed under 'Young Aged' (55-59), mid aged (60-69) and Aged (70^{+}) with the aged being the majority group (38.9%) in the sample population. These findings lend support to research findings about the ageing population in Ghana and the African continent as well. Research findings by (UN, 2006) stipulate that, the population aged 60 years and above is said to have tripled from 1950 to 600 million in 2000. Further investigations suggest an increase from 600 million in the year 2000 to over 700 million in 2006, with a further projection of 2 billion older persons by the year 2050. Recent survey gives an estimate of the proportion of the elderly population

to be 7.2 percent, thereby making Ghana one of the countries with the highest proportions of persons aged 60 and above years in sub-Saharan Africa (Mba, 2010).

5.3 Dietary Pattern and Blood Pressure.

A chi square results (X^2_2=12.777, p=0.042) suggest a linear trend in the association between dietary pattern and blood pressure level among the aged in the sample population (table 4.8). The relationship persisted even after controlling for other variables [(AOR) = 5.989, p = 0.006]. (Table 4.9). This therefore renders support to findings of other research on the relationship between poor dietary pattern and hypertension in the developing world (Kotchen, 2010; Popkin *et al.*, 2012).Studies elsewhere have also ascertained the relationship between diet and high blood pressure (Simon, 2004, Safar, 2005). In their studies, they found a significant relationship between salt excretion, sodium levels in diet and Systolic blood pressure. Thereby suggesting that, the over consumption of high level salt could induce changes in the vascular muscles resulting in the deposition of collagen in the arteries leading to arterial stiffness hence the rise in blood pressure (Safar, 2005). The relationship between diet and high blood pressure has been widely reported in literature (Appel *et al*., 2009). Findings of this study showed that, those who fell within the acceptable dietary pattern category responded to having taken Fruits, Vegetables, Carbohydrates and Pulses at least four to seven times in a week and also responded to taking meat and fish at least three times in a week. Those who fell within the borderline food category responded to taking Fruits, Vegetables, Carbohydrates and Pulses at most three to four times in a week with meat and fish products once or twice in a week but consumed a greater portion of sugar and fat and oil products. Those who fell within the poor dietary pattern category responded to taking Fruits, Vegetables,

Carbohydrates and Pulses at most two to three times in a week with meat and fish products consumed occasionally but consumed a greater portion of sugar and fat and oil products. Surprisingly milk and milk products were conspicuously missing across all the categories.

The Dietary Approaches to Stop Hypertension (DASH) intervention study conducted by Appel and colleagues (1997) and also the Oxford Fruit and Vegetable study (John, *et al.,* 2002) have both shown that high blood pressure can be minimized using a diet rich in fruit, vegetables, reduced-fat dairy products and low in saturated fat. When asked what factors contributed to their choice of food intake, 86.9% of the respondents stated regular habits as the major factor with 7.6% stating economic or financial reasons for the choice of food intake. It therefore indicates that, the proportion of the respondents who fell within the poor dietary category could have attributed that to financial reasons. The linkage between income status and health has been extensively discussed in literature (Steffen *et al.*, 2005) Findings from this research therefore also suggest the possible influence of income status on dietary pattern. Although the chi square results showed a linear relationship between dietary pattern and blood pressure level, the regression analysis revealed that, the evidence of linear relationship between dietary pattern and blood pressure level was accounted for by poor dietary pattern and not acceptable dietary pattern. The relationship was however more pronounced in the mild blood pressure compared to the high blood pressure. (Table 4.9).

Though there appears to be a linear relationship between poor dietary pattern and mild blood pressure, other factors may also influence the shifting from mild to high blood

pressure. Several findings have attributed hypertension and other NCDs prevalence to tobacco use, harmful use of alcohol, more sedentary life style along with physical inactivity (Waxman, 2004; Popkin, 2006; Habib and Saha, 2010) and Body Mass Index(Awosan *et al.*, 2014). Interestingly, this study however is not consistent with some of the findings. In this study, the relationship between; Smoking ($p = 0.75$), alcohol consumption ($p = 0.22$), Physical inactivity ($p = 0.46$), Time of dietary intake ($p = 0.17$) and Body Mass Index ($p = 0.59$) were all statistically insignificant. The differences in findings could be attributed to differences in the population as well as the environment. Most importantly the smaller sample size used in this study could have also accounted for the differences in the findings.

5.4 Age and Blood Pressure

The relationship between age and blood pressure status was statistically insignificant ($p = 0.165$). This result however contradicts the findings of Awosan *et al*., (2014) and Safdar *et al.*, (2015). In their findings, age was a major predictive factor of high blood pressure even after controlling for other factors. On the contrary findings from other research also suggest a negative relationship between age and blood pressure (Stott and Bowman, 2000).In their report, they attributed the change in blood pressure level to change in diet and reduction of exercise due to migration from underdeveloped population to a more developed population. Others are also of the view that, increase in blood pressure with age could be due to other factors influenced by the environment and not age as an independent component (Safar, 2005). Furthermore, (Pinto,2007) also argues that some individuals may have a decreased blood pressure with increasing age due to the onset of certain diseases like Alzheimer's and other forms of cancer or inactive ventricular function arising as a result of myocardial

infarction and therefore conclude that, the age blood pressure relationship is a complex one and needs further investigations. Although the age-blood pressure relationship was statistically insignificant, the results however predict a particular pattern, it shows that, as age increases, blood pressure also increases (fig. 2).

Those who fell within the age group 55-59 years and reported having high blood pressure were 36.6%, with those within the age group of 60-64 recording a percentage of 47.8%. Those in the 65-69 age group recorded 64.7%. However, those within the age group 70 and above recorded a lower a percentage of high blood pressure (41.6%). Literature has it that, as age increases, the tendency of one getting high pressure also increases due to various physiological factors associated with the aging process. It can also be argued that, as the ageing process reaches a particular peak that is from 70 and above, most of those within that category are regularly monitored thereby limiting their activities and dietary pattern compared to their counter parts in the 50s and 60s. In the advanced world, people at that age group are mostly giving special attention by health personnel either in a care facility or employed at home to monitor their activities. In the developing world however, it is possible to have such people still actively engaging in various activities such as farming as seen in this study. It is also possible that as the ageing process peaks, those in that category also face a lot of medical complications thereby strictly adhering to the medical advice given to them as observed by Pinto (2007). These could account for the observed pattern.

5.5 History of Family Hypertension and other CVDs

It is believed that, family history of other cardiovascular related diseases can be a predisposing factor for the occurrence of high blood pressure. As seen in this study, a

chi-square analysis revealed a statistically significant relationship between family history and blood pressure (X^2_2=6.575, p=0.037). This report goes to augment earlier findings on the relationship between family history of blood pressure and the subsequent occurrence of high blood pressure (Carretero and Oparil, 2000; Barlassin, 2002). According to the American heart foundation, any person who has two or three of his or her family members having a history of blood pressure before the age 60 years is two times more likely to have the risk of also developing a high blood pressure at older age compared to someone who has no family history. Several other studies in other jurisdictions have also reiterated the possible relationship between family history of blood pressure and the risk of high blood pressure at a later stage (Corvol *et al*., 1992; Masuo *et al.,* 1998; Ranasinghe *et al*., 2015). And that those with family history were equally 2-4 times more likely to develop high blood pressure at a later stage compared to those without family history. (Corvol *et al*., 1992; Masuo *et al.,* 1998). In this study, the odds of one with family history of high blood pressure having high blood pressure was 3times compared to those without family history.[AOR(0.312)] (table 4.9)

However, the regression model excluded the influence of family history of other cardiovascular related diseases on blood pressure level. The American Heart foundation Association cited the possible relationship between family history of High blood pressure and future high blood pressure among the elderly to a number of factors, some of which include possession of similar genes in a family thereby predisposing a person to high blood pressure. They also pointed to the fact that, family members or relations could share similar dietary pattern and other lifestyle practices such as physical inactivity and smoking.

5.6 Locality

In this study, there was a statistically significant relationship observed between urbanization and high blood pressure (p = 0.014). This result corroborates the findings made by Bernabé-Ortiz and colleagues (2017). The influence of urbanization on the health of a population due to alterations in diet and physical activity level have been also discussed by other scholars (Patel and Burke, 2009; Patil, 2014). The impact of globalization, trade policies, economic development and urbanization which serve as major drivers on food systems and change in dietary patterns is well articulated by several commentators (de Haan *et al.,* 2003; Haddad, 2003; Popkin, 2003; Popkin, 2006; Reardon *et al.,* 2003). Globalization seems to be the pivot around which urbanization, economic growth, changes in food system revolve (Hawkes *et al.,* 2009). In their report, Popkin and colleagues (2012) argued that, modernization has been a major contributory factor to the change in dietary pattern in the developing world thereby leading to the occurrence of various Non-communicable diseases with hypertension being the major example. Modernization of the food systems from local staples to refined energy dense carbohydrates and processed foods and oil (WHO, 2002) have also been attributed to agricultural industrialization influenced by urbanization (Popkin *et al.,* 2001; Popkin, 2002) and globalization (Mazzocchi *et al.,* 2012).These changes have equally affected local production there by shifting away from a more diversified traditional subsistence farming known to produce yields that are highly nutritious (Spigelski, 2004; Gidamis *et al.,* 2004; Lestienne, 2005) to markets for a more refined food purchase and income as well(John and Sthapit, 2004). Hence, the observed pattern.

CHAPTER SIX

RECOMMENDATIONS AND CONCLUSIONS

6.1 Conclusion

This study provides an assessment of the dietary pattern and prevalence of high blood pressure status and their distribution across various age categories among the elderly. It also looked at the ageing pattern and some socio-economic pattern in the study area. It also tests the hypothesis as to whether dietary pattern has a link with blood pressure level. Findings from the study suggest that, a dietary pattern when modeled with appropriate controls is associated with increased risk of hypertension among the aged. By contrast, body mass index, physical activity, alcohol consumption and smoking were not related to the risk of hypertension in this study. The higher diet score (representing healthy diet or food secured) was significantly protective for hypertension. These findings provide useful information regarding the possible association of hypertension and diet in Ghana, especially in the context that this is one of the first studies in the Tano District of the Brong Ahafo region of Ghana.

6.2 Limitations

The major challenge of this study was the willingness of participants to respond and partake in the various health status measurements. Most studies have reported on the difficulty in recruiting participants for studies that generally has to do with health status determination at home other than the hospital. Dietary intake solely depended on the ability of the participants to recall, which might have introduced errors in the process. Also, No cause-effect relationship can be inferred from cross-sectional data. In addition, there was limited power to detect small effects or differences between groups due to the smaller sample size (n=198)

6.3 Recommendation

It is recommended that Government should expand its Social grant intervention dubbed 'LEAP' for the elderly in the district to enable them meet the daily nutritional requirements through improved dietary intake.

More attention should be paid to sensitizing the aged on the need for adequate dietary intake by health professionals at the community level.

Fruits and vegetable consumption should also be encouraged especially by nutrition officers and health professionals at the health facilities and home visits.

Longitudinal studies should be encouraged to ascertain the real effects of dietary patterns on individuals before they reach the aged status.

6.3.1 What is Known?

Mixed reactions on the relationship between dietary patterns and hypertension.

Ageing predisposes people to health challenges.

6.3.2 What is New?

About 60% of the aged in the Tano North District in the Brong Ahafo Region fall within the acceptable dietary pattern limit indicating that, they eat adequately.

Hypertension status among the aged in the Tano North District is 40% calling for the need for more sensitization on regular medical checkups by the aged in the district.

REFERENCES

Addo, J., Agyemang, C., Smeeth, L., Aikins, A.D.G., Adusei, A. and Ogedegbe, O. (2012).A Review of Population-Based Studies on Hypertension in Ghana.*Ghana Medical Journal*, **46**(2), Pp. 4-11.

Addo, J., Amoah, A.G. And Koram, K.A. (2006). The Changing Patterns of Hypertension in Ghana: A Study of Four Rural Communities in the Ga District. *Ethnicity & Disease*, **16**(4), Pp. 894-899.

Addo, J., Smeeth, L. and Leon, D.A. (2007). Hypertension in Sub-Saharan Africa: A Systematic Review. *Hypertension (Dallas, Tex.: 1979)*, **50**(6), Pp. 1012-1018.

Aganiba, B.A., Owusu, W.B., Steiner-Asiedu, M. and Dittoh, S. (2015).Association between Lifestyle and Health Variables with Nutritional Status of the Elderly in the Northern Region of Ghana.*African Journal of Food, Agriculture, Nutrition and Development*, *15*(4), Pp.10198-10216.

Agyemang, C., Bruijnzeels, M.A. and Owusu-Dabo, E. (2006). Factors Associated With Hypertension Awareness, Treatment, and Control in Ghana, West Africa. *Journal of Human Hypertension*, **20**(1), Pp. 67.

Ahluwalia, V.K. and Ahluwalia, M. (2005).A Guide to Aging.Lotus Press. Delhi, Pp: 1, 22-44, 57-79.

Alonso, A., Beunza, J.J., Delgado-Rodriguez, M., Martinez, J.A. and Martinez-Gonzalez, M.A., (2005). Low-Fat Dairy Consumption and Reduced Risk of Hypertension: The Seguimiento Universidad De Navarra (Sun) Cohort. *The American Journal of Clinical Nutrition*, **82**(5), Pp. 972-979.

Altorf-Van Der Kuil, W., Engberink, M.F., Van Rooij, F.J., Hofman, A., Van't Veer, P., Witteman, J.C. and Geleijnse, J.M. (2010). Dietary Protein and Risk of Hypertension in a Dutch Older Population: The Rotterdam Study. *Journal of Hypertension*, **28**(12), Pp. 2394-2400.

American Heart Foundation (2017).www.Nhlbi.Nih.Gov or Www.Americanheart.Org [Accessed 20 April 2017].

Angel, R. and Angel, J.L. (1999).*Who Will Care For Us? Aging and Long-Term Care in Multicultural America.*Nyu Press.

Appel, L.J. (2009). Ash Position Paper: Dietary Approaches to Lower Blood Pressure. *The Journal of Clinical Hypertension*, **11**(7), Pp. 358-368.

Appel, L.J., Moore, T.J., Obarzanek, E., Vollmer, W.M., Svetkey, L.P., Sacks, F.M., Bray, G.A., Vogt, T.M., Cutler, J.A. and Windhauser, M.M. (1997). A Clinical Trial of the Effects of Dietary Patterns on Blood Pressure.*New England Journal of Medicine*, **336**(16), Pp. 1117-1124.

Appollonio, I., Carabellese, C., Frattola, A. and Trabucchi, M. (1997).Influence of Dental Status on Dietary Intake and Survival in Community-Dwelling Elderly Subjects.*Age and Ageing*, **26**(6), Pp. 445-455.

Apt, N.A. (1999). Rural Ageing in Ghana: Evidence from the Field. In *Position Paper Presented To The Expert Group Meeting On Rural Aging, Shepherdstown, Wv*.

Asenso-Okyere, W.K., Benneh, G. and Tims, W. (1997).*Sustainable Food Security in West Africa.*Springer.

Atzmon, G., Schechter, C., Greiner, W., Davidson, D., Rennert, G. and Barzilai, N. (2004). Clinical Phenotype of Families with Longevity.*Journal of the American Geriatrics Society*, **52**(2), Pp. 274-277.

Awosan, K., Ibrahim, M., Essien, E., Yusuf, A. and Okolo, A. (2014).Dietary Pattern, Lifestyle, Nutrition Status and Prevalence of Hypertension among Traders in Sokoto Central Market, Sokoto, Nigeria.*International Journal of Nutrition and Metabolism,* **6**(1), Pp. 9-17.

Baker, A.H. and Wardle, J. (2003) Sex Differences In Food Choice: The Contribution Of Health Beliefs and Dieting. Appetite 40, 269–275.

Bales, C.W., C.S. Ritchie and Russell, R.M.(2004). Handbook of Clinical Nutrition and Aging. Humana Press, Totowa, Nj, Pp: 214-271.

Barasi, M. (2003).*Human Nutrition: A Health Perspective.* Crc Press.

Barlassina, C., Lanzani, C., Manunta, P. and Bianchi, G. (2002). Genetics Of Essential Hypertension: From Families to Genes. *Journal of the American Society of Nephrology: Jasn,* 13 Suppl 3, Pp. S155-64.

Bartali, B., Salvini, S., Turrini, A., Lauretani, F., Russo, C.R., Corsi, A.M., Bandinelli, S., D'amicis, A., Palli, D., Guralnik, J.M. and Ferrucci, L. (2003). Age and Disability Affect Dietary Intake. *The Journal of Nutrition,* **133**(9), Pp. 2868-2873.

Bartfeld, J. and Dunifon, R. (2006) State-Level Predictors Of Food Insecurity Among Households With Children. *Journal of Policy Analysis and Management* [Online].25 (4), Pp.921-942.

Barzilai, N., Gabriely, I., Gabriely, M., Iankowitz, N.And Sorkin, J.D. (2001). Offspring Of Centenarians Have A Favorable Lipid Profile. *Journal of the American Geriatrics Society,* **49**(1), Pp. 76-79.

Bashir, M. K. And Schilizzi, S. (2013). Determinants of Rural Household Food Security: A Comparative Analysis of African and Asian Studies. *Journal of the Science of Food and Agriculture*.[Online].

Bernabe-Ortiz, A., Carrillo-Larco, R.M., Gilman, R.H., Checkley, W., Smeeth, L., Miranda, J.J. and Cronicas Cohort Study Group, (2017).Impact of Urbanisation and Altitude on the Incidence of, and Risk Factors for, Hypertension.*Heart (British Cardiac Society),* **103**(11), Pp. 827-833.

Bickel, G., Nord, M., Price, C., Hamilton, W. and Cook, J. (2000) Guide To Measuring Household Food Security. *Alexandria. Department of Agriculture Food and Nutrition Service* [Online].

Biesalski, H.K., Brummer, R., König, J., O'connell, M.A., Ovesen, L., Rechkemmer, G., Stos, K. and Thurnham, D.I. (2003).Micronutrient Deficiencies.*European Journal of Nutrition*, **42**(6), Pp. 353-363.

Blackburn, G.L., Bistrian, B.R., Maini, B.S., Schlamm, H.T. and Smith, M.F. (1977).Nutritional and Metabolic Assessment of the Hospitalized Patient.*Journal of Parenteral and Enteral Nutrition*, **1**(1), Pp. 11-21.

Bohman, D.M., Vasuthevan, S., Van Wyk, N.C. and Ekman, S. (2007). "We Clean Our Houses, Prepare For Weddings and Go To Funerals": Daily Lives Of Elderly Africans in Majaneng, South Africa. *Journal of Cross-Cultural Gerontology*, **22**(4), Pp. 323-337.

Booker, C.L. and Sacker, A. (2011). Health over the Life Course: Associations Between Age, Employment Status And Well-Being. *Understanding Society*, **2**.

Brauer, P.M., Slavin, J.L. and Marlett, J.A. (1981). Apparent Digestibility of Neutral Detergent Fiber In Elderly And Young Adults. *The American Journal of Clinical Nutrition*, **34**(6), Pp. 1061-1070.

Bray, G.A. (2000). Afferent Signals Regulating Food Intake.*Proceedings of the Nutrition Society*, **59**(3), Pp. 373-384.

Bromley, D.B. (1988). *Human Ageing: An Introduction to Gerontology.* Penguin.

Brong Ahafo Regional Health Directorate (BARHD) (2016).Annual report on disease prevalence in the Brong Ahafo Region for the 2016 implementation year.

Brooks-Wilson, A.R. (2013). Genetics of Healthy Aging And Longevity. *Human Genetics,* **132**(12), Pp. 1323-1338.

Brown, J.E., Isaacs, J.S., Krinke, U.B., Murtaugh, M.A., Sharbaugh, C. and Stang, J. (2008).Nutrition through the Life Cycle. 3rd Edn., Thomson Wadsworth, Belmont, CA

Bu, N., Food and Nutrition Bulletin.(2004). *Food and Nutrition Bulletin,* **1**(9).[Online].

Caldwell, J.C. (1982) *Theory of Fertility Decline,* Academic Press, London, UK, 1982.

Caple, F., Williams, E.A., Spiers, A., Tyson, J., Burtle, B., Daly, A.K., Mathers, J.C. and Hesketh, J.E. (2010). Inter-Individual Variation In Dna Damage And Base Excision Repair In Young, Healthy Non-Smokers: Effects Of Dietary Supplementation And Genotype. *British Journal of Nutrition,* **103**(11), Pp. 1585-1593.

Carretero, O.A. and Oparil, S. (2000). Essential Hypertension. Part I: Definition and Etiology. *Circulation,* **101**(3), Pp. 329-335.

Casey, P.H., Szeto, K., Lensing, S., Bogle, M. and Weber, J. (2001). Children in Food-Insufficient, Low-Income Families: Prevalence, Health, and Nutrition Status. *Archives of Pediatrics & Adolescent Medicine* [Online].155 (4), Pp.508.

Charlton, K. E. and Rose, D. (2001). Nutrition Among Older Adults In Africa: The Situation At The Beginning of the Millenium. *The Journal of Nutrition, 131*(9), 2424s-2428s

Charlton, K., Ferreira, M. and Du Plessis, L. (2008).The Nutritional Status and Needs of Older Persons.

Cherchye, L., De Rock, B. and Vermeulen, F. (2008). Economic Well Being and Poverty Among The Elderly: An Analysis Based On A Collective Consumption Model.

Chernoff, R. (1994). Meeting The Nutritional Needs Of The Elderly In The Institutional Setting. *Nutrition Reviews, 52*(4), Pp.132-136.

Chou, K. (2008). Combined Effect of Vision and Hearing Impairment on Depression in Older Adults: Evidence from the English Longitudinal Study of Ageing.*Journal of Affective Disorders,* **106**(1), Pp. 191-196.

Christian A. Gregor y, Alisha Coleman-Jensen (2017). Food Insecurity, Chronic Disease, and Health Among Working-Age Adults, ERR-35, U.S. Department of Agriculture,Economic Research Service, July 201

Coale, A.J. (1964). How A Population Ages or Grows Younger.

Conklin, A.I., Maguire, E.R. and Monsivais, P. (2013). Economic Determinants of Diet in Older Adults: Systematic Review. *Journal of Epidemiology and Community Health*, **67**(9), Pp. 721-727.

Coody, D.K., Yetman, R.J. and Portman, R.J. (1995).Hypertension in Children.*Journal of Pediatric Health Care,* **9**(1), Pp. 3-11.

Corvol, P., Jeunemaitre, X., Charru, A. and Soubrier, F. (1992). Can The Genetic Factors Influence The Treatment Of Systemic Hypertension? The Case Of The Renin-Angiotensin-Aldosterone System. *The American Journal of Cardiology*, **70**(12), Pp. D14-D20.

Dare, N.J., Appiah, C.A., Nti, C. and Steiner-Asiedu, M. (2016). Determinants of Hypertension Among Elderly People In The Bongo District Of Ghana. *Journal of Food and Nutrition Research,* **4**(11), Pp. 742-749.

Darmon, N., Ferguson, E.L. and Briend, A. (2002). A Cost Constraint Alone Has Adverse Effects On Food Selection And Nutrient Density: An Analysis Of Human Diets By Linear Programming. *The Journal of Nutrition,* **132**(12), Pp. 3764-3771.

Davis, M.A., Neuhaus, J.M., Moritz, D.J., Lein, D., Barclay, J.D. and Murphy, S.P. (1994). Health Behaviors And Survival Among Middle Aged and Older Men and Women in the Nhanes I Epidemiologic Follow-Up Study. *Preventive Medicine,* **23**(3), Pp. 369-376.

Davis, M.A., Randall, E., Forthofer, R.N., Lee, E.S. and Margen, S. (1985). Living Arrangements And Dietary Patterns Of Older Adults in the United States. *Journal of Gerontology,* **40**(4), Pp. 434-442.

Dawson, B., Taylor, J. and Favaloro, E.J. (2008). Potential Benefits of Improved Protein Intake In Older People. *Nutrition & Dietetics*, **65**(2), Pp. 151-156.

De Castro, J.M. (2002). Age-Related Changes in the Social, Psychological, and Temporal Influences on Food Intake in Free-Living, Healthy, Adult Humans.*The Journals of Gerontology Series A: Biological Sciences And Medical Sciences,* **57**(6), Pp. M368-M377.

De Haen, H., Stamoulis, K., Shetty, P. and Pingali, P. (2003). The World Food Economy in the Twenty-First Century: Challenges For International Co-Operation. *Development Policy Review*, **21**(5-6), Pp. 683-696. [Online].

de Lima Santos, P.C.J., de Oliveira Alvim, R., Ferreira, N.E., de Sá Cunha, R., Krieger, J.E., Mill, J.G. and Pereira, A.C.(2011). Ethnicity and arterial stiffness in Brazil.*American journal of hypertension*, *24*(3), pp.278-284.

De Magalhaes, J.P., Budovsky, A., Lehmann, G., Costa, J., Li, Y., Fraifeld, V. and Church, G.M., 2009. The Human Ageing Genomic Resources: Online Databases and Tools For Biogerontologists. *Aging Cell,* **8**(1), Pp. 65-72.

Dean, M., Raats, M.M., Grunert, K.G. and Lumbers, M., 2009.Factors Influencing Eating a Varied Diet in Old Age.*Public Health Nutrition,* **12**(12), Pp. 2421-2427.

Deitchler, M., Ballard, T., Swindale, A. and Coates, J. (2011) Introducing A Simple Measure of Household Hunger For Cross-Cultural Use. *Washington, Dc: Food and Nutrition Technical Assistance Ii Project, Aed* [Online].

Denny, A. (2008). An Overview of the Role of Diet During The Ageing Process. *British Journal of Community Nursing,* **13**(2).

Dey, D.K., Rothenberg, E., Sundh, V., Bosaeus, I. and Steen, B. (1999). Height and Body Weight In The Elderly. I. A 25-Year Longitudinal Study Of A Population Aged 70 To 95 Years. *European Journal of Clinical Nutrition,* **53**(12), Pp. 905-914.

Donini, L.M., Savina, C. And Cannella, C., 2003. Eating Habits and Appetite Control in the Elderly: The Anorexia Of Aging. *International Psychogeriatrics*, **15**(1), Pp. 73-87.

Douglass, C.W., Jette, A.M., Fox, C.H., Tennstedt, S.L., Joshi, A., Feldman, H.A., Mcguire, S.M. And Mckinlay, J.B., 1993. Oral Health Status of the Elderly in New England.*Journal of Gerontology*, *48*(2), Pp.M39-M46.

Dowler, E. (2008) Policy Initiatives To Address Low-Income Households' Nutritional Needs In The UK. *Proceedings Of The Nutrition Society* [Online]. 67 (3), Pp.289-300.

Drewnowski, A. (2004) Obesity and the food environment: dietary energy density and diet costs. *American Journal of Preventive Medicine* [online]. 27 (3), pp.154-162.[Accessed 15 September 2016].

Drewnowski, A., Renderson, S.A., Driscoll, A. and Rolls, B.J. (1997). The Dietary Variety Score: Assessing Diet Quality In Healthy Young and Older Adults. *Journal of the American Dietetic Association*, **97**(3), Pp. 266-271.

Duda, R.B., Anarfi, J.K., Adanu, R.M., Seffah, J., Darko, R. and Hill, A.G. (2011). The Health of the "Older Women" In Accra, Ghana: Results Of The Women's Health Study Of Accra. *Journal of Cross-Cultural Gerontology*, **26**(3), Pp. 299-314.

Duffy, V.B., Backstrand, J.R. And Ferris, A.M., 1995. Olfactory Dysfunction And Related Nutritional Risk In Free-Living, Elderly Women. *Journal of the American Dietetic Association*, **95**(8), Pp. 879-884.

Dwyer, J., White, J., Ham, R.J., Lipschitz, D. and Wellman, N.S. (1991).Screening Older Americans' Nutritional Health: Future Possibilities.*Nutrition Today*, **26**(5), Pp. 21-24.

Elliott, P., Stamler, J., Nichols, R., Dyer, A.R., Stamler, R., Kesteloot, H. and Marmot, M. (1996).Intersalt Revisited: Further Analyses Of 24 Hour Sodium Excretion And Blood Pressure Within And Across Populations. Intersalt Cooperative Research Group. *BMJ (Clinical Research Ed.)*, **312**(7041), Pp. 1249-1253.

Ericksen, P.J. (2008) Conceptualizing Food Systems For Global Environmental Change Research. *Global Environmental Change* [Online].18 (1), Pp.234-245.

Estruch, R., Ros, E., Salas-Salvadó, J., Covas, M., Corella, D., Arós, F., Gómez-Gracia, E., Ruiz-Gutiérrez, V., Fiol, M.And Lapetra, J. (2013). Primary Prevention Of Cardiovascular Disease With A Mediterranean Diet. *New England Journal of Medicine,* **368**(14), Pp. 1279-1290.

Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults, (2001). Executive Summary of The Third Report of The National Cholesterol Education Program (NCEP) Expert Panel On Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel Iii). *Jama,* **285**(19), Pp. 2486-2497.

Fanelli, M.T. and Stevenhagen, K.J. (1985). Characterizing Consumption Patterns by Food Frequency Methods: Core Foods And Variety Of Foods In Diets Of Older Americans. *Journal of The American Dietetic Association,* **85**(12), Pp. 1570-1576.

Favé, G., Beckmann, M., Draper, J. and Mathers, J.C. (2009). Measurement of Dietary Exposure: A Challenging Problem Which May Be Overcome Thanks to Metabolomics? *Genes & Nutrition,* **4**(2), Pp. 135-141.

Fischer, J. and Johnson, M.A. (1990).Low Body Weight and Weight Loss in the Aged.*Journal Of The American Dietetic Association,* **90**(12), Pp. 1697-1706.

Food and Agriculture Organization of the United Nations. (2001). Human Energy Requirements

Frankie, R. and Owen, A. (1993). Nutrition in the Community: The art of Delivering Services. Ftp://Ftp.Fao.Org/Docrep/Fao/007/Y5686e/Y5686e00.Pdf [Accessed 21 March 2017].

Fung, T.T., Rimm, E.B., Spiegelman, D., Rifai, N., Tofler, G.H., Willett, W.C. and Hu, F.B. (2001). Association Between Dietary Patterns And Plasma Biomarkers Of Obesity And Cardiovascular Disease Risk. *The American Journal of Clinical Nutrition*, **73**(1), Pp. 61-67.

Garcia-Palmieri, M.R., Costas, R.,Jr, Cruz-Vidal, M., Sorlie, P.D., Tillotson, J. and Havlik, R.J. (1984). Milk Consumption, Calcium Intake, And Decreased Hypertension In Puerto Rico. Puerto Rico Heart Health Program Study.*Hypertension (Dallas, Tex.: 1979)*, **6**(3), Pp. 322-328.

Garrow, J.S., James, W.P.T, and Ralph, A. (ed) (2000). Human Nutrition and Dietetics. 10th ed. London: Harcourt Publishers Limited

Gaziano, T.A., Bitton, A., Anand, S., Abrahams-Gessel, S. and Murphy, A. (2010). Growing Epidemic Of Coronary Heart Disease In Low-And Middle-Income Countries. *Current Problems In Cardiology*, **35**(2), Pp. 72-115.

Geleijnse, J., Grobbee, D. and Kok, F. (2005). Impact of Dietary and Lifestyle Factors on the Prevalence of Hypertension In Western Populations. *Journal of Human Hypertension*, **19**(Suppl 3), Pp. S1-S4.

Ghana Statistical Service (GSS)(2013).2010 population and housing census, the elderly in Ghana. [Accessed 10 June 2016]

Ghana Statistical Service (GSS), Noguchi Memorial Institute for Medical Research (NMIMR), Ghana Health Service (GHS), Ghana AIDS Commission (GAC) and Macro International (MI), (2009). *Ghana Demographic and Health Survey 2008*.Calverton,Md, USA: GSS, NMIMR, GHS, GAC and MI.

Ghana Statistical Service (GSS). (2005a). *Population Data Analysis Reports: Volume 1, Socio-Economic and Demographic Trends Analysis*. The GSS, Accra, Ghana.

Ghana. Statistical Service. (2005b). *2000 Population & Housing Census of Ghana: Ga-My* (Vol. 2). Ghana Statistical Service.

Gibson, R. (1990). Evaluation of Nutrient Intake Data.*Principles of Nutritional Assessment,* , Pp. 137-154.

Gidamis, A., Panga, J., Sarwatt, S., Chove, B. and Shayo, N. (2003). Nutrient AndAntinutrient Contents In Raw And Cooked Young Leaves And Immature Pods of MoringaOleifera, Lam. *Ecology Of Food And Nutrition*, **42**(6), Pp. 399-411. [Online].

Green, L.A. (2005). Prescription For Health: Round 1 Initial Results. *Annals of Family Medicine*, **3 Suppl 2**, Pp. S2-3.

Haan M.D. (2000). The Health of Southern Africa. 7th Ed. Republic of South Africa: Juta and Co, Ltd.

Habib, S.H. and Saha, S. (2010). Burden of non-communicable disease: global overview. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, *4*(1), pp.41-47.

Haddad, L. (2003). Redirecting the Diet Transition: What Can Food Policy Do? *Development Policy Review*, **21**(5-6), Pp. 599-614. [Online].

Hamelin, A., Habicht, J. and Beaudry, M. (1999) Food insecurity: consequences for the household and broader social implications.*The Journal of Nutrition* [online]. 129 (2), pp.525S-528S.

Haveman-Nies, A., De Groot, L.C. and Van Staveren, W.A. (2003). Dietary Quality, Lifestyle Factors and Healthy Ageing In Europe: The Seneca Study. *Age and Ageing*, **32**(4), Pp. 427-434.

Hawkes, C., Chopra, M. and Friel, S. (2009). Globalization, Trade, and The Nutrition Transition. *Globalization and Health: Pathways, Evidence And Policy,* **4**, Pp. 235. [Online].

Hays, N.P. and Roberts, S.B. (2006).The Anorexia of Aging in Humans.*Physiology and Behavior*, **88**(3), Pp. 257-266.

Health Organization.(Online). Available www:

Hendy, H.M., Nelson, G.K. And Greco, M.E. (1998). Social Cognitive Predictors Of Nutritional Risk In Rural Elderly Adults. *The International Journal of Aging and Human Development*, **47**(4), Pp. 299-327.

Herne, S. (1995). Research on Food Choice and Nutritional Status in Elderly People: A Review. *British Food Journal,* **97**(9), Pp. 12-29.

Hetherington, M.M. (1998). Taste and Appetite Regulation in the Elderly.*Proceedings of the Nutrition Society*, **57**(4), Pp. 625-631.

Heuberger, R. (2009). Special Topics in Nutrition and the Diet of the Older Adult: Diet, Lifestyle, Disease, and Pharmacologic Considerations. In: Edelstein, S. and J. Sharlin (Eds.), Life Cycle Nutrition: An Evidence-Based Approach. Jones and Bartlett Publishers, Massachusetts. pp: 377-406

Hickson, M. (2006).Malnutrition and Ageing.*Postgraduate Medical Journal*, **82**(963), Pp. 2-8.

Hilpert, K.F., West, S.G., Bagshaw, D.M., Fishell, V., Barnhart, L., Lefevre, M., Most, M.M., Zemel, M.B., Chow, M. and Hinderliter, A.L. (2009). Effects of Dairy Products on Intracellular Calcium and Blood Pressure in Adults with Essential Hypertension.*Journal of The American College Of Nutrition*, **28**(2), Pp. 142-149.

http://sun025.sun.ac.za/portal/page/portal/Health_Sciences/English/Centres%20and%20Institutions/Nicus/Micronutrients/Vitamins/Biotin (Accessed 22 September 2017).

Hu, F.B. (2002). Dietary Pattern Analysis: A New Direction in Nutritional Epidemiology. *Current Opinion InLipidology*, **13**(1), Pp. 3-9.

Huijbregts, P., Feskens, E., Rasanen, L., Fidanza, F., Nissinen, A., Menotti, A. And Kromhout, D., 1997. Dietary Pattern And 20 Year Mortality In Elderly Men In Finland, Italy, And The Netherlands: Longitudinal Cohort Study. *Bmj (Clinical Research Ed.)*, **315**(7099), Pp. 13-17.

Institute of Medicine (IoM).(2001). Committee on Quality of Health Care in America. Crossing the

Irving, S.M., Njai, R.S. and Siegel, P.Z. (2014). Peer Reviewed: Food Insecurity and Self-Reported Hypertension Among Hispanic, Black, and White Adults in 12 States, Behavioral Risk Factor Surveillance System, 2009. *Preventing chronic disease*, *11*.

Jacobs, D.R. and Tapsell, L.C. (2007). Food, Not Nutrients, is the Fundamental Unit in Nutrition. *Nutrition Reviews*, **65**(10), Pp. 439-450.

Jacobs, D.R.,Jr and Steffen, L.M. (2003). Nutrients, Foods, and Dietary Patterns As Exposures In Research: A Framework For Food Synergy. *The American Journal Of Clinical Nutrition*, **78**(3 Suppl), Pp. 508s-513s.

Jafar, T.H., Jessani, S., Jafary, F.H., Ishaq, M., Orkazai, R., Orkazai, S., Levey, A.S. and Chaturvedi, N., (2005). General practitioners' approach to hypertension in urban Pakistan: disturbing trends in practice. *Circulation, 111*(10), pp.1278-1283.

Jetter, K.M. and Cassady, D.L. (2006) The availability and cost of healthier food alternatives. *American Journal of Preventive Medicine* [online]. 30 (1), pp.38-44.

John, J., Ziebland, S., Yudkin, P., Roe, L. and Neil, H. (2002). Effects Of Fruit And Vegetable Consumption On Plasma Antioxidant Concentrations And Blood Pressure: A Randomised Controlled Trial. *The Lancet,* **359**(9322), Pp. 1969-1974.

Johns, T. and Sthapit, B.R. (2004).Biocultural Diversity in the Sustainability Of Developing-Country Food Systems. *Food & Nutrition Bulletin,* **25**(2), Pp. 143-155. [Online].

Kaiser, L., Baumrind, N. and Dumbauld, S. (2007) Who Is Food-Insecure In California? Findings From The California Women's Health Survey, 2004. *Public Health Nutrition* [Online].10 (6), Pp.574-581.

Kaplan Nm. Kaplan's Clinical Hypertension. 8th Ed. Philadelphia, Lippincott Williams and Wilkins, 2002.

Kearney, P.M., Whelton, M., Reynolds, K., Muntner, P., Whelton, P.K. and He, J. (2005). Global Burden of Hypertension: Analysis Of Worldwide Data. *The Lancet,* **365**(9455), Pp. 217-223.

Kearney, P.M., Whelton, M., Reynolds, K., Whelton, P.K. and He, J. (2004). Worldwide Prevalence of Hypertension: A Systematic Review. *Journal Of Hypertension,* **22**(1), Pp. 11-19.

Kestin, M., Rouse, I.L., Correll, R.A. and Nestel, P.J. (1989). Cardiovascular Disease Risk Factors In Free-Living Men: Comparison Of Two Prudent Diets, One Based On Lactoovovegetarianism And The Other Allowing Lean Meat. *The American Journal of Clinical Nutrition,* **50**(2), Pp. 280-287.

Kirkwood, T.B. (2005). Understanding the Odd Science of Aging.*Cell,* **120**(4), Pp. 437-447.

Kirkwood, T.B. (2008). A Systematic Look at an Old Problem.*Nature,* **451**(7179), Pp. 644-647.

Kokkinos, P., Panagiotakos, D.B. and Polychronopoulos, E. (2005). Dietary Influences on Blood Pressure: The Effect Of The Mediterranean Diet on the Prevalence of Hypertension. *The Journal of Clinical Hypertension,* **7**(3), Pp. 165-172.

Kotchen, T.A. (2010). The Search for Strategies to Control Hypertension.*Circulation,* **122**(12), Pp. 1141-1143.

Krinke, U.B. (2008). Nutrition throughout the Life Cycle.3rd Edn. Thomson Wards Worth, USA, Pp: 445-486.

Kuller, L.H. (2007). Epidemic Hypertension in Sub-Saharan Africa.*Hypertension (Dallas, Tex.: 1979),* **50**(6), Pp. 1004-1005.

Lahmann, P.H. and Kumanyika, S.K. (1999). Attitudes About Health and Nutrition Are More Indicative Of Dietary Quality In 50-To 75-Year-Old Women Than Weight and Appearance Concerns. *Journal Of The American Dietetic Association,* **99**(4), Pp. 475-478.

Leather, S. (1992). Less Money, Less Choice: Poverty and Diet in The UK Today. *Your Food—Whose Choice,* , Pp. 72-94.

Lesourd, B. (1997). Nutrition and Immunity in the Elderly: Modification of Immune Responses With Nutritional Treatments. *The American Journal of Clinical Nutrition*, *66*(2), Pp.478s-484s.

Lestienne, I., Icard-Vernière, C., Mouquet, C., Picq, C. and Trèche, S. (2005). Effects of Soaking Whole Cereal And Legume Seeds On Iron, Zinc And Phytate Contents. *Food Chemistry,* **89**(3), Pp. 421-425. [Online].

Lim, S.S., Vos, T., Flaxman, A.D., Danaei, G., Shibuya, K., Adair-Rohani, H., AlMazroa, M.A., Amann, M., Anderson, H.R., Andrews, K.G. and Aryee, M. (2013). A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *The lancet*, *380*(9859), pp.2224-2260.

Lobstein, T., Baur, L. and Uauy, R. (2004). Obesity in Children and Young People: A Crisis in Public Health. *Obesity Reviews,* **5**(S1), Pp. 4-85. [Online].

Louisa Marais, M., Marais, D. and Labadarios, D. (2007).Assessment of nutritional status of older people in homes for the aged in the Somerset West area.*South African Journal of Clinical Nutrition*, *20*(3), pp.102-108.

Macia, E., Duboz, P. And Gueye, L. (2012). Prevalence, Awareness, Treatment and Control of Hypertension Among Adults 50 Years and Older in Dakar, Senegal: Cardiovascular Topics. *Cardiovascular Journal of Africa,* **23**(5), Pp. 265-269.

Mann, J. and Truswell, S. (Eds.)(2017). *Essentials of human nutrition*.Oxford University Press.

Masuo, K., Mikami, H., Ogihara, T. and Tuck, M.L. (1998). Familial Hypertension, Insulin, Sympathetic Activity, And Blood Pressure Elevation. *Hypertension (Dallas, Tex.: 1979)*, **32**(1), Pp. 96-100.

Mazzocchi, M., Shankar, B. and Traill, B. (2012).*The development of global diets since ICN 1992: influences of agri-food sector trends and policies*. Food and Agriculture Organization of the United Nations.

Mba, C. J. (2005) Racial Differences in Marital Status and Living Arrangements of Older Persons In South Africa: *Generations Review*, Vol. 15, No. 2, Pp. 23–31.

Mba, C.J. (2004). Population Ageing and Survival Challenges In Rural Ghana. *Journal Of Social Development In Africa*, **19**(2),.

Mba, C.J. (2007). Population Ageing in Ghana and Correlates of Support Availability.*Gerontechnology*, **6**(2), Pp. 102-111.

Mba, C.J. (2010). Population Ageing in Ghana: Research Gaps and the Way Forward. *Journal of Aging Research*, **2010**, Pp. 672157.

Mcbee, S., Cotugna, N. and Vickery, C.E. (2001).Fruit and Vegetable Consumption in an Elderly Population.*Journal Of Nutrition For The Elderly*, **21**(1), Pp. 59-67.

Mccormack, P. (1997). Undernutrition in the Elderly Population Living At Home In The Community: A Review Of The Literature. *Journal of Advanced Nursing*, **26**(5), Pp. 856-863.

Mcdonald, T., Webster, J. (1998).Nutrition Information the Key to Better Diet, Better Health.Usda's Healthy Eating Index and Nutrition Information. Press Release No. 0209.98. Http://Www.Usda.Gov/Cnpp/Release_Hei.Html [Accessed November 2016].

Mcintosh, W.A. and Shifflett, P.A. (1984). Influence of Social Support Systems on Dietary Intake Of The Elderly. *Journal of Nutrition for the Elderly,* **4**(1), Pp. 5-18.

Mckevith, B. (2005). Diet and Healthy Ageing.*British Menopause Society Journal,* **11**(4), Pp. 121-125.

Mehra-Kerpelman, K., Yadon, Z., Rodrigues, L., Davies, C., Quigley, M., Rodriquez, C., Hassan, M., Ali, N., Wiegers, E. and Scott, M. (2003) Food Access Indicator Review. *World of Work* [Online].68 (49), Pp.22-24.

Ministry Of Health (2006).The Ghana Health Sector 2006 Programme of Work.

Mitchell, A.A., Kaufman, D.W. and Rosenberg, L. (2004). Patterns of Medication Use in the United States. A report from the Slone Survey.Retrieved From: www.bu.edu/slone/slonesurvey/annualrpt/slonesurveyreport2004.Pdf.[Accessed 12 September, 2016].

Mittal, B.V. and Singh, A.K. (2010). Hypertension in the Developing World: Challenges And Opportunities. *American Journal Of Kidney Diseases*, **55**(3), Pp. 590-598.

Mooijaart, S.P., Van Heemst, D., Noordam, R., Rozing, M.P., Wijsman, C.A., De Craen, A.J., Westendorp, R.G., Beekman, M. and Slagboom, P.E. (2011). Polymorphisms Associated With Type 2 Diabetes In Familial Longevity: The Leiden Longevity Study. *Aging,* **3**(1), Pp. 55-62.

Moore, D. S. and Mccabe, G.P. (1993). Introduction to the Practice Of Statistics. 2nd ed. New York: W. H. Freeman and Co., 1993: 583.

Moran, J.P., Cohen, L., Greene, J.M., Xu, G., Feldman, E.B., Hames, C.G. and Feldman, D.S. (1993). Plasma Ascorbic Acid Concentrations Relate Inversely To Blood Pressure In Human Subjects. *The American Journal of Clinical Nutrition*, **57**(2), Pp. 213-217.

Morley, J.E. (1986). Nutritional Status of the Elderly.*The American Journal of Medicine*, **81**(4), Pp. 679-695.

Mufunda, J., Scott, L., Chifamba, J., Matenga, J., Sparks, B., Cooper, R. and Sparks, H., 2000. Correlates of Blood Pressure In An Urban Zimbabwean Population and Comparison to Other Populations of African Origin. *Journal of Human Hypertension*, **14**(1), Pp. 65.

Naidoo, J. And Wills, J. (2008) Health Studies: An Introduction. Basingstoke: Palgrave Macmillan.

Nettleton, J.A., Steffen, L.M., Mayer-Davis, E.J., Jenny, N.S., Jiang, R., Herrington, D.M. and Jacobs, D.R., Jr. (2006). Dietary Patterns Are Associated With Biochemical Markers of Inflammation And Endothelial Activation In The Multi-Ethnic Study Of Atherosclerosis (Mesa). *The American Journal of Clinical Nutrition*, **83**(6), Pp. 1369-1379.

Newman, A.B., Glynn, N.W., Taylor, C.A., Sebastiani, P., Perls, T.T., Mayeux, R., Christensen, K., Zmuda, J.M., Barral, S., Lee, J.H., Simonsick, E.M., Walston, J.D., Yashin, A.I. and Hadley, E. (2011). Health And Function Of Participants In The Long Life Family Study: A Comparison With Other Cohorts. *Aging*, **3**(1), Pp. 63-76.

Nutrition Information Centre at the University of Stellenbosch (NICUS) 2003. Dietaryreference Intake s(online). Available WWW:

Olivares, M., Hertrampf, E., Capurro, M.And Wegner, D. (2000). Prevalence of Anemia in Elderly Subjects Living At Home: Role Of Micronutrient Deficiency And Inflammation. *European Journal of Clinical Nutrition,* **54**(11), Pp. 834.

Olson, L.K. (1994). *The Graying Of The World: Who Will Care For The Frail Elderly?* Psychology Press.

Paquet, C., St-Arnaud-Mckenzie, D., Ma, Z., Kergoat, M., Ferland, G. and Dube, L. (2008). More Than Just Not Being Alone: The Number, Nature, and Complementarity of Meal-Time Social Interactions Influence Food Intake in Hospitalized Elderly Patients. *The Gerontologist,* **48**(5), Pp. 603-611.

Patel, R.B. and Burke, T.F. (2009). Urbanization—An Emerging Humanitarian Disaster. *New England Journal of Medicine,* **361**(8), Pp. 741-743.

Patil, R.R. (2014). Urbanization as a Determinant Of Health: A Socioepidemiological Perspective. *Social Work In Public Health,* **29**(4), Pp. 335-341.

Peltzer, K. and Phaswana-Mafuya, N. (2013). Hypertension and Associated Factors in Older Adults In South Africa. *South African Journal of Diabetes and Vascular Disease,* **10**(2), Pp. 54-58.

Penn, L., Boeing, H., Boushey, C.J., Dragsted, L.O., Kaput, J., Scalbert, A., Welch, A.A. and Mathers, J.C., 2010. Assessment of Dietary Intake: Nugo Symposium Report. *Genes and Nutrition,* **5**(3), Pp. 205.

Pereira, M., Lunet, N., Azevedo, A. and Barros, H. (2009). Differences in Prevalence, Awareness, Treatment And Control Of Hypertension Between Developing and Developed Countries. *Journal of Hypertension,* **27**(5), Pp. 963-975.

Pereira, M.A., Jacobs Jr, D.R., Van Horn, L., Slattery, M.L., Kartashov, A.I. and Ludwig, D.S, (2002). Dairy Consumption, Obesity, and the Insulin Resistance Syndrome In Young Adults: The Cardia Study. *Jama*, **287**(16), Pp. 2081-2089.

Perissinotto, E., Pisent, C., Sergi, G., Grigoletto, F. And Enzi, G. (2002). Anthropometric Measurements In The Elderly: Age And Gender Differences. *British Journal of Nutrition,* **87**(2), Pp. 177-186.

Pinstrup-Andersen, P. (2009). Food security: definition and measurement. *Food security*, *1*(1), pp.5-7.

Pinto, E. (2007) Blood Pressure and Ageing Postgrad Med J 2007;83:109–114. Doi: 10.1136/Pgmj.2006.048371

Poehlman, E. and Toth, M. (1996).Energy Dysregulation in Menopause.*Menopause Management,* **5**, Pp. 18-21.

Poehlman, E.T. (1998). Effect of Exercise on Daily Energy Needs in Older Individuals.*The American Journal of Clinical Nutrition,* **68**(5), Pp. 997-998.

Pope, T.P. (2008). Socializing Appears to Delay Memory Problems (Online). Available at: www.

Popkin, B.M. (2002). Part Ii. What Is Unique about the Experience in Lower-and Middle-Income Less-Industrialised Countries Compared With The Very-High income Industrialised Countries? *Public Health Nutrition*, **5**(1a), Pp. 205-214.

Popkin, B.M. (2003). The Nutrition Transition in the Developing World.*Development Policy Review,* **21**(5-6), Pp. 581-597.

Popkin, B.M. (2006). Technology, Transport, Globalization and the Nutrition Transition Food Policy.*Food Policy,* **31**(6), Pp. 554-569.

Popkin, B.M., Adair, L.S. and Ng, S.W. (2012).Global Nutrition Transition and the Pandemic of Obesity in Developing Countries.*Nutrition Reviews,* **70**(1), Pp. 3-21.

Popkin, B.M., Horton, S. and Kim, S. (2001). *The Nutrition Transition and Prevention of Diet-Related Diseases In Asia And The Pacific.* Asian Development Bank.

Population Reference Bureau (Prb) (20016).*World Population Data Sheet*.

Ramsey, R., Giskes, K., Turrell, G. and Gallegos, D. (2012) Food Insecurity Among Adults Residing In Disadvantaged Urban Areas: Potential Health And Dietary Consequences. *Public Health Nutrition* [Online].15 (2), Pp.227-237. [Accessed 10 September 2013]

Ranasinghe, P., Cooray, D.N., Jayawardena, R. and Katulanda, P. (2015). The Influence of Family History Of Hypertension On Disease Prevalence And Associated Metabolic Risk Factors Among Sri Lankan Adults. *BMC Public Health,* **15**(1), Pp. 576.

Reardon, T., Timmer, C.P., Barrett, C.B. and Berdegue, J. (2003). The Rise of Supermarkets In Africa, Asia, And Latin America. *American Journal of Agricultural Economics,* **85**(5), Pp. 1140-1146. [Online]. [Accessed 13 March 2013]

Reedy, J. And Krebs-Smith, S.M., 2008. A Comparison Of Food-Based Recommendations And Nutrient Values Of Three Food Guides: USDA's Mypyramid, Nhlbi's Dietary Approaches To Stop Hypertension Eating Plan, And Harvard's Healthy Eating Pyramid. *Journal of The American Dietetic Association,* **108**(3), Pp. 522-528.

Reese, H. (2007). Nutrition for the Elderly. Available at: Http://www.Healthcentral.Com/Diet-Exercise/C/92/14272/Elderly/. [Accessed 23 October 2016].

Remig, V. (2002).Diet for Elderly People (Online). Available at www: Http://Www.Diet .Com/Dietelderly People.Htm [Accessed 10 December 2016].

Revenson, T.A. and Johnson, J.L. (1984). Social and Demographic Correlates of Loneliness In Late Life. *American Journal of Community Psychology*, **12**(1), Pp. 71-85.

Richard, M. and Roussel, A. (1999). Micronutrients and Ageing: Intakes and Requirements. *Proceedings of The Nutrition Society,* **58**(3), Pp. 573-578.

Rimm, E.B., Ascherio, A., Giovannucci, E., Spiegelman, D., Stampfer, M.J. And Willett, W.C. (1996). Vegetable, Fruit, and Cereal Fiber Intake and Risk of Coronary Heart Disease Among Men. *Jama,* **275**(6), Pp. 447-451.

Ritz, P. (2001). Factors Affecting Energy and Macronutrient Requirements In Elderly People. *Public Health Nutrition,* **4**(2b), Pp. 561-568.

Roberts, S.B. (2000). Regulation of Energy Intake In Older Adults: Recent Findings and Implications. *The Journal of Nutrition, Health & Aging,* **4**(3), Pp. 170-171.

Roberts, S.B. and Rosenberg, I. (2006). Nutrition and Aging: Changes in the Regulation Of Energy Metabolism With Aging. *Physiological Reviews,* **86**(2), Pp. 651-667.

Rolls, B.J.And Mcdermott, T.M. (1991). Effects Of Age On Sensory-Specific Satiety. *The American Journal Of Clinical Nutrition,* **54**(6), Pp. 988-996.

Rose, D. (1999). Economic Determinants and Dietary Consequences Of Food Insecurity In The United States. *The Journal of Nutrition*, *129*(2), 517s-520s. [Online].

Rudman, D., 1989. Nutrition and Fitness In Elderly People. *The American Journal Of Clinical Nutrition*, **49**(5 Suppl), Pp. 1090-1098.

Ruidavets, J.B., Bongard, V., Simon, C., Dallongeville, J., Ducimetiere, P., Arveiler, D., Amouyel, P., Bingham, A.And Ferrieres, J. (2006). Independent Contribution of Dairy Products And Calcium Intake To Blood Pressure Variations At A Population Level. *Journal of Hypertension*, **24**(4), Pp. 671-681.

Ruigómez, A., Alonso, J. and Antó, J.M. (1995). Relationship Of Health Behaviours To Five-Year Mortality In An Elderly Cohort. *Age and Ageing*, **24**(2), Pp. 113-119.

Sacks, F.M., Svetkey, L.P., Vollmer, W.M., Appel, L.J., Bray, G.A., Harsha, D., Obarzanek, E., Conlin, P.R., Miller, E.R. and Simons-Morton, D.G. (2001). Effects On Blood Pressure Of Reduced Dietary Sodium And The Dietary Approaches To Stop Hypertension (Dash) Diet. *New England Journal Of Medicine*, **344**(1), Pp. 3-10.

Safar, M.E. (2005). Systolic Hypertension in the Elderly: Arterial Wall Mechanical Properties And The Renin–Angiotensin–Aldosterone System. *Journal Of Hypertension*, **23**(4), Pp. 673-681.

Safdar, N.F., Bertone-Johnson, E.R., Cordeiro, L., Jafar, T.H. and Cohen, N.L.(2015). Dietary patterns and their association with hypertension among Pakistani urban adults.*Asia Pacific journal of clinical nutrition*, *24*(4), pp.710-719.

Sahyoun, N.R. and Zhang, X.L. (2005). Dietary Quality and Social Contact Among A Nationally Representative Sample of The Older Adult Population In The United States. *The Journal Of Nutrition, Health & Aging,* **9**(3), Pp. 177-183.

Salva, A. and Pera, G. (2001).Nutrition and Ageing.*Public Health Nutrition,* **4**(6a), Pp. 1375-1378.

Scheier, L.M. (2005) What is the hunger-obesity paradox? *Journal of the American Dietetic Association* [online].105 (6), pp.883-885.[Accessed 10 September 2016]

Schiffman, S.S. (1997). Taste and Smell Losses In Normal Aging And Disease. *Jama,* **278**(16), Pp. 1357-1362.

Schlenker, E.D. (1992). Nutrition for Aging and the Aged.*Nutrition throughout the Life Cycle.2nd Ed.St.Louis: Mosby*, Pp. 344-380.

Schwartz, M.W., Woods, S.C., Porte Jr, D., Seeley, R.J. and Baskin, D.G. (2000). Central Nervous System Control Of Food Intake. *Nature,* **404**(6778), Pp. 661.

Schwartz, R.S. (1998). Obesity in the Elderly: Handbook Of Obesity. *Handbook of Obesity*.

Seligman HK, Laraia BA, Kushel MB. Food insecurity is associated with chronic disease among low-income NHANES participants. J Nutr 2010;140(2):304–10

Sharpe, D.L., Huston, S.J. and Finke, M.S. (2003). Factors Affecting Nutritional Adequacy Among Single Elderly Women. *Family Economics and Nutrition Review,* **15**(1), Pp. 74.

Shetty, P.S. (2002).Nutrition Transition in India.*Public Health Nutrition,* **5**(1a), Pp. 175-182.

Simon, G. (2004). Pathogenesis of Structural Vascular Changes In Hypertension. *Journal of Hypertension,* **22**(1), Pp. 3-10.

Sofi, F., Abbate, R., Gensini, G.F. and Casini, A. (2010). Accruing Evidence on Benefits Of Adherence To The Mediterranean Diet On Health: An Updated Systematic Review And Meta-Analysis. *The American Journal of Clinical Nutrition*, **92**(5), Pp. 1189-1196.

Solomons, N.W. (1997). Pitfalls and Experiences In Nutritional Research On The Elderly In Developing Countries. The Development Of A Protocol To Study The Interactions Of Nutrition, Aging, And Urbanization In Developing Countries: Cross-Cultural Research On The Nutrition Of Older Subjects. Food Nutr.Bull., 18(3).

Spigelski, D. (2004). Dietary Diversity and Nutrient Adequacy In Women Of Childbearing Age In A Peri-Urban Community In Senegal, West Africa. *Montreal, Canada, McgillUniversity.MasterOf Science,* [Online]. [Accessed 13 March 2013]

Steffen, L.M., Kroenke, C.H., Yu, X., Pereira, M.A., Slattery, M.L., Van Horn, L., Gross, M.D. and Jacobs, D.R., J. (2005). Associations of Plant Food, Dairy Product, and Meat Intakes With 15-Y Incidence Of Elevated Blood Pressure In Young Black And White Adults: The Coronary Artery Risk Development In Young Adults (Cardia) Study. *The American Journal of Clinical Nutrition,* **82**(6), Pp. 1169-77; Quiz 1363-4.

Steiner-Asiedu, M., Pelenah, S.J.M., Bediako-Amoa, B. and Danquah, A. (2010). The Nutrition Situation Of The Elderly In Ghana: A Case Study. *Asian Journal Of Medical Sciences,* **2**(3), Pp. 95-103.

Stott, D.And Bowman, A. (2000).Blood Pressure and Aging.*Journal of Human Hypertension,* **14**(12), Pp. 771-772.

Stroebele, N. And De Castro, J.M., 2004. Effect of Ambience on Food Intake and Food Choice.*Nutrition,* **20**(9), Pp. 821-838.

Tanumihardjo, S.A., Anderson, C., Kaufer-Horwitz, M., Bode, L., Emenaker, N.J., Haqq, A.M., Satia, J.A., Silver, H.J. and Stadler, D.D. (2007) Poverty, obesity, and malnutrition: an international perspective recognizing the paradox.*Journal of the American Dietetic Association* [online].107 (11), pp.1966-1972. [Accessed 10 September 2016]

Tayie, F., Adjetey-Sorsey, E., Armah, J., Busolo, D. and Imaya, E. (2004). Prevalence of UndernutritionAmong Elderly Persons In Accra. *Ghana Medical Journal*, **38**(2), Pp. 51-55.

Terry, D.F., Wilcox, M.A., Mccormick, M.A., Pennington, J.Y., Schoenhofen, E.A., Andersen, S.L. and Perls, T.T. (2004). Lower All-Cause, Cardiovascular, And Cancer Mortality In Centenarians' Offspring. *Journal of The American Geriatrics Society*, **52**(12), Pp. 2074-2076.

Tingay, R.S., Tan, C.J., Tan, N.C., Tang, S., Teoh, P.F., Wong, R. and Gulliford, M.C. (2003) Food insecurity and low income in an English inner city.*Journal of Public Health* [online]. 25 (2), pp.156-159.

Toffanello, E., Inelmen, E., Minicuci, N., Campigotto, F., Sergi, G., Coin, A., Miotto, F., Enzi, G. And Manzato, E., 2010. Ten-Year Trends In Dietary Intake, Health Status And Mortality Rates In Free-Living Elderly People. *The Journal of Nutrition, Health & Aging*, **14**(4), Pp. 259-264.

Toledo, E., Delgado-Rodríguez, M., Estruch, R., Salas-Salvadó, J., Corella, D., Gomez-Gracia, E., Fiol, M., Lamuela-Raventós, R.M., Schröder, H. and Arós, F. (2008). Low-Fat Dairy Products And Blood Pressure: Follow-Up Of 2290 Older Persons At High Cardiovascular Risk Participating In The Predimed Study. *British Journal of Nutrition,* **101**(1), Pp. 59-67.

Treas, J. and Logue, B. (1986). Economic Development and The Older Population. *Population And Development Review,* Pp. 645-673.

Trichopoulou, A., Kouris-Blazos, A., Wahlqvist, M.L., Gnardellis, C., Lagiou, P., Polychronopoulos, E., Vassilakou, T., Lipworth, L. and Trichopoulos, D. (1995). Diet and Overall Survival In Elderly People. *Bmj (Clinical Research Ed.),* **311**(7018), Pp. 1457-1460.

Trichopoulou, A., Orfanos, P., Norat, T., Bueno-De-Mesquita, B., Ocke, M.C., Peeters, P.H., Van Der Schouw, Y.T., Boeing, H., Hoffmann, K., Boffetta, P., Nagel, G., Masala, G., Krogh, V., Panico, S., Tumino, R., Vineis, P., Bamia, C., Naska, A., Benetou, V., Ferrari, P., Slimani, N., Pera, G., Martinez-Garcia, C., Navarro, C., Rodriguez-Barranco, M., Dorronsoro, M., Spencer, E.A., Key, T.J., Bingham, S., Khaw, K.T., Kesse, E., Clavel-Chapelon, F., Boutron-Ruault, M.C., Berglund, G., Wirfalt, E., Hallmans, G., Johansson, I., Tjonneland, A., Olsen, A., Overvad, K., Hundborg, H.H., Riboli, E. and Trichopoulos, D. (2005). Modified Mediterranean Diet and Survival: Epic-Elderly Prospective Cohort Study.*BMJ (Clinical Research Ed.),* **330**(7498), Pp. 991.

Tyson, J. and Mathers, J. (2007).Dietary and Genetic Modulation of DNA Repair in Healthy Human Adults.*Proceedings of the Nutrition Society,* **66**(1), Pp. 42-51.

UNFPA, H. (2012). Ageing in the twenty-first century: a celebration and a challenge. London: United Nations Population Fund. United Nations Population Fund/HelPage International. Available at : www.unfpa.org, www.helpage.org. [Accessed 20 November 2016]

United Nations World Population Prospects (2000). *The 2000 Revision: Highlights*, Population division, Department Of Economic and Social Affairs, New York, NY, USA, 2001, ESA/P/WP.165.

United Nations, World Population Prospects (2004).*The Revision Vol. I: Comprehensive Tables*, Population Division, Department of Economic and Social Affairs, New York, NY, USA.

United Nations, World Population Prospects (2006).*The 2006 Revision Vol. I: Comprehensive Tables*, Population Division, Department of Economic and Social Affairs, New York, NY, USA.

Van Rooyen, J., Kruger, H., Huisman, H., Wissing, M., Margetts, B., Venter, C. and Vorster, H. (2000). An Epidemiological Study of Hypertension and its Determinants In A Population In Transition: The Thusa Study. *Journal of Human Hypertension*, **14**(12), Pp. 779.

Waite, L.J.(2004). The demographic faces of the elderly.*Population and development review*, *30*(Supplement), p.3.

Wakimoto, P. And Block, G. (2001). Dietary Intake, Dietary Patterns, and Changes with Age: An Epidemiological Perspective. *The Journals of Gerontology Series A: Biological Sciences and Medical Sciences*, **56**(Suppl_2), Pp. 65-80.

Walker, D. And Beauchene, R.E., 1991. The Relationship Of Loneliness, Social Isolation, And Physical Health To Dietary Adequacy Of Independently Living Elderly. *Journal of The American Dietetic Association*, **91**(3), Pp. 300-304.

Wang, Y. and Lim, H. (2012). The Global Childhood Obesity Epidemic and the Association Between Socio-Economic Status And Childhood Obesity. *International Review of Psychiatry,* **24**(3), Pp. 176-188. [Online]. [Accessed 09 March 2013]

Wang, Y. and Lobstein, T., (2006). Worldwide Trends in Childhood Overweight And Obesity. *International Journal of Pediatric Obesity,* **1**(1), Pp. 11-25. [Online].

Wang, Y., YancyJr, W., Yu, D., Champagne, C., Appel, L. And Lin, P. (2008). The Relationship between Dietary Protein Intake And Blood Pressure: Results From The Premier Study. *Journal Of Human Hypertension,* **22**(11), Pp. 745.

Wardlaw, G. M., (2003). *Contemporary Nutrition: Issues and Insights*. McGraw-Hill.

Waxman, A. (2004). WHO's global strategy on diet, physical activity and health: response to a worldwide epidemic of non-communicable diseases.*Scandinavian Journal of Nutrition, 48*(2), pp.58-60.

Wellman, N.S. And Kamp, B., 2008. Nutrition in Aging.*Mahan And Lk And Escott Stump S.Krauer's Food, Nutrition And Diet Therapy.12th Ed.Philadelphia, Pennsylvania: W B.Saunders Company, .*

Westenhoefer, J. (2005). Age and Gender Dependent Profile of Food Choice.*Diet Diversification and Health Promotion.*Karger Publishers, Pp. 44-51.

Willows, N.D., Veugelers, P., Raine, K. and Kuhle, S. (2009) Prevalence and Sociodemographic Risk Factors Related To Household Food Security In Aboriginal Peoples In Canada. *Public Health Nutrition* [Online].12 (8), Pp.1150.

Wood, R.J., Suter, P.M. And Russell, R.M. (1995).Mineral Requirements of Elderly People.*The American Journal of Clinical Nutrition,* **62**(3), Pp. 493-505.

World Food Progrmme. (2008). Technical Guidance Sheet - Food Consumption Analysis: Calculation and Use of the Food Consumption Score in Food Security Analysis Available *at: http://documents.wfp.org/stellent/groups/public/documents/manual_guide_proced/wfp197216.pdf?_ga=2.209141138.1258113078.1503563890-592355874.1493311784*[Accessed 15 May 2017]

World Health Organisation.(2007). Nutrition for Older Persons. Geneva, Switzerland: World

World Health Organisation.(2010). Micronutrients [Online]. Available at: http://www.Who.Int/Nutrition/Topics/Micronutrients/En/ [Accessed 19 November 2016].

World Health organization (2013).Obesity and Overweight.Http://Www.Who.Int/Topics/Obesity/En [Accessed 11 October 2016]

World Health Organization. (1992). International Conference on Nutrition: Final Report of The Conference, Rome, December 1992.

World Health Organization. (1995). Physical Status: The use of and Interpretation of Anthropometry, Report ao A Who Expert Committee.

World Health Organization.(1999). International Society of Hypertension.1999 World Health Organization-International Society of Hypertension Guidelines for the Management of Hypertension.Guidelines Subcommittee.*J Hypertens*, **17**(2), Pp. 151-183.

World Health organization. (2000). Obesity: Preventing and Managing the Global Epidemic.

World Health Organization.(2002). Globalization, Diets and Noncommunicable Diseases.*Dietary Transition in Developing Countries: Challenges for Chronic Disease Prevention .Geneva.*

World Health Organization.(2005).Clinical Guidelines for the management of hypertension.EMRO Technical Publications series 29.[Accessed 19 November 2016].

World Health Organization.(2008). Causes of Death 2008 [Online Database]. Geneva: World Health Organization. Available at: http ://www.who.int/healthinfo/global_burden_disease/cod_2008_sources_methods.pdf. [Accessed 19 November 2016].

World Health Organization.(2011). *Global status report on noncommunicable diseases 2010*. Geneva: World Health Organization.

World Health Organization.(2013). Global Brief on Hypertension; World Health Day, 2013.Who, Geneva.

Wu, Y., Huxley, R., Li, L., Anna, V., Xie, G., Yao, C., Woodward, M., Li, X., Chalmers, J., Gao, R., Kong, L., Yang, X., China Nnhs Steering Committee and China Nnhs Working Group. (2008). Prevalence, Awareness, Treatment, And Control Of Hypertension In China: Data From The China National Nutrition And Health Survey 2002. *Circulation*, **118**(25), Pp. 2679-2686.

Wunderlich, G.S. and Norwood, J.L. (2006).*Food Insecurity and Hunger in the United States: An Assessment of The Measure*. National Academies Press Washington, Dc. [Online]. [Accessed 06 March 2013]

Zunzunegui, M., Alvarado, B.E., Del Ser, T. and Otero, A. (2003). Social Networks, Social Integration, and Social Engagement Determine Cognitive Decline in Community-Dwelling Spanish Older Adults. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences,* **58**(2), Pp. S93-S100.

APPENDICES

Appendix 1 Questionnaire

QUESTIONNAIRE ON DIETARY PATTERNS AND THEIR CORRELATION WITH HYPERTENSION AMONG THE AGED

INTRODUCTION

Please read carefully and indicate your answers in the provided boxes by ticking (x or ✓)

ID Number.....

Location.....

SECTION 1: DEMOGRAPHIC CHARACTERISTICS OF RESPONDENTS.

1. Sex: Male( ) Female( )

2. Age category: 55-59( ) 60-64( ) 65-69( ) 70^{+}( )

3. Marital status: Single( ) Married ( ) Divorced( ) Widowed( )

4. Religion: Christian( ) Muslim( ) Traditionalist( ) Other( )

Specify……

SECTION 2: SOCIO-ECONOMIC CHARACTERISTICS

4. Educational Level: None( ) Basic( ) GCSE/SSCE( ) Above GCSE/SSCE( )

5. Employment status: Employed( ) Unemployed( )

6. Nature of occupation: Health( ) Education( ) Trade/sale( ) Office related( )

Field related( ) Manpower/manual related( ) Other( )(specify) ..……..

7. Locality: Urban( ) Rural( ) Peri- urban( )

SECTION 3: Health Status

8. Physiological status: History of high blood pressure: Yes( ) No( )

9. History of other Cardiovascular related disease: Yes( ) No( )

9. If yes, how many years/months have you known your High Blood Pressure Status?

1-6 Months( ) 7-12 months( ) 1-2 years( ) 2-5 years( ) 5 years and above( ).

10. Do you have a relative who has BP/CVD related diseases? Yes( ) No( )

Don't know( ).

Section 4: Life style and Habits

Smoking Habits

11. Do you smoke? Yes( ) No( )

12. If No, have you ever smoked before? Yes( ) No( )

13. If Yes, How often do you smoke? Daily( ) weekly( ) monthly( )

14. How many sticks do you smoke whenever you engage in smoking? 1( ) 2( ) 3( ) 4 and above( ).

15. How do you smoke? Filter tipped cigarettes( ) Plain or un-tipped cigarette( ) Hand rolled( )

16. If you ever smoked but have stopped, how long ago did you stop smoking? Less than 6 months( ) 6months to 1 year( ) 1-2 years( ) above 2 years( )

Drinking habits

17. Do you drink alcohol? Yes( ) No( )

18. If No go to question 21.

19. If Yes how long? 1 year( ) 2 years( ) 3 years( ) 4 years( ) 5 and above years( )

20. How frequent do you drink? Daly( ) 3-4 days a week( ) 5-6days a week( ) Once or twice a week( ) Once or twice a month( ) Once or twice a year( )

21. If No Have you ever indulged in drinking alcohol? Yes( ) No( )

22. If yes how often? Daily( ) 3-4- days a week( ) 5-6 days a week( ) Once or twice a week( ) Once or twice a month( ) Once or twice a year( )

23. What type of drink do you take or did you take in the past? Normal strength beer [star, Guinness, etc.] ( ) Strong beer [spirits, liquor] ( ) Other alcoholic drinks [eg; Wine, Smirnoff, Pito, etc] ( )

24. Quantity of drinks taken at a sitting: 1-2 Pints( ) 2 and above pints( ) 1-2 small cans( ) above 2 small cans( ) 1-2 large cans( ) above 2 large cans( ) 1-2 standard bottle( ) above 2 standard bottles( ) 1-2 glass of Wine( ) above 2 glass of wine( ).

Physical activity level

25. Do you undertake any physical activity? Yes( ) No( )

26. How does your activity look like? Commuting on foot( ) Running/Jogging( ) Press ups( ) machine activity/cycling( ) Other( ) (specify)……..……..

27. What is the intensity of your activity? Usually not becoming out of breath or sweating( ) Becoming out of breath and sweating slightly( ) Becoming out of breath and sweating considerably( )

28. How frequent is your activity? Daily( ) Once a week( ) 2-3 times a week( ) 4-5 times a week( ) Once a month( ).

29. What is the average duration of your activity or single exercise? Under 20 minutes( ) 20 -40 minutes( ) 40-60 minutes( ) above 60 minutes( ).

Dietary Pattern/Habits

26.How many times do you eat in a day? Once( ) twice( ) three times( ) above three times( )

27. What times do you normally eat? 6-8am( ) 9-11( ) 12-2( ) 2-4( ) 5-7( ) 7-9( ) 9-10( ) above 10( ).

28. Do you take any soft drinks (e.g. Coke, fanta etc.)? Yes ( ) No( )

29. How often do you drink such items? Daily( ) 3-4days a week( ) 5-6 days a week( ) Once or twice a week( ) Once or twice a month( ) Once or twice a year( ) Occasionally( ).

30. Do you take any fast food? Yes( ) No( )

31. If yes, How often? Daily( ) 3-4days a week( ) 5-6 days a week( ) Once or twice a week( ) Once or twice a month( ) Once or twice a year( ) Occasionally( )

32. What has always been your most predominant food taken all the time? [Tick as many that apply]. Starches [cereals, tubers] ( ) Fruits( ) Vegetables( ) Milk and milk products( ) Meat and Meat Products( ) Fats and Oils( )

33. What has been the main factor (s) influencing the kind of food you take? Regular habit( ) Sickness/health reasons( ) Economic/financial reasons( ) Travelling( ) On a special day/occasion( ) Too busy( ) Dieting( ) Bored or stressed( ) Don't know( ) Cultural reasons( ) Some other reason (specify)……

Appendix 2 Food Consumption Score Sheet

Date:……

NAME:
TIME:
IDENTIFICATION NUMBER:

DIRECTIONS:
The questionnaire is to assess the number of times of energy dense foods, high fats foods, foods rich in fibres and processed foods you have consumed over the past 6 months. Where possible provide one answer to a question

Meal consumed	codes	1 time	2 to 3 times	4 to 7 times	1-2 times	3-6 times	Once (1) time	2-7 times	occasionally	never
		week			2 weeks		month			
Energy dense foods										
Banku	A1									
Plantain ampesi	A2									
Fufu	A3									
Yam ampesi	A4									
Kenkey	A5									
Plain rice	A6									
Tuozaafi(de3huo)	A7									
Waakye	A8									
Jollof rice	A9									
Fried ripe plantain and beans stew	A10									

Glycemic foods										
Fruit drinks (ceres,lucozade orange drink	B1									
Soft drinks(coke ,fanta sprite)	B2									
Cowbell Coffee tea	B3									
Royal cocoa powder	B4									
Milo	B5									
White/ tea bread	B6									
Fibre foods										
Maize porridge(hausa or akankooko)	C1									
Wheat/millet porridge	C2									
Cereals oat	C3									
Tom brown	C4									
Wheat bread	C5									
Vegetables										
Carrot	D1									
Kontomire	D2									
Garden eggs	D3									
Kwansosaa (abedru)	D4									
Tomatoes	D5									
Green or red pepper	D6									
Lettuce	D7									
Fruits										
Pawpaw	E1									
Watermelon	E2									
Orange	E3									
Banana	E4									
Fat and oil										

Fried egg	F1									
fried/smoke fish	F2									
Salmon/frozen fish	F3									
Herrings	F4									
Milk (powder/liquid)	F5									
Palm oil	F6									
Vegetable oil (frytol)	F7									
Meat (goat, cow, sheep)	F8									
Chicken(boiled or fried)	F9									
Koose, masa	F10									
Boiled egg	F11									
Sausage	F12									
Soup/ stew										
Palm nut soup	G1									
Groundnut soup	G2									
Tomatoes stew	G3									
Light soup	G4									
Vegetable(carrot,spring onion, cabbage) stew	G5									
Processed foods										
Sardines	H1									
Canned tin fish (tuna, mackerel,obaapa, vega)	H2									
Spaghetti/ indomie	H3									

NB: I kindly request you list any food you have consumed which does not appear on the food table

……

……

THANK YOU

Appendix 3 Summaries of Analysis Conducted.

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	74	37.4	37.4	37.4
	female	124	62.6	62.6	100.0
	Total	198	100.0	100.0	

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	55-59	41	20.7	20.7	20.7
	60-64	46	23.2	23.2	43.9
	65-69	34	17.2	17.2	61.1
	70+	77	38.9	38.9	100.0
	Total	198	100.0	100.0	

Educational level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	none	106	53.5	53.5	53.5
	basic	77	38.9	38.9	92.4
	SSCE	7	3.5	3.5	96.0
	Above ssce	7	3.5	3.5	99.5
	missing	1	.5	.5	100.0
	Total	198	100.0	100.0	

Employment status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	employed	190	96.0	96.0	96.0
	unemployed	8	4.0	4.0	100.0
	Total	198	100.0	100.0	

Nature of Occupation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	education	6	3.0	3.0	3.0
	trade/sale	31	15.7	15.7	18.7
	office related	1	.5	.5	19.2
	manpower/manual	137	69.2	69.2	88.4
	other	19	9.6	9.6	98.0
	misssing	4	2.0	2.0	100.0
	Total	198	100.0	100.0	

Urban or rural

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	urban	132	66.7	66.7	66.7
	rural	66	33.3	33.3	100.0
	Total	198	100.0	100.0	

History of High BP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	49	24.7	24.7	24.7
	no	149	75.3	75.3	100.0
	Total	198	100.0	100.0	

Place of stay

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yamfo	53	26.8	26.8	26.8
	Ahyiam	19	9.6	9.6	36.4
	Susuanso	30	15.2	15.2	51.5
	Tanoso	29	14.6	14.6	66.2
	Nkwanta	50	25.3	25.3	91.4
	Ansin	17	8.6	8.6	100.0
	Total	198	100.0	100.0	

History of other CVD

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	12	6.1	6.1	6.1
	no	186	93.9	93.9	100.0
	Total	198	100.0	100.0	

Do you smoke

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	13	6.6	6.6	6.6
	no	185	93.4	93.4	100.0
	Total	198	100.0	100.0	

Do you drink

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	41	20.7	20.7	20.7
	no	157	79.3	79.3	100.0
	Total	198	100.0	100.0	

Blood pressure level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	normal	87	43.9	43.9	43.9
	High	91	46.0	46.0	89.9
	mild	20	10.1	10.1	100.0
	Total	198	100.0	100.0	

Food Consumption Score

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Poor (0-28)	25	12.6	12.6	12.6
	Border line (28.5-42)	54	27.3	27.3	39.9
	Acceptable (Above 42)	119	60.1	60.1	100.0
	Total	198	100.0	100.0	

BMI Values

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	underweight	15	7.6	7.6	7.6
	normal	124	62.6	62.6	70.2
	overweight	39	19.7	19.7	89.9
	obese	20	10.1	10.1	100.0
	Total	198	100.0	100.0	

Do you undertake any physical activity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	193	97.5	97.5	97.5
	no	2	1.0	1.0	98.5
	missing	3	1.5	1.5	100.0
	Total	198	100.0	100.0	

Which factors influence your choice of food

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Regular habit	172	86.9	87.8	87.8
	Sickness/health reasons	5	2.5	2.6	90.3
	economic/inancial reasons	15	7.6	7.7	98.0
	missing	4	2.0	2.0	100.0
	Total	196	99.0	100.0	
Missing	System	2	1.0		
Total		198	100.0		

What times do you eat

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	6-8/12-2/5-7 good	25	12.6	12.6	12.6
	6-8/12-2/7-9/ not good	93	47.0	47.0	59.6
	anything either than the above not good	76	38.4	38.4	98.0
	missing	4	2.0	2.0	100.0
	Total	198	100.0	100.0	

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	12.777[a]	4	.012
Likelihood Ratio	10.599	4	.031
Linear-by-Linear Association	2.442	1	.118
N of Valid Cases	198		

a. 1 cells (11.1%) have expected count less than 5. The minimum expected count is 2.53.

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.155[a]	6	.165
Likelihood Ratio	9.046	6	.171
Linear-by-Linear Association	.043	1	.835
N of Valid Cases	198		

a. 3 cells (25.0%) have expected count less than 5. The minimum expected count is 3.43.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.036[a]	2	.007
Likelihood Ratio	10.166	2	.006
Linear-by-Linear Association	3.641	1	.056
N of Valid Cases	198		

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 4.95.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	6.575[a]	2	.037
Likelihood Ratio	7.890	2	.019
Linear-by-Linear Association	5.307	1	.021
N of Valid Cases	198		

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 1.21.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.487[a]	2	.014
Likelihood Ratio	8.382	2	.015
Linear-by-Linear Association	.006	1	.939
N of Valid Cases	198		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.67.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.570[a]	2	.752
Likelihood Ratio	.530	2	.767
Linear-by-Linear Association	.031	1	.861
N of Valid Cases	198		

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 1.31.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.030[a]	2	.220
Likelihood Ratio	2.743	2	.254
Linear-by-Linear Association	.593	1	.441
N of Valid Cases	198		

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 4.14.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.599[a]	4	.463
Likelihood Ratio	4.522	4	.340
Linear-by-Linear Association	.015	1	.904
N of Valid Cases	198		

a. 6 cells (66.7%) have expected count less than 5. The minimum expected count is .20.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.844[a]	6	.933
Likelihood Ratio	2.077	6	.912
Linear-by-Linear Association	.302	1	.583
N of Valid Cases	198		

a. 6 cells (50.0%) have expected count less than 5. The minimum expected count is .20.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.093[a]	6	.168
Likelihood Ratio	10.106	6	.120
Linear-by-Linear Association	.216	1	.642
N of Valid Cases	198		

a. 4 cells (33.3%) have expected count less than 5. The minimum expected count is .40.

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	4.662[a]	6	.588
Likelihood Ratio	4.811	6	.568
Linear-by-Linear Association	1.545	1	.214
N of Valid Cases	198		

a. 3 cells (25.0%) have expected count less than 5. The minimum expected count is 1.52.

Parameter Estimates

Blood pressure level[a]		B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
								Lower Bound	Upper Bound
High	Intercept	-.575	.321	3.204	1	.073			
	[FCS=.00]	-.260	.531	.240	1	.624	.771	.272	2.183
	[FCS=1.00]	-.440	.359	1.497	1	.221	.644	.318	1.303
	[FCS=2.00]	0[b]	.	.	0	.	.	.	.
	[Locality=.00]	.700	.342	4.191	1	.041	2.013	1.030	3.933
	[Locality=1.00]	0[b]	.	.	0	.	.	.	.
	[HHBP=.00]	1.165	.379	9.429	1	.002	3.205	1.524	6.739
	[HHBP=1.00]	0[b]	.	.	0	.	.	.	.
mild	Intercept	-1.668	.484	11.855	1	.001			
	[FCS=.00]	1.790	.654	7.480	1	.006	5.989	1.661	21.598
	[FCS=1.00]	.481	.610	.622	1	.430	1.617	.489	5.344
	[FCS=2.00]	0[b]	.	.	0	.	.	.	.
	[Locality=.00]	-.755	.519	2.111	1	.146	.470	.170	1.301
	[Locality=1.00]	0[b]	.	.	0	.	.	.	.
	[HHBP=.00]	.409	.648	.398	1	.528	1.505	.423	5.360
	[HHBP=1.00]	0[b]	.	.	0	.	.	.	.

a. The reference category is: normal

b. This parameter is set to zero because it is redundant.

Blood pressure level * Food Consumption Score Crosstabulation

			Food Consumption Score			Total
			Poor (0-28)	Border line (28.5-42)	Acceptable (Above 42)	
Blood pressure level	normal	Count	9	27	51	87
		% within Food Consumption Score	36.0%	50.0%	42.9%	43.9%
	High	Count	9	21	61	91
		% within Food Consumption Score	36.0%	38.9%	51.3%	46.0%
	mild	Count	7	6	7	20
		% within Food Consumption Score	28.0%	11.1%	5.9%	10.1%
Total		Count	25	54	119	198
		% within Food Consumption Score	100.0%	100.0%	100.0%	100.0%