KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI GHANA

COLLEGE OF HEALTH SCIENCES SCHOOL OF PUBLIC HEALTH DEPARTMENT OF HEALTH PROMOTION AND EDUCATION

ASSESSMENT OF RISK FACTORS FOR HYPERTENSION IN DORMAA MUNICIPALITY (GHANA)

BY

FIDELIS ATIBILA

(MPH- HEALTH PROMOTION AND EDUCATION)

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A THESIS SUBMITTED TO THE DEPARTMENT OF HEALTH PROMOTION AND EDUCATION, COLLEGE OF HEALTH SCIENCES, SCHOOL OF PUBLIC HEALTH IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF PUBLIC HEALTH DEGREE IN HEALTH PROMOTION AND EDUCATION

DECLARATION

I hereby declare that this submission is my own work towards a Master of Public Health Degree (MPH) and that, to the best of my knowledge, it contains no material previously published by another person, nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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Dr. Ellis Owusu-Dabo

(Supervisor)

Signature ……………………………………………………….

Name…………………………………………………………….

(Head of Department)

DEDICATION

I dedicate this work to my parents and all well wishes for their support and investment in my education.

ACKNOWLEDGEMENT

My profound gratitude goes to the Almighty God for his protection and guidance throughout this work. My greatest appreciation goes to Dr. Ellis Owusu-Dabo my supervisor for his patience and guidance throughout this piece of work. I also wish to acknowledge all other members of faculty in the school of public Health for their invaluable contribution to my education, encouragement and advice throughout the course of this study. I would also like to extend my heartfelt thanks to Emmanuel Timmy Donkoh who gave me invaluable advice with data collection and analysis.

Finally, I unreservedly wish to extend my words of appreciation to the respondents for their time and enormous cooperation during the study. And my special tribute is accorded to all those who supported me physically and emotionally during the writing of this dissertation and making it a success. GOD RICHLY BLESS YOU ALL.

LIST OF ABBREVIATIONS

AIDS	-	Acquired Immune Deficiency Syndrome
BP	-	Blood Pressure
CHRPE	-	Committee for Human Research, Publication and Ethics
CVD	-	Cardiovascular Disease
GDP	-	Gross Domestic Product
GHS	-	Ghana Health Service
HIV	-	Human Immunodeficiency Virus
ISH	-	International Society for Hypertension
KATH	-	KomfoAnokye Teaching Hospital
KNUST	-	Kwame Nkrumah University of Science and Technology
LMIC	-	Lower and Middle-Income Countries
NCD	-	Non Communicable Diseases
NHIS	-	National Health Insurance Scheme
PPS	-	Probability Proportional to size
SMS	-	School of Medical Sciences
SSA	-	Sub-Saharan Africa
STEPS	-	STEPwise approach to Surveillance
WHO	-	World Health Organization

WHSA	-	Women‘s Health Study of Accra

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ABSTRACT

Hypertension is an important public health challenge worldwide and is the single most important risk factor for cardiovascular disease. As life expectancy rates improve in Ghana and prevalence of risk factors increase, the burden of non-communicable diseases such as hypertension are also expected to increase. However, little is known about the specific factors that dispose Ghanaians to greater risk of hypertension. A cross-sectional study was conducted in the Dormaa municipality using the WHO STEPwise approach to investigate risk factors for hypertension. Study participants were recruited by probability proportional sampling techniques. In all, 202 males and 198 females participated in this study. The mean age of the participants was 50.06 years (95% CI: 48.46-51.66). In all, 40% of all participants in this study had an elevated BP (BP ≥ 140/90mmHg). Further, the rate of isolated systolic hypertension was 11.2% among the study population (12.9% in males and 9.6% among females). Risk factors as measured in the population were advancing age above 45 years (OR = 2.745, CI 1.20 – 6.30, P = 0.017), gender (44.6% males versus 35.4% females with elevated BP, male OR = 0.492, CI 0.28 – 0.86, P = 0.012) and tobacco use (OR = 2.66, CI 1.41 – 5.04, P = 0.003).Males reported a higher mean number of fruit (P = 0.036) and vegetable servings than females (*P* = 0.009) and spend more time each day on physical activities compared to females (*P* = 0.000). The results of the present study provide useful data on hypertension prevalence and associated risk factors in Dormaa and the Brong Ahafo region. To be able to control hypertension in the Municipality, health practitioners and policy makers should focus on these modifiable risk factors if any success is to be achieved.

CHAPTER ONE

INTRODUCTION

1.0 Background of the study

Many Lower and Middle-Income Countries (LMIC) have entered, or are entering, what has been termed the ‗epidemiologic transition' (CIHR, 2013). Along with lifestyle changes, environmental hazards and an increase in life expectancy, the epidemiologic transition has caused an elevated rate of non-communicable diseases (NCDs) globally and especially in developing countries. The World Health Organization (WHO) Global Burden of Disease Project , and more recently the WHO 2005 Chronic Disease Report (WHO, 2005b) have all demonstrated that such countries are experiencing an increase in cardiovascular disease (CVD) and other non-communicable diseases, such that 80% of global CVD-related deaths and 87% of CVD-related disabilities now occur in LMIC. In industrialized countries, the risk of becoming hypertensive during a lifetime exceeds 90%.

Hypertension has been recognised as the leading risk factor for mortality worldwide and the third leading risk factor for global burden of disease after tobacco and alcohol (Ezzati *et al.*, 2002a). However, almost three-quarters of people with hypertension (639 million people) live in developing countries with limited health resources and where people have a very low awareness of hypertension and poor blood pressure control (WHO, 2002; WHO, 2005a). Furthermore, the prevalence of hypertension is increasing and is predicted to grow by more than 500 million by 2025 (Fuentes *et al.*, 2000; Kearney *et al.*, 2005). That means almost three-quarters of people with hypertension will be living in developing countries (Kearney *et al.*, 2005). As late as 1940, hypertension was almost non-existent in non-developed populations—example, a prevalence of 1·8% was reported in Ethiopian rural villages at this time (Zein and Assefa, 1986). Hypertension in areas where it was once rare is emerging as a serious health disorder. Prevalence has risen throughout the past four decades to a rate similar to and sometimes exceeding that in many developed countries example, hypertension prevalence in Venezuelan men is 45·2% (Kearney *et al.*, 2005). In South Africa, the risk of death from high blood pressure has increased by 25% in less than a decade (Mayosi, 2007). In India, prevalence of hypertension has increased by 30 times in urban populations over 25 years, and by 10 times in rural populations over 36 years (Padmavati, 2002). Serial surveys done in Tanzania with the same methods in 1987 and 1998 showed an increase in prevalence of hypertension from 25·4% to 41·1% in males and from 27·2% to 38·7% in females for rural and urban populations (Edwards *et al.*, 2000).

Hypertension has gradually and progressively become an important public health problem in Ghana, even in the poorest rural communities. Like in most developing countries, it has no demographic indices comparable to developed countries where hypertension has been a major problem for years: In 2000 Ghanaians had a life expectancy at birth of 55 years for males and 60 years for females (GSS *et al.*, 2009). Per capita total health expenditure as a percentage of GDP was 4.5% in 2003. Fifty eight percent of the population lives less than 30 minutes of a public or private health facility, with geographical access being considerably better in the urban (78.5%) than in the rural populations (42.3%) (GSS, 2004).

Several decades ago, a survey conducted in a village about 60 miles from Accra found that only 5.5% of the village inhabitants had cardiovascular diseases (Colbourne *et al.*, 1950). Since then the picture has remarkably worsened. Nearly one quarter of the deaths in Mamprobi, Accra over the 1975-1980 period was due to cardiovascular diseases (Chukwuemeka *et al.*, 1982). Recently, the number of reported new cases of hypertension in outpatient public health facilities in Ghana increased more than ten-fold from 49,087 in 1988 to 505,180 in 2007 (GHS, 2008a). Over the same period, hypertension relative to the total reported outpatient diseases increased from 1.7% to 4.0% in all ages.

1.1 Problem statement

Hypertension is the commonest risk factor for cardiovascular diseases such as heart failure, stroke, and ischemic heart disease. In most regions in Ghana, hypertension ranks as the fifth commonest cause of outpatient morbidity. However, in the Greater Accra Region, hypertension moved from fourth to become second to malaria as the leading cause of outpatient morbidity in 2007 (GHS, 2008b). Although the incidence of cardiovascular diseases is rising, it appears that only a few population based studies have been carried out in Ghana using standardized methods. However, reasons for the increasing prevalence and poor control of hypertension need to be empirically examined, and approaches to prevent and improve control should be identified to boost the national agenda of controlling hypertension and other related cardiovascular diseases.

According to reports of the Dormaa Municipal Health Directorate, there appear to be an increase in the prevalence of hypertension in the Dormaa Municipality. The factors accounting for this rise is yet to be researched into. However, in order to target hypertension for control, one needs to understand the risk factors prevalent in the community. This study therefore sought to elucidate the risk factors for hypertension in the Dormaa Municipality to provide the basis for control interventions.

1.2 Rationale of study

High blood pressure has several preventable risk factors such as smoking, poor diet, high alcohol consumption, pre-hypertension, sedentary lifestyle, and obesity (Sadeghi-Bazargani *et al.*, 2011). But reliable evidence is the keystone for any disease prevention plan to be initiated. The introduction of a National Health Insurance Scheme (NHIS) in March 2005 was intended to reduce financial barriers to treatment and management of hypertension and as such presented an exciting opportunity in terms of reducing the burden of hypertension in

Ghana. Before then, several studies in Ghana revealed that the treatment and control of hypertension was low (Amoah, 2003b; Agyemang *et al.*, 2006). Several years on, population studies like this are necessary to evaluate the veracity of the NHIS promise and find ways to deal with emerging challenges in the prevention and management of the disease.

In this study we will carry out a risk factor investigation based on the World Health Organization (WHO) STEPwise approach to Surveillance (STEPS) to contribute the necessary reliable evidence for effective health policy interventions in Ghana. Thus, in contrast to previous studies, the data generated from this study can be easily appreciated and will be relevant within a broad international context.

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1.3 Conceptual framework/hypothesis

We hypothesize that BMI and Blood pressure are associated with socio-behavioural factors. These socio-behavioural factors may be confounded by demographic characteristics. Some of these socio-behavioural factors are modifiable and if identified, could influence policy by clarifying key messages and target groups for education on prevention of overweight and hypertension in low income settings

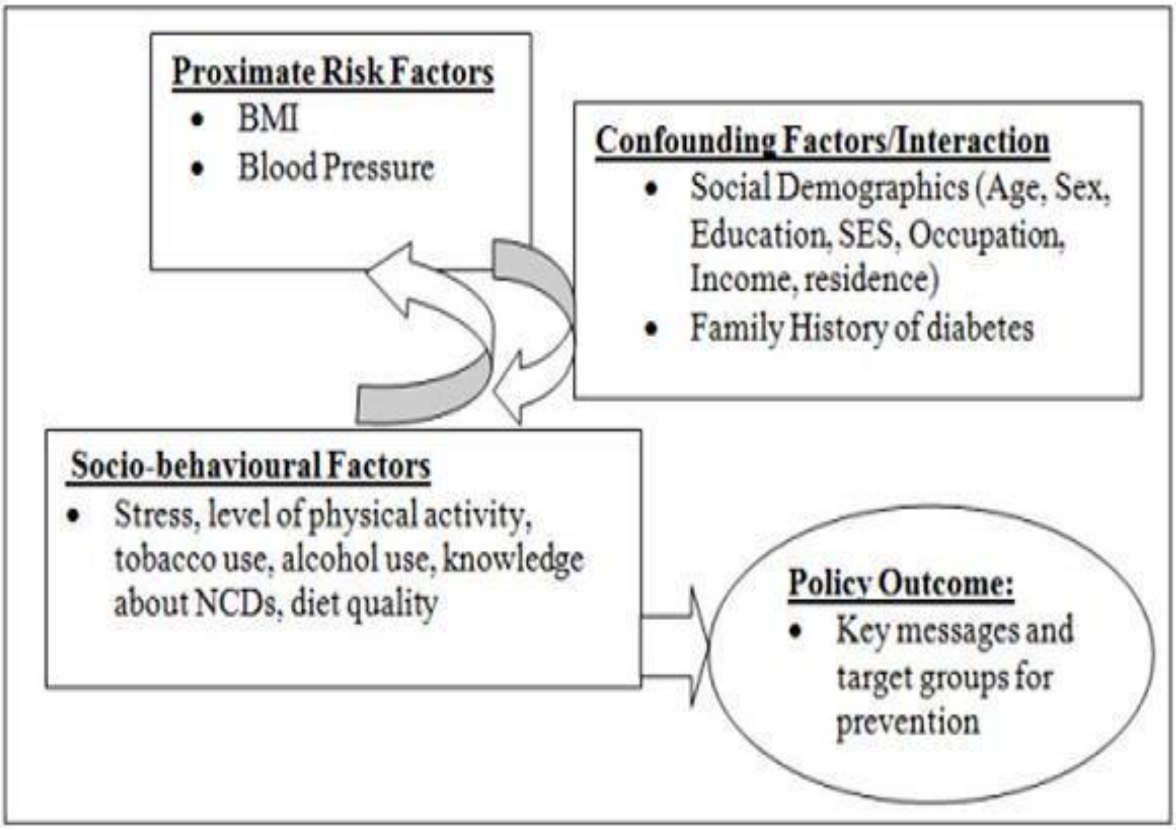

Figure 0-1: Conceptual framework on socio-behavioural factors likely associated with BMI and blood pressure. Source: (Mayega *et al.*, 2012).

1.4 Research questions

The study was guided by the following research questions.

1. What is the prevalence of hypertension within the Dormaa Municipality?

2. How does prevalence vary by socio-demographic characteristics?

3. What are the risk factors for hypertension in the study population?

1.5 General objective

The main objective of this study is to assess risk factors associated with hypertension in Dormaa Municipality based on the WHO Stepwise approach to Surveillance (STEPS) as a basis for primary disease prevention.

1.6 Specific Objectives:

1. To investigate the prevalence of hypertension in Dormaa Municipality.
2. To determine lifestyles that contributes to risk of developing hypertension.
3. To identify socio-economic factors associated with hypertension.
4. To use findings to make recommendations to the municipal health directorate and other stake holders for intervention.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

In Ghana, hypertension is also known as the white man‘s disease. Not in the very least because it is often linked with behavioural habits and lifestyles that are very much conceived to be western. Only until very recently, has the disease become a source of worry to the developing world and countries like Ghana. Essentially, the underlying risk factors leading to hypertension can help to explain why populations in developing economies are experiencing a greater surge of risk of developing hypertension than are others (Ibrahim and Damasceno, 2012).

2.1 Brief History of Hypertension

In 1931, Paul Dudley White postulated that the increase in blood pressure was essential (or compensatory) to guarantee adequate perfusion of the target organs (White, 1931). At that time, his view summarized the confusion among experts on the subject. Regrettably, this misconception lingered in published work until a few years ago. Today, after much contrary evidence this view is regarded as a common misconception about the clinical significance of essential hypertension. In fact, by 1967 several pieces of evidence had come together to shape our present understanding. Notably, results of the famous Veterans‘ Administration Studies (VAS) attested to the benefits of antihypertensive treatment (VAS, 1967; VAS, 1970). Since then, findings of many trials have shown unequivocally that lowering blood pressure reduces cardiovascular morbidity and mortality for hypertension of all degrees of severity and even in high-risk normotensive individuals (Messerli *et al.*, 2007).

2.2 Types of Hypertension

The normal level for blood pressure is below 120/80, where 120 represent the systolic measurement (peak pressure in the arteries) and 80 represents the diastolic measurement (minimum pressure in the arteries). Blood pressure between 120/80 and 139/89 is called prehypertension (to denote increased risk of hypertension), and a blood pressure of 140/90 or above is considered hypertension. Hypertension, also referred to as high blood pressure, is a condition in which the arteries have persistently elevated blood pressure. Hypertension may be classified as essential or secondary. Essential hypertension is the term for high blood pressure with unknown cause. It accounts for about 95% of cases. Secondary hypertension is the term for high blood pressure with a known direct cause, such as kidney disease, tumours, or birth control pills.

2.3 Essential Hypertension

Essential hypertension can be defined as a rise in blood pressure (blood pressure >140/90 mm Hg) of unknown cause that increases risk for cerebral, cardiac, and renal events (Messerli *et al.*, 2007). Essential, primary, or idiopathic hypertension is a case of high BP in which secondary causes such as renovascular disease, renal failure, pheochromocytoma, aldosteronism, or other causes of secondary hypertension or mendelian forms (monogenic) are not present (Carretero and Oparil, 2000). Essential hypertension is a heterogeneous disorder, with different patients having different causal factors that lead to high BP. Essential hypertension usually clusters with other cardiovascular risk factors such as ageing, being overweight, insulin resistance, diabetes, and hyperlipidemia (Messerli *et al.*, 2007).

2.4 Non-essential Hypertension

Non-essential hypertension therefore is elevated blood pressure secondary to other known causes such as renovascular disease, renal failure, pheochromocytoma, aldosteronism, or mendelian forms (monogenic)

2.5 Diagnosis

The recommended practice for evaluating a patient for hypertension is to determine baseline BP; assess the presence and extent of target organ damage and concomitant CVD; screen for potentially curable specific causes of hypertension (secondary hypertension); identify hypertensinogenic factors and other CVD risk factors; and characterize the patient to facilitate the choice of therapy (especially drug selection) and define prognosis (Carretero and Oparil, 2000).

2.6 BP Measurement and Challenges

Diagnosis and treatment of hypertension hinges on correct measurement of blood pressure (Messerli *et al.*, 2007). Therefore the accurate and reproducible measurement of BP by the cuff technique is the most important part of the diagnostic evaluation and follow-up of the patient and should be carried out in a standardized fashion with the use of properly calibrated and certified equipment (Black *et al.*, 1991; Prisant *et al.*, 1995; JNC, 1997). For this purpose, the mercury sphygmomanometer is preferred for an unsurpassed accuracy and more reliable investigation (Tholl *et al.*, 2004), acceptable alternatives include a recently calibrated aneroid manometer or validated auscultatory or oscillometric semiautomatic devices attached to an arm cuff. However, it must be noted that the reliability of wrist blood pressure measurements with oscillatory devices is limited (Rogers *et al.*, 1999; Zweiker *et al.*, 2000).

Diagnosis of hypertension should be based ideally on several blood-pressure measurements taken on separate days, as stated in guidelines (European Society of Hypertension-European

Society of Cardiology Guidelines, 2003). At each visit, two or 3 measurements should be taken and at least 2 minutes should be allowed between readings. The diastolic reading is taken at the level when sounds disappear (Korotkoff phase V). However, the procedure has barely seen any evolution or improvement beyond what Korotkoff introduced 100 years ago (Korotkoff, 1905). Consequently, this seemingly simple procedure is wrought with many inadequacies. As Kaplan noted: ―The measurement of [blood pressure] is likely the clinical procedure of greatest importance that is performed in the sloppiest manner.‖(Kaplan, 1998) For example, home blood-pressure measurement permits identification of so-called whitecoat hypertension (see next section) correlates better than blood-pressure values measured in the doctor‗s office with target-organ damage, and could enhance patients‗ adherence to drugs (Mancia *et al.*, 1997).

2.7 Epidemiology of Hypertension

2.7.1 Global Burden of Hypertension

The prevalence of hypertension in various regions of the world has been widely reported; (Gupta, 1999; Hernandez-Hernandez *et al.*, 2000; Singh *et al.*, 2000; Ueshima *et al.*, 2000) however, it was not until 2005 that this information was compiled for its prevalence and absolute burden around the world (Kearney *et al.*, 2005).

Overall, 26·4% of the world‗s adult population in 2000 had hypertension (26·6% in men and 26·1% in women), and 29·2% were predicted to have hypertension by 2025 (29·0% in men and 29·5% in women). The estimated total number of people with hypertension in 2000 was 972 million; 333 million in economically developed countries, and 639 million in economically developing countries (Kearney *et al.*, 2005).

The relation between sex and prevalence of hypertension was not the same in all regions of the world. The sex-specific and age-specific prevalence indicate that there may be an interaction between sex and age. At young ages the prevalence of hypertension were higher in men than in women, whereas in older people they were higher in women than in men. This shows that men and women have similar overall prevalence of hypertension, and that such prevalence increase with age consistently in all world regions. In men, the highest estimated prevalence was in the region ―Latin America and the Caribbean‖, whereas for women the highest estimated prevalence was in the former socialist economies. The lowest estimated prevalence of hypertension for both men and women was in other parts of Asia. It is projected that between 2000 and 2025, the worldwide prevalence of hypertension was predicted to increase by 9% in men and 13% in women because of projected changes in the age distribution of the population. Specifically, a larger proportion of the world population is expected to be older by 2025.

The number of adults with hypertension was projected to increase by 60% to a total of 1·56 billion (1·54 billion–1·58 billion) in 2025. Most of this rise can be attributed to an expected increase in the number of people with hypertension in economically developing regions. Although the number of people with hypertension in economically developed countries was projected to increase by 24% from 333 million to 413 million (409–418 million), a rise of 80% was predicted for economically developing countries from 639 million to 1·15 billion (1·12–1·17 billion). On the basis of these estimates, almost three-quarters of the world‘s hypertensive population will be in economically developing countries by 2025.

2.7.2 Hypertension in Sub-Saharan Africa

It has been suggested that the prevalence of cardiovascular disease and hypertension is increasing rapidly in sub-Saharan Africa (SSA) (Seedat, 2004). A recent survey by Addo et al., (2007) analyzed results from a total of 37 publications describing 25 studies from 10 countries to establish reliable and comparable evidence on hypertension in black adults in SSA indicated that the prevalence of hypertension varied extensively between and within studies (Addo *et al.*, 2007b). When Studies with both urban and rural populations were examined, prevalence of hypertension was observed to be higher in the urban compared with the rural population.

With hypertension defined as BP 140/90 mm Hg, the level of hypertension detection ranged between 11% in all participants in rural Cameroon (Mbanya *et al.*, 1998) and 47% in females in South Africa, (Steyn *et al.*, 2001). Treatment levels ranged between 10% in urban Cameroon (Edwards *et al.*, 2000) and 32% in Ghana (Agyemang *et al.*, 2006), and control between 0.4% and 16.8% (Steyn *et al.*, 2001). The difference in the prevalence of hypertension between males and females was marginal for almost all communities. Females seem to be more likely to have been detected, be on treatment, and have hypertension controlled compared with males. A one-year follow-up of newly diagnosed hypertensive in 1 study showed that despite referral, 62.9% had uncontrolled hypertension and 26.8% claimed to be unaware of their hypertension (Metcalf *et al.*, 1996).

2.7.3 Epidemiology of Hypertension in Ghana

In 1979 Pobee et al. (1979) described an epidemic of hypertension in Ghana. Since then, a recent review conducted by Bosu (2010) has demonstrated that the epidemic of hypertension in Ghana has persisted or increased. Based on an estimate of 15.8 million adults aged 15 years or older in 2008 , 48% urbanization (WHO, 2007), a prevalence of hypertension of 25% in urban and 20% in rural populations, it is estimated that, at least, 3.5 million adults had hypertension in Ghana in 2008. In comparison, 236,151 adults were estimated with living with HIV and AIDS in Ghana in 2008 (Ghana AIDS Commission - GAC, 2009).

2.7.4Factors associated with Hypertension in Ghana

Several studies in Africa show some sex differences in prevalence of hypertension (Usman et al., 2006; Addo et al., 2007a). As in Ghana, some countries report a higher prevalence among men (Kamadjeu et al., 2006; WHO, 2008a) while others report the converse (Temmar et al., 2007; Adedoyin et al., 2008). Male or female preponderance of hypertension could differ in the same study subjects depending on the threshold used (Adedoyin et al., 2008).

2.8 Awareness, Treatment and Control of Hypertension in Ghana

Estimates from a total of seven available studies on hypertension awareness, treatment and control of hypertension in Ghana, show that only 22%-54% hypertensives were aware of their condition, 7%-31% were on treatment and 0%-13% successfully had their blood pressures controlled. Between studies, the proportion of hypertensives aware, on treatment and who had controlled blood pressure in urban populations was not markedly different from that in rural populations (Bosu, 2010). The most favorable awareness, treatment and response rate was observed among civil servants in Accra (Addo et al., 2008) and the worse among public servants in Accra in 1979 (Pobee, 1993).

Although the differences in study populations hinder direct comparison, there appeared to be a trend towards improved awareness, treatment and control from the mid-1970s to the late 2000s. in 1979, the level of awareness of hypertension was 24.1% among public servants. But by 2008, awareness levels had increased to 54.1% (Addo et al., 2008).

2.9 Risk factors associated with Hypertension

2.9.1 Non-modifiable risk factors

2.9.2 Ethnicity

As a risk factor for hypertension, susceptible ethnic origin or the genetics of a population rarely acts in isolation. Usually, they act in interaction with environmental factors. Ibrahim *et al.* (2012) conclude that hypertension is mainly related to environmental and lifestyle factors rather than to genetically defined racial differences since substantial differences in the prevalence of hypertension between people of African and European origin are greatly reduced after adjustment for socio-economic status (Agyemang *et al.*, 2009). In a study of children of African descent living in the UK, blood pressure results were either lower than or similar to those of their white UK counterparts (Harding *et al.*, 2006). In adults, blood pressure results were higher in people of African descent than in white people (Harding *et al.*, 2006). Genetic predisposition might be permissive rather than determinative, with the addition of biosocial factors such as weight gain, high salt intake, anxiety, psychosocial stress, and excess alcohol consumption necessary to cause disease (Sanders, 2009). Genetic factors seem to play an important part in salt sensitivity, which is common in black people. Single gene mutations have been found that promote salt retention through a defect in renal sodium handling (Sanders, 2009).

2.9.3 Age

Changes in body structure and function occur with age. Age-related rise of blood pressure is neither an inevitable nor normal biological feature of the ageing process.

Increased age and male gender are important risk factors for cardiovascular disease. Males have a gene that influences hypertension more than females, when compared at the same age; interestingly, however in postmenopausal women and men of the same age, there is no difference in findings (Williams *et al* 2000). In a study of 24 hour ambulatory blood pressure monitoring in 352 healthy Danish subjects aged 20 to 79 years. These participants were divided into groups of 25 to 30 subjects, of each sex, across all age groups. Blood pressure monitoring was measured on the left arm every 15 minutes from 7am to 11pm and every 30 minutes from 11pm to 7am. The study found that systolic blood pressure increased only slightly with age and was significantly higher in men than in women. In summary, males have higher systolic blood pressure than females of the same age and systolic blood pressure in both sexes increases with age while diastolic blood pressure is likely to be similar in both sexes at the same age.

2.9.4 Genetic Predisposition

Genetics is also claimed to contribute to hypertension. A study of 591 Japanese Participants, aged 20 to 59 years, showed that family history was strongly related to the incidence of hypertension especially in older people (Naruse*et al* 2008). It has-been shown that gene products were related to a change of blood pressure in between 30% and 50% of individuals (Dominiczak*et al* 2000). Data showed that the gene identified as influencing hypertension was found more frequently in hypertensive than normotensive people, and more frequently in normotensive people with hypertensive parents than in those with normotensive parents. In addition, this study also found this gene more often in hypertensive siblings (Williams *et al* 2000)

2.9.5 Modifiable Risk Factors

2.9.6 Urbanisation

Urbanisation and migration from rural to urban areas are strongly correlated with an increase in hypertension prevalence (BeLue *et al.*, 2009). South Africans who have spent most of their life in urban areas are more likely to be hypertensive than are those from rural areas (Steyn *et al.*, 2008). Mass migration from rural to urban and peri-urban areas probably accounts for the high prevalence of hyper tension in black Africans living in urban areas. Urbanisation affects food consumption patterns, with increased consumption of fats, oils, and animal-based foods. This diet change can increase bodyweight, which is an independent risk factor for the development of hyper tension. In Cameroon, migration to urban areas is associated with high body-mass index, fasting blood sugar, and blood pressure (Sobngwi *et al.*, 2004). Body-mass index—a powerful predictor of hypertension—is also strongly associated with urbanisation (BeLue *et al.*, 2009) and might result from dietary changes, reduced physical activity in addition to increased psychological stress, and interruption of traditional family ties.

2.9.7 Diet and weight

Consumption of food high in saturated fat, salt or sodium, the level of alcohol intake, and weight gain play an important role in contributing to hypertension. The National Heart Foundation of Australia (2003) and the Australian Institute of Health and Welfare (2004) concluded that obesity, saturated fat intake and consumption of food high in salt or sodium related to the incidence of hypertension.

2.9.8 Obesity and Body Mass Index

Body-mass index alone was the most powerful predictor of hypertension in the Nurses‘ Health Study II (Forman *et al.*, 2009a). A stable linear relation between adiposity and blood pressure has been reported, independent of age and body-fat distribution across developed and developing countries (Doll *et al.*, 2002a). As the body mass index increases, blood pressure also increases. In Chinese women from rural areas followed up for 28 months, the risk of progression to hypertension was associated with advancing age, body-mass index, salt intake, and low physical activity (Sun *et al.*, 2010b). Kotsis*et al* (2005) found that body mass index was a contributory factor for high blood pressure. A cohort study of 300 JapaneseAmericans, using a 10 to 11 year follow-up, found that intra-abdominal fat measured using computed tomography was significantly related to hypertension (Hayashi *et al* 2004).A similar result was found by Poirier *et al* (2005). This study supported the finding that abdominal obesity as measured by waist circumference related to the increase of systolic blood pressure in both sexes. Another study by Niskanen*et al.* (2004), showed that an increase in waist circumference was strongly associated with the development of hypertension. This cohort study investigated the effects of abdominal obesity and smoking on the development of hypertension in 379 middle-aged normotensive men over an 11 year follow-up period. It found that 124 participants (33%) developed hypertension; factors which substantially related to the incidence of hypertension were cigarette smoking and waist circumference. Obesity not only significantly increased systolic blood pressure but also decreased insulin sensitivity and vasodilation (de Jongh*et al* 2004). Furthermore, an additional study in the area showed that an increase in body mass index and systolic blood pressure contributed to deaths in both genders, but especially in men (Bender *et al* 2002).

There is strong evidence that overweight is a significant risk factor for hypertension.

2.9.9 Consumption of food high in sodium

High sodium intake is found to be a factor influencing hypertension development. In animal trials, it was found that a high sodium intake contributed to an impairment of renal blood flow, a decrease of the glomerular filtration rate and filtration fraction, and also induced albuminuria and hypertension in rats (Sanders *et al* 2005). In a human study, high sodium intake was related to an increase in systolic blood pressure (Hajjar*et al* 2001).

2.9.10 Alcohol consumption

Several studies have demonstrated a non-linear relationship between alcohol and blood pressure. Both blood pressure and the heart rate significantly increased in healthy normotensive men after drinking 40 grams of red wine or beer (Zilkens et al 2005). In a study by Nanchadal, Ashton & Wood (2000), the risk of hypertension was also found to increase in people who drank more than 15 alcoholic units a week. Other studies have found that drinking more than 210g alcohol a week induced hypertension (Fuchs et al 2001), especially drinking every day or drinking without food (Stranges et al 2004; Marques-Vidal et al 2001).

Consumption of large amounts of alcohol contributes to other health issues. Reynolds et al (2003) found that heavy alcohol consumption (more than 60g of alcohol a day) increased the incidence of stroke, however light to moderate consumption of alcohol (less than 15 units a week) decreased the incidence of cerebrovascular accident or cerebrovascular disease (Malinski et al 2004; Nanchadal, Ashton & Wood 2000; Sierksma et al 2004). Schminke et al (2005) found that drinking less than 80g per day of alcohol helped to decrease the thickness of the carotid artery in men, resulting in a decreased incidence of cerebrovascular disease and stroke. Moderate wine consumption (less than 60g of alcohol a day) has been demonstrated to decrease deaths in patients with hypertension (Renaud et al 2004).In conclusion, excess alcohol consumption is related to high blood pressure and its complications, whereas light to moderate alcohol consumption is a factor in maintaining good health. This may be particularly relevant in individuals where high alcohol intake is linked to poor nutrition, obesity and other risk factors such as smoking.

2.9.11 Smoking

It was known that smoking causes an acute rise in blood pressure, whereas chronic smoking has been associated with the development of hypertension. Chronically, cigarette smoking induces arterial stiffness which may persist for a decade after smoking cessation (Rosen *et al.*, 2006). The incidence of hypertension is increased among those who smoke 15 or more cigarettes per day (Norman, 2014), and the coexistence of hypertension and smoking decreases left ventricular function in asymptomatic people (Norman, 2014).

With each cigarette, the blood pressure rises transiently and the pressor effect may be missed if the blood pressure is measured 30 minutes after the last smoke. The transient rise in blood pressure may be most prominent with the first cigarette of the day even in habitual smokers.

In one study of normotensive smokers, there was an average elevation in systolic pressure of 20 mmHg after the first cigarette(Norman, 2014).

However, habitual smokers generally have lower blood pressures than nonsmokers as observed in most (Mikkelsen *et al.*, 1997), but not all (Primatesta *et al.*, 2001), studies. It is a paradox that while smoking acutely increases blood pressure, a slightly lower blood pressure level has been found among smokers than nonsmokers in larger epidemiological studies (Agyemang *et al.*, 2006). The mild reduction in blood pressure in smokers is related to decreased body weight (Norman, 2014). Further support for this observation is the higher body weight and increased blood pressure among former smokers versus that observed among never-smokers (Poulter, 2002). Although stopping smoking is extremely beneficial with respect to cardiovascular risk and other health outcomes, the subsequent weight gain and increase in waist girth associated with smoking cessation may offset the decrease in risk of hypertension that one may otherwise expect. Thus stopping smoking is commonly associated with weight gain which is itself a well-established risk factor for hypertension (Niskanen *et al.*, 2004). Despite these observations, the general consensus is that smoking should be avoided in any hypertensive patient because it can markedly increase the risk of secondary cardiovascular complications and enhance the progression of renal insufficiency (Regalado *et al.*, 2000; Orth, 2002).But because blood pressure may increase after cessation of smoking, a smoke quitting program should not postpone initiation of antihypertensive treatment in patients otherwise in need of such treatment.

2.10 Methodological differences in blood pressure assessment

The differences in the approaches to blood pressure measurement are well acknowledged in the literature (Croft, 1999; McAlister and Straus, 2001). Factors such as talking, acute exposure to cold, recent ingestion of alcohol, incorrect arm position, and incorrect cuff size have all been shown to affect readings by more than 5 mmHg (McAlister and Straus, 2001). Attention to such details is not always evident in blood pressure studies from Africa.

The WHO recommends using the average of three blood pressure readings at one visit in risk factor surveys (WHO, 2008b) although single visit measurements could result in an overestimation (Bovet *et al.*, 2003). Interestingly, a recent study showed that the first of five office BP readings by a trained nurse using a manual sphygmomanometer effectively predicted the presence of a wide range of markers of target organ damage in a standardized ambulatory BP monitoring, as did the average of all five readings measured at 2-3 minute intervals (Padfield, 2009). On the whole, recent published guidelines from leading professional institutions provide adequate guidance on the measurement of blood pressure in different settings (e.g. office, home, clinic) (European Society of Hypertension-European Society of Cardiology Guidelines, 2003). According to Bosu (2010), proper training and supervision is required to ensure that these guidelines are strictly followed in prevalence studies.

CHAPTER THREE

METHODOLOGY

3.0 INTRODUCTION

The chapter focuses on the procedures adopted in carrying out the study and the detailed implementation of the research design, data collection, population, sampling technique, sample size and data collection methods.

3.1 Study type and design

A cross sectional study was used to determine risk factors associated with hypertension in the Dormaa Municipality of the Brong Ahafo Region, Ghana. Participants were recruited by probability proportional to size (PPS) using multistage stratified cluster sampling. Household family members in the Dormaa Municipality constituted the smallest sampling unit. In PPS sampling, the selection probability for each element is set to be proportional to its size measure.

3.2 Profile of Study area

The Dormaa Municipality is located at the Western part of the Brong-Ahafo Region. It lies within longitudes 3º West and 3 º.3‘ West and latitudes 7º North and 7º.3‘ North. The District is bordered by Jaman and Berekum Municipality in the north, the Sunyani Municipality in the east, in the South by Asunafo and Asutifi Districts respectively. The Municipal Capital is Dormaa Ahenkro, located about 80 kilometers west of the regional capital, Sunyani. The Municipality has a total land area of 1,685 km^2 which is about 3.5 percent of the total land area of Brong Ahafo Region and about 0.6 percent of that of the country. It has one traditional authority and three constituencies, namely: Dormaa East, Dormaa Westand Dormaa central.

The staple foods eaten in the area are fufu, yam, plantain, cassava and banku. Most of the people are physically active, engaging in farming activities but there is also a significant proportion of the population that appears to be sedentary.

3.3 Population Size and Growth Rate

According to the 2010 population census, the population of Dormaa Municipal Assembly is 159,789 (78,270 males and 81,519 females) (GSS, 2011). Between 1984 and 2000, the growth rate between the census periods was 2.1 for the municipality and 2.5 and 2.7 for the region and nation respectively (ghanadistricts.com, 2006).

3.4 Settlement Distribution

There are 296 settlements in the municipality and these are concentrated mostly in the northern and southern part of the Municipality with the central portion poorly populated. The central part is sparsely populated due to the fact that it constitutes a substantial part of the Mpamaso Forest Reserve. There are two settlements with a population of 5000 and above thus can be classified as urban namely Dormaa Ahenkro and Nkrankwanta. The urban population constitutes 31.3 percent of the Municipality‘s total population. This implies that the district is predominantly rural in character, with agriculture as the predominant occupation (MOFEP, 2013).

3.5 Data Collection Techniques and Tools

Data were collected based on interviews, physical examinations, and anthropometric measurements carried out by a team of trained nurses and health professionals. The research team visited households according to previously arranged appointments. Before the interviews by the team, appointments were made by pioneer teams visiting households at least 1 day before and preferably during evenings when most people are at home.

The team used WHO STEPwise Instrument for evaluating risk factors for NCDs (WHO, 2008b). The WHO STEPS tool has been used for risk factor surveillance in a number of countries in sub-Saharan Africa(Guthold *et al.*, 2011). This approach uses a multistep approach for risk factor assessment including collecting information using questionnaires (step 1), physical measurements (step 2), and taking blood samples for biomedical assessment, (step 3). However, only the first and second steps were carried out.

Measurements were done using calibrated and standard instruments. We measured height with participants standing without shoes using a standard metal ruler. Weight was measured using calibrated digital scales. All participants wore light clothes for weighing. Waist circumference was measured midway between the lower rib margin and iliac crest to the nearest 0.5 cm. Blood pressure (BP) was measured based on WHO recommendations used in the research protocol. Blood pressure measurement and definition of hypertension was based on WHO guidelines. Physical activity was measured using questions on four different aspects, physical activity at the workplace, physical activity during recreation time, physical activity while traveling, and physical resting time. To define a combined risk factor index, five components were considered: (1) being a current daily smoker; (2) five servings of fruits and vegetables per day; (3) low level of activity (600 Metabolic Energy Time in minutes); (4)body mass index ≥ 25 kg/m2); (5) raised BP (SBP ≥ 140 and/or DBP ≥ 90 mmHg). Participants who lacked any of these were classified as low risk and those having at least three of the above-mentioned risk factors were considered as high risk of NCDs. For the definition of abdominal obesity the cut-off points of 102 cm in men and 88 cm in women was used according to the WHO guidelines.

3.7 Study Population

The study population comprised individuals aged 25 years and older living in rural and urban areas of the Dormaa Municipality in the Brong Ahafo Region. Consenting individuals between the stipulated age ranges in the Municipality participated in the study.

3.8 Study Variables

In the first step, data was collected on socioeconomic and demographic variables including years of education, tobacco and alcohol use, ethnicity, educational attainment, occupation, income, behavioral and lifestyle factors such as physical inactivity, intake of fruit and vegetables, use of smoke-less tobacco, fat consumption, and types of physical activity. Participants were also interviewed on their clinical history of high blood pressure, history of diabetes, treatment for diabetes and treatment for high blood pressure.

Under the second step, measurements of weight, height, waist circumference, blood pressure, hip circumference and pulse rate were taken.

Table 3-0 Study Variables

Study variables	Operational definition	Scale of measurement
Age	The number of years	Continuous
Sex	Whether male or female	Binary
Education	The level of education attained by respondent	Ordinal
Marital status	Whether or not respondent is married	Nominal
occupation	The work or job of respondent	Nominal
Study variables	**Operational definition**	**Scale of measurement**
Ethnicity	The tribe of the respondent	Categorical
Tobacco use	Whether or not the respondent smokes	Continuous
Alcohol consumption	Whether or not the respondent takes alcohol	Interval
Physical activity	Whether or not the respondent exercises	Interval
Blood pressure	Refers to the amount of blood pushing against blood vessel walls	Continuous

History of diabetes	Whether the respondent has diabetes or not	Nominal
History of raised cholesterol	Whether the respondent has had elevated fat level or not	Nominal
Height	A measure of how tall or short the respondent is	Continuous
weight	The mass of the respondent	Continuous

3.9 Sampling technique and sample size

The study was a community-based cross-sectional house-to-house survey aimed at ascertaining the prevalence of hypertension in the Municipality as well as identifying related risk factors. Participants for the study were randomly selected from the Dormaa area in the region using multistage cluster sampling technique. Sample sizes of 400 respondents were recruited into five age groups to participate in the study. The final figure was calculated using Cochran's maximum proportions formula (Cochran, 1963). The minimum sample that is sufficiently representative of the entire population is obtained by assuming that the rate of hypertension in the municipality is 50%. Based on the published population of 159 578 inhabitants in the Dormaa municipality, a minimum sample size of 383 was calculated to give a 0.05 confidence interval and confidence level of 95% (MaCorr, 2013). Therefore, a total of 400 respondents comprising both males and females were selected into five distributed groups between age 25years and older (Table 3-1).

Table 3.1: Distribution of participants between age-sex groups

Age Group	Male (n=202)	Female (n =198)
25-34	41	38
35-44	41	43
45-54	41	38

55-64	38	41
>65	41	38

Clusters were selected in this system based on the political map of the district assembly to ensure uniform coverage of the study area and in line with study objectives. Enrolment and data collection started after all cluster start points had been determined. Consecutive households were selected based on simple relative geographical positioning to the right-hand side of previous buildings until the required number of participants was enrolled.

3.10 Sampling Frame

The sampling frame was based on the Electricity Company of Ghana's bill distribution network, which is used to disseminate utility bills to households on a monthly basis. The unit of sampling was the selected households.

3.11 Pre-Testing

A pilot test of the questionnaire was carried out on a selected sample of 20 respondents in Berekum municipality.

3.12 Data handling and analysis

The data obtained through the questionnaires was checked for accuracy and entered immediately into the computer using Microsoft® Excel® software. Data was cleaned and managed using SPSS version 21. Exploratory analysis was carried out to obtain descriptive statistics. Differences between proportions were tested using Chi square test.

3.13 Ethical considerations

Ethical clearance for commencement of the study was obtained from the Committee on Human Research, Publication and Ethics (CHRPE), Kwame Nkrumah University of Science and

Technology, School of Medical Sciences (KNUST-SMS), & the Municipal Director of Health services Dormaa-Ahenkro Ghana. In line with ethical modalities, study participants were adequately informed of the purpose, nature, procedures, risks and hazards of the study. Points emphasized were anonymity, confidentiality and the freedom to decline to participate at any time without penalty. Approval was also sought from relevant authorities within the Municipality.

3.14 Assumptions

In this study, the following assumptions were made:

1. The population selected for the study is representative enough of the Municipality and the region to allow us to be able to generalize our conclusions about the risk factors for hypertension in the Municipality.
2. The risk status of the study population is not known
3. Adults and aged are included in the study because behavior patterns of adults and old age are associated with hypertension.

CHAPTER FOUR

RESULTS

4.0 Introduction

This chapter presents the results of the study.

4.1 Socio-demographic characteristics of participants

Table 4-1: Socio-demographic characteristics of study population stratified by gender

Parameter	Total	Male	Female	P-value
	n (%)	n (%)	n (%)	
Age Group				
25 - 34	77 (19.25)	39 (9.75)	38 (9.50)	0.987
35 - 44	85 (21.25)	42 (10.50)	43 (10.75)	
45 - 54	79 (19.75)	41(10.25)	38 (9.50)	
55 - 64	80 (20.00)	39 (9.75)	41(10.25)	
≥ 65	79 (19.75)	41(10.25)	38 (9.50)	
Total	**400 (100)**	**202 (50.5)**	**198 (49.5)**	
Education				
No formal school	150 (37.5)	63 (15.75)	87 (21.75)	**0.010**
Less than primary school	15 (3.75)	6 (1.50)	9 (2.25)	
Completed prim school	31 (7.75)	15 (3.75)	16 (4.00)	
JSS/ Middle school	129 (32.25)	66 (16.50)	63 (15.75)	
SHS/ High school	45 (11.25)	28 (7.00)	17 (4.25)	
College/University	27 (6.75)	21 (5.25)	6 (1.50)	
Post graduate degree	3 (0.75)	3 (0.75)	0 (0.00)	
Total	**400 (100)**	**202 (50.5)**	**198 (49.5)**	
Ethnicity				
Akan	330 (82.50)	132 (33)	198 (49.5)	**0.000**
Ga	9 (2.25)	9 (2.25)	0 (0.00)	

Ewe	12 (3.00)	12 (3.00)	0 (0.00)	
Mole Dagbani	49 (12.25)	49 (12.25)	0 (0.00)	
Total	**400 (100)**	**202 (50.5)**	**198 (49.5)**	
Work status				
Govt employee	60 (15.00)	35 (8.75)	25 (6.25)	0.095
Non Govt employee	246 (61.50)	126 (31.50)	120 (30.00)	
Self employed	24 (6.00)	8 (2.00)	16 (4.00)	
Volunteer	26 (6.50)	13 (3.25)	13 (3.25)	

Student	44 (11.00)	20 (5.00)	24 (6.00)	
Total	**400 (100)**	**202 (50.5)**	**198 (49.5)**	
Marital status				
Never married	99 (24.75)	48 (12.00)	51 (12.75)	0.346
Currently married	126 (31.50)	58 (14.50)	68 (17.00)	
Separated	160 (40.00)	86 (21.50)	74 (18.50)	
Widowed	15 (3.75)	10 (2.50)	5 (1.25)	
Total	**400 (100)**	**202 (50.5)**	**198 (49.5)**	

The socio-demographic characteristics of the study population as shown in table 4-1 above indicates that out of a total of 400 respondents who participated in this study, 202 (50.5%) were males and198 (49.5%) were females. The mean age of the participants was 50.06 years (95% CI: 48.46-51.66). The median age ranged from 45 - 54 years. Illiteracy was reported to be 37.5% of study participants with the majority of them being females. Most of the study participants (32.25%) had middle/Junior high as their highest level of educational attainment and had been in formal school for at most 9 years. The present data suggests that males in the study population were more likely to be highly educated than females (P =0.010). In all, only 6.75% of participants had been to college or university and even less (0.75%) had a postgraduate degree. Participants had a largely uniform cultural structure, comprising 82.5% Akans and 12.25% from the Northern tribes collectively known as the Mole-Dagbani. With respect to occupation status, only 17.5% of study participants reported to be either a student or volunteer worker. The rest were all involved in non-government employment (61.5%), Government employment (15%). A few were self-employed (6%). Females were more likely to be self-employed while males were more likely to be government workers. Although all participants were old enough to marry, 24.75% had never been married before. Of those who had married before, 31.5% were currently together, 40% have been separated and 3.75% were widowed.

Table 4-2: Summary of results from step 1 WHO STEPS approach studying risk factors of noncommunicable diseases

Parameter	Male	Female	Total	95% CI	*P*-Value
Total Respondents					
Step 1 Tobacco use					
Percentage who currently smoke tobacco daily	22.4%	1.5%	12.0%		**0.000**
Step 1 Fruit and vegetable consumption (in a typical week)					
Mean number of servings of fruit consumed per day	1.75	1.40	1.59	1.41 – 1.74	**0.036**
Mean number of servings of vegetables consumed per day	3.38	2.30	2.85	2.45 – 3.26	**0.009**
Percentage who ate ≥5 combined servings of fruit and vegetables per day	36.1%	17.2%	26.8%		**0.000**
Step 1 Physical Activity					
Percentage with low levels of activity (defined as <600 METminutes/week)	29.7%	46.2%	37.3%		**0.004**
Median time spent in physical activity per day (hours)	3.56	2.22	2.90	2.50 – 3.29	**0.000**

Abbreviation: MET, metabolic energy.

A summary of results from step one is given in table 4.2 above. This shows that lesser proportion of females were significantly more likely to be current smokers compared to males,1.5% of all females were daily tobacco users while 22.4% of all males smoked daily. But females were also more likely to have a more sedentary lifestyle (46.2% of females‘ versus. 29.7% of males) and eat less serving of fruits and vegetables (17.2% versus. 36.1%) than males. The averagenumber of servings of fruits and vegetables consumed per day was 1.59 (95% CI; 1.41 – 1.74) and 2.85 (95% CI; 2.45 – 3.26) respectively. Males reported a higher mean number of fruit and vegetable servings than females and spend more time each day on physical activities compared to females.

Table 4-3: Summary of results from step 2 WHO STEPS approach studying risk factors of non-communicable diseases

Parameter	Male	Female	Total	95% CI	*P*-Value
Total Respondents					
Step 2 Physical measurements					
Mean body mass index (BMI, kg/m2)	22.89	23.51	23.19	22.75 - 23.62	0.162
Percentage who were overweight or obese (BMI ≥ 25 kg/m2)	18.8%	32.4%	25.3%		**0.002**
Percentage who are obese (BMI ≥ 30 kg/m2)	2.5%	7.0%	4.7%		**0.034**
Average waist circumference (cm)	84.52	86.99	85.70	84.54 – 86.86	**0.036**
Mean systolic blood pressure (SBP, mmHg)	127.1	125.9	126.49	124.4 – 128.5	0.575
Mean diastolic blood pressure (DBP, mmHg)	79.26	77.66	78.47	77.2 – 79.7	0.214
Percentage with raised BP (SBP ≥ 140 and/or DBP ≥ 90 mmHg)	44.6%	35.4%	40.0%		0.060
Percentage with raised BP (SBP ≥ 160 and/or DBP ≥ 100 mmHg)	3.0%	6.6%	4.8%		0.207

Percentage with isolated systolic hypertension (SBP ≥ 140 and DBP < 90 mmHg)	12.9%	9.6%	11.2%	0.300

Table 4.3 above shows a summary of results from step 2 WHO STEPS approach to studying risk factors of non-communicable diseases. The average BMI of study participants was 23.19 (95% CI; 22.75 - 23.62). Females (23.51) had a slightly higher BMI than males (22.89). In all 4.7% of participants were overweight and obese respectively. Again, females were significantly more likely to be classified as overweight or obese as compared to their male counterparts (Pearson Chi square $p<0.05$) and had a bigger mean waist circumference than males. Both the mean systolic BP and the mean diastolic BP of participants are in the healthy category. However, the present data shows that 40% of all participants in this study had an elevated BP (≥140/90mmHg). There were more males (44.6%) with elevated BP than females (35.4%) and more males with severely elevated BP (≥160/100mmHg) than females. In all, the rate of isolated systolic hypertension was 11.2% among the study population,
12.9% in males and 9.6% among females.

4.2 Risk factors for hypertension

Table 4-4: Odds of Hypertension (SBP ≥140;DBP ≥90) among study participants and corresponding 95% confidence intervals according to demographic characteristics

Parameter	**Total n (%)**	**Elevated BP**		
		OR	***95% CI***	***P-value***
Age Group				
25 - 34	77 (19.2)			
35 - 44	84 (21.0)	1.377	0.59-3.22	0.464
45 - 54	79 (19.8)	2.745	1.20-6.30	**0.017**
55 - 64	81 (20.2)	2.875	1.30-6.35	**0.009**
≥ 65	79 (19.8)	5.330	2.31-12.27	**0.000**

Gender				
Male	202 (50.5)			
Female	198 (49.5)	0.492	0.28-0.86	.012
Education				*.467*
No formal school	150 (37.5)			
Less than primary school	15 (3.8)	0.973	0.27-3.50	.966
Completed prim school	31 (7.8)	1.847	0.68-4.98	.226
JSS/ Middle school	129 (32.2)	0.881	0.48-1.61	.681
SHS/ High school	45 (11.2)	0.365	0.14-0.98	**.046**
College/University	27 (6.8)	1.033	0.39-2.77	.948
Post graduate degree	2 (0.5)	0.645	0.02-16.99	.793
Ethnicity				*0.352*
Akan	330 (83.3)			
Ga	8 (2.0)	0.412	0.03-6.14	.520
Ewe	9 (2.3)	2.668	0.49-14.54	.257
Mole Dagbani	49 (12.4)	0.671	0.30-1.49	.329
Work status				0.839
Govt employee	58 (14.5)			
Non Govt employee	246 (61.7)	1.175	0.65-2.14	.227
Self employed	14 (3.5)	0.760	0.21- 2.73	.745
Volunteer	25 (6.3)	1.754	0.68-4.55	.199
Student	44 (11.0)	1.900	0.85-4.24	.245
Marital status				0.979

Parameter	**Total n (%)**	**Elevated BP**		
		OR	***95% CI***	***P-value***
Never married	40 (11.7)			
Currently married	126 (36.8)	0.818	0.35-1.90	.638
Separated	160 (46.8)	0.822	0.369-1.83	.631
Widowed	15 (4.4)	1.157	0.246-5.44	.853

Table 4-4 shows the odds of Hypertension (BP≥140/90mmHg) among study participants and corresponding 95% confidence intervals according to demographic characteristics. Persons aged 65 years and over had the highest statistically significant odds of elevated blood pressure among all study participants (OR=5.33, CI 2.31-12.27, P = 0.000) followed by those aged 55

– 64years (OR=2.89, CI 1.30-6.35, P = 0.009) and 45 – 54 years (OR=2.75, CI 1.206.30, P= 0.017). Thus, the odds of developing hypertension increased with advancing age. With respect to gender, the present data shows that the odds of elevated blood pressure in males are doubled compared to females. That is, males were twice as likely as females to develop hypertension, all other things being equal. Concerning an individual‘s educational status, the odds of hypertension follows a complicated pattern in which only those who completed secondary school (high school) were associated with significant odds of developing hypertension (OR = 0.365, CI 0.14-0.98, P = 0.046**)**. Although not statistically significant, Ewes had higher odds of developing hypertension (OR=2.67) compared with the other ethnic groups. The data also suggests that employment and marital status were not significant predictors of hypertension among the study population.

Table 4-5: Odds of Hypertension (SBP≥ 140;DBP ≥90) among study participants and corresponding 95% confidence intervals according to behavioural characteristics

Parameter	Elevated BP		
	OR	***95% CI***	***P*-Value**
Tobacco status smokers	2.66	1.41-5.04	**0.003**
Non-smokers	1		
Tobacco frequency daily	1.23	0.52-2.48	0.109
Non-daily	1		
Alcohol status			
Ever consumed	1.59	0.97-2.61	0.069
Never consumed	1		
Alcohol frequency			
Daily	5.28	1.09-25.41	**0.038**
5-6 days per week	0.45	0.05-4.06	0.478
3-4 days per week	1.36	0.30-6.08	0.690

1-2 days per week	1.44	0.42-4.98	0.565
1-3 days per month	1.50	0.54-4.18	0.438
Less than once a month	1		
Diet			
Fruit & vegetable servings/week			
More than 5	0.321	0.15-0.67	**0.003**
Less than 5	1		

Table 4-5 above shows the odds of hypertension (SBP ≥140; DBP ≥90) among study participants and corresponding 95% confidence intervals according to specific behavioural characteristics of participants such as tobacco use, alcohol use and diet. Smoking was associated with significantly increased odds of elevated blood pressure. Among all smokers, those who reported a habit of smoking daily were also at higher odds of having an elevated blood pressure.

The present data suggests that alcohol consumption may be associated with increased chances of having higher than the desired upper threshold of BP. Among all alcohol users, daily indulgers recorded the greatest odds (OR=5.28, CI 1.09-25.41, P = 0.038) of elevated BP compared to those who took alcohol only rarely.

An individual's dietary habits concerning fruit and vegetable intake is thought to play a role in enhancing his/her likelihood of developing hypertension. In this study, a habit of eating less fruits and vegetables every week was associated with significantly increased odds of having elevated blood pressure as compared to individuals who eat more.

4.3 Cardiovascular risks

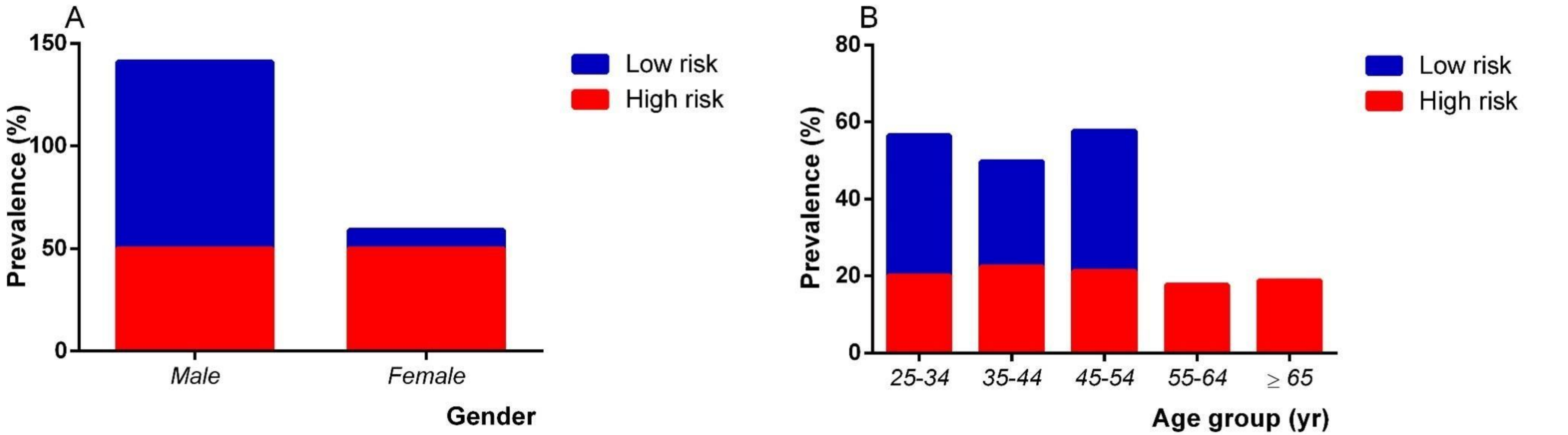

Figure 4-1: Combined cardiovascular risk factor analysis of study population.

Figure 4.1 above, combined risk factor analysis showed that 2.8% of participants were in the low-risk group (up to 5.1% among men and 0.5% among women). In addition, 21.5% of participants were in the high-risk group. Of those in the high-risk group, 20.0% were in the 25- to 44-year age group and 18.8% in the ≥65-year age group. The highest age-related prevalence of high cardiovascular risk was 22.4% attributed to the 35-44 year age group. There was no low risk case aged greater than 54.

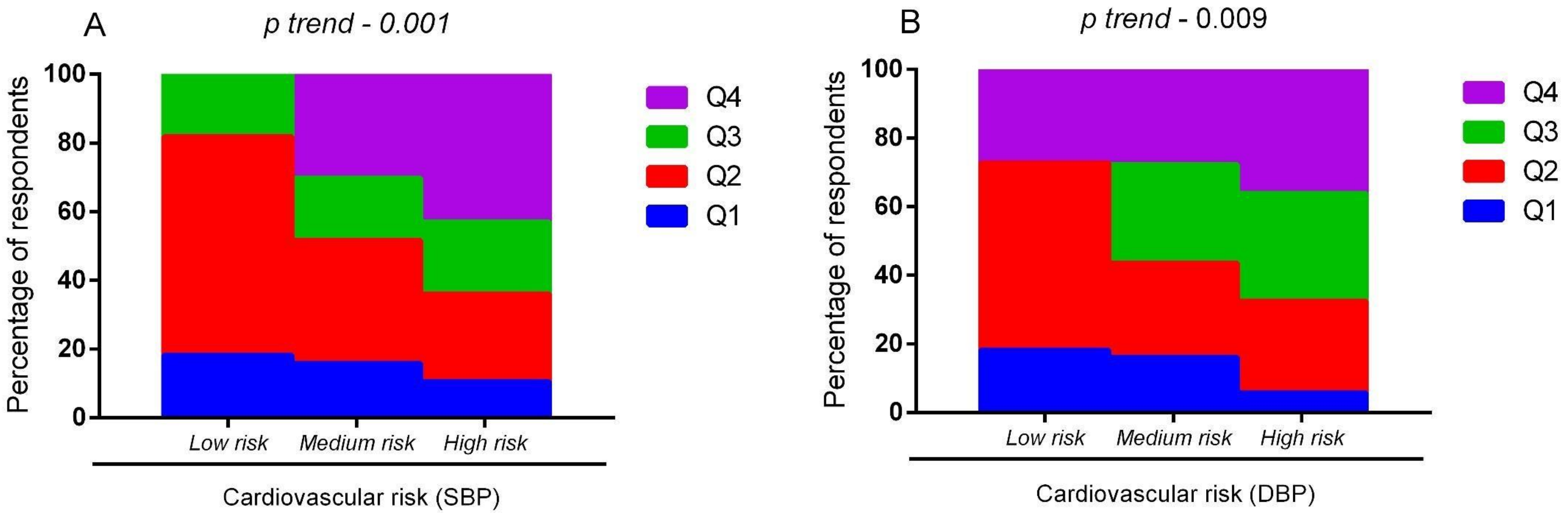

Figure 4-2: Inter-quartile distribution of participants' blood pressure according to combined cardiovascular risk status.

In order to determine the effect of blood pressure on cardiovascular risk, participants were classified according to the specific quartile that included their mean BP as Q1, Q2, Q3 and Q4. Figure 4.2 shows the inter-quartile distribution of participants' blood pressure according to combined cardiovascular risk status. Participants whose mean SBP was registered in the third and fourth quartiles were more likely to be at high risk for cardiovascular disease than those whose blood pressure readings were found in the lower quartiles (p for trend= 0.001). Similarly, those whose mean DBP was registered in the third and fourth quartiles were more likely to be at high risk for cardiovascular disease than those whose blood pressure readings were found in the lower quartiles (p for trend= 0.009).

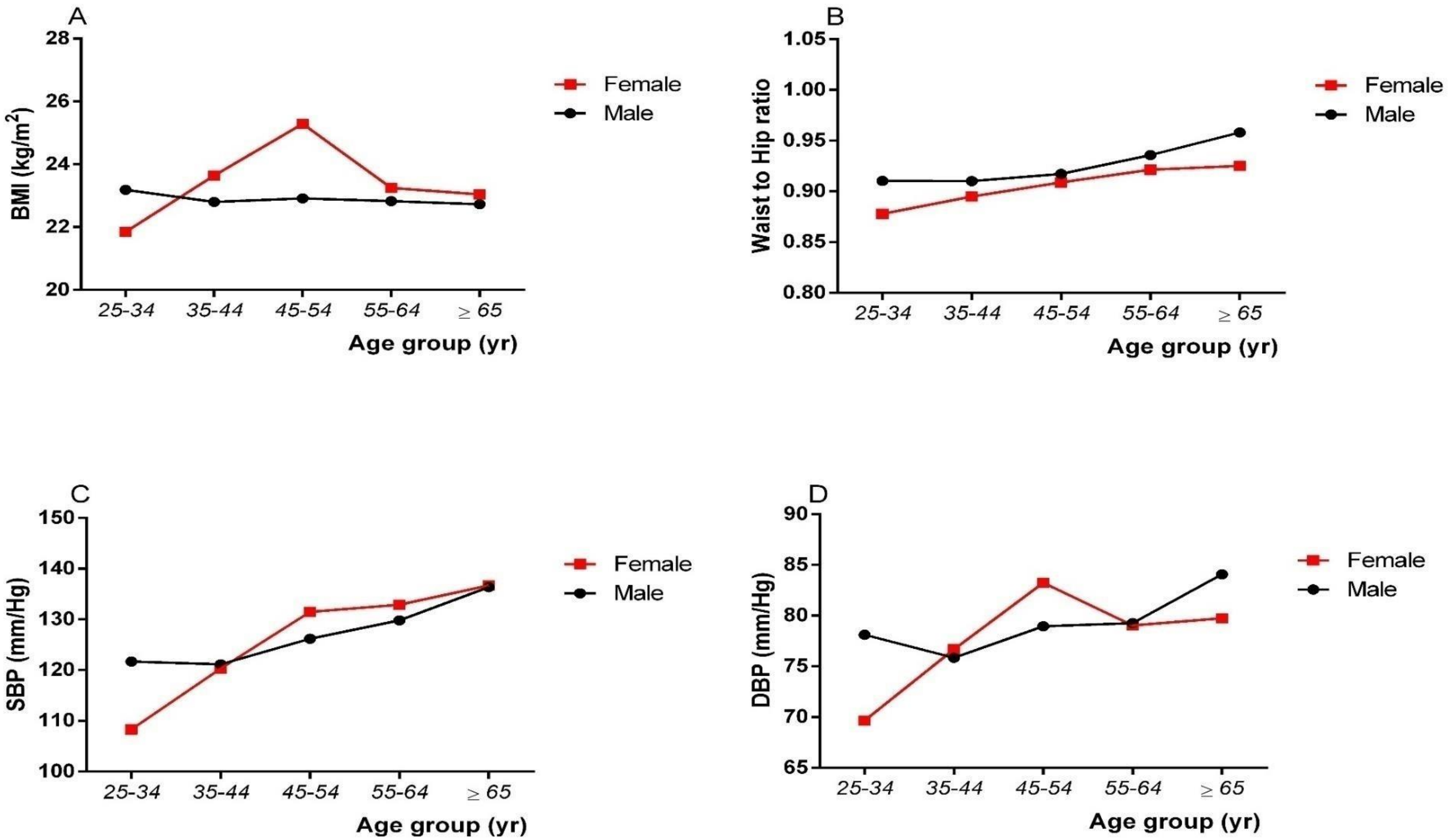

Figure 4-3: Comparison between physical measurements of males and females under STEP 2

Differences between physical measurements of males and females under STEP 2 are compared in Figure 4.3 above. Mean body mass index (BMI) increased with age to a peak in both sexes within the first three decades of adult life before decreasing thereafter. Except in the second decade of life, females had a consistently higher BMI than males (Figure 4.3a).Although females had a higher mean waist circumference than males, males had a higher waist-to-hip ratio than females indicating central obesity among males. This trend was observed throughout all age categories of study participants (Figure 4.3b).

CHAPTER FIVE

DISCUSSION

5.0 Introduction

This chapter presents the major findings of the study and discusses them in relation to similar studies conducted by other researchers.

Hypertension is an important public health challenge worldwide because of its high prevalence and concomitant increase in risk of cardiovascular disease (Kearney *et al.*, 2005). It is the most important modifiable risk factor for cardiovascular, cerebrovascular and renal diseases; cementing its position as the leading global risk factor for mortality as well as the third leading risk factor for disease burden (Ezzati *et al.*, 2002a). While hypertension is well recognized as a major cause of morbidity and mortality in the economically developed world, the importance of hypertension in economically developing countries is less well established but believed to be on the ascendancy (Fuentes *et al.*, 2000; Kearney *et al.*, 2005). As life expectancy rates improve in Ghana and prevalence of risk factors increase, the burden of noncommunicable diseases such as hypertension are also expected to increase.

5.1 Hypertension prevalence

The present study estimated the prevalence of hypertension in the Dormaa, a suburb in Ghana. In all, 40% of all participants had at least mild hypertension (SBP $\geq$ 140 and/or DBP $\geq$ 90 mmHg) measured with a digital sphygmomanometer. This estimate is higher than both the 2000 global estimate of 26·4% and the 2025 projected hypertension prevalence estimate of 29.2% in the world‘s adult population (Kearney *et al.*, 2005).

However, reliable early estimates from Ghana peg the prevalence of hypertension as high (i.e. >30%) (Agyemang *et al.*, 2006).

The prevalence of hypertension found in the present study is higher than previous estimates of 11% in all participants in rural Cameroon (Mbanya *et al.*, 1998), 16% in a large cross-sectional survey in Erithrea (Usman *et al.*, 2006).

In 1979 Pobee*et al.* (1979) described an epidemic of hypertension in Ghana. Since then, a recent review conducted by Bosu (2010) has demonstrated that the epidemic of hypertension in Ghana has persisted or increased. In 2007, the WHO estimated that the prevalence of hypertension of 25% in urban and 20% in rural populations. Either estimate is well below the 40% found in this study. Bosu (2010) reviewed 24 population –based studies in Ghana. Most studies reported a crude prevalence of hypertension between 25% and 48%, using the newer threshold of 140/90 mmHg. The Women‘s Health Study of Accra (WHSA) reported a crude prevalence of 54.6% among 1,303 women in upright position (Duda *et al.*, 2007). Only four studies reported a prevalence of less than 20%. Regardless of the cut-off used, most studies reported a higher prevalence among men than among women. The Women‘s Health Study of Accra (WHSA) reported a crude prevalence of 54.6% among 1,303 women in upright position (Duda *et al.*, 2007). Only four studies reported a prevalence of less than 20%. Regardless of the cut-off used, most studies reported a higher prevalence among men than among women. The pattern of sex differences in the prevalence of hypertension remained after adjusting for age (Amoah, 2003a; Addo *et al.*, 2006; Addo *et al.*, 2008). In mixed populations, the prevalence of hypertension was higher in urban than in rural populations. In four of six rural populations, prevalence of hypertension (BP ≥ 140/90 mmHg) was 24% or higher (Cappuccio *et al.*, 2004; Addo *et al.*, 2006; Burket, 2006). It is striking that in the other two studies with lower prevalence, both conducted in the same rural district in the Upper East Region, there was a three-fold disparity in the prevalence of hypertension (Cappuccio *et al.*, 2004; Burket, 2006).

5.2 Sex-related prevalence

Globally, the prevalence of hypertension is higher in males than in females(Kearney *et al.*, 2005). In the present study, 44.6% of males and 35.4% of females had at least mild hypertension. However, in both cases, the worldwide estimates were lower than estimates from the present study. In conformity with our results, several studies in Africa and in Ghana have shown some sex differences in prevalence of hypertension (Usman *et al.*, 2006; Addo *et al.*, 2007a). As in Ghana, some countries report a higher prevalence among men (Kamadjeu *et al.*, 2006; WHO, 2008a) while others report the converse (Temmar *et al.*, 2007; Adedoyin *et al.*, 2008). Male or female preponderance of hypertension could differ in the same study subjects depending on the threshold used (Adedoyin *et al.*, 2008).

5.3 Age-related prevalence

The age-specific prevalence of hypertension increased consistently with increasing age (group), in all the population sub-groups, with a more steep increase at the age group 55–64 years. A similar pattern has been reported in other studies (Bovet et al., 2002; Mufunda et al., 2006). This is similar to earlier work by Agyeman *et al.,* (2006) who found that old age was independently associated with poorer BP control even though they had higher hypertension awareness and treatment. Higher awareness and treatment levels among the older age group (>50 years), who have poor BP control is a much reported phenomenon (Chen *et al.*, 2003; Muntner *et al.*, 2004; Wang and Wang, 2004)

5.4 Isolated Systolic Hypertension

The crude prevalence of isolated systolic hypertension in the present study was 11.2% overall. The estimate was lower higher than an estimate of 28% found in a prospective cross-sectional survey of primary care patients in Belgium. In that study, males had a lower prevalence of ISH than in females. What we found in Dormaa is exactly the reverse. Several observational and intervention studies have demonstrated that systolic hypertension is even a more potent predictor of adverse cardiovascular outcome than is diastolic hypertension (Van der Niepen *et al.*, 2008). A meta-analysis concluded that antihypertensive drug treatment improves outcome mainly through lowering of the SBP (Wang *et al.*, 2005). Therefore, guidelines on the management of hypertension recommend targeting the SBP to less than 140mmHg (Waeber, 2003;
Mancia *et al.*, 2007).

5.5 Hypertension risk factors

A risk factor is defined as any attribute, characteristic, or exposure of an individual that increases the likelihood of developing a non-communicable disease (WHO, 2003). Underlying risk factors leading to hypertension can help to explain why some populations are at a greater risk of developing hypertension than are others.
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(Hajian-Tilaki and Heidari, 2007; Kelishadi *et al.*, 2008).

Mean BMI (Figure 4-3a) increased with age in the first three decades of age among both men and women, then, after a plateau, it continued to increase at a slower rate. For women the increase continued for a little longer, but then declined after 54 years of age. BMI in this study was significantly correlated with SBP and DBP, which was consistent with the WHO STEPS study in Asian and African countries (Tesfaye et al., 2007). In that study, Tesfaye et al., (2007) examined the association between BMI and BP in three populations across Africa and Asia. Mean BP levels increased with increasing BMI. The risk of hypertension is higher among population groups with overweight and obesity (BMI ≥ 25kg/m2). Positive associations between body mass and BP have been documented in Caucasian populations (Stamler et al., 1978;

Macmohan et al., 1987; Cassano et al., 1990), across populations in Asia (Collaboration, 2004), Latin America, United States and Canada, and in sub Saharan Africa (Tesfaye et al., 2007). Significant correlation of BMI to SBP and DBP, in men and women, was reported by studies in Tanzania (Njelekela et al., 2001)37 and Nigeria (Kadiri et al., 1999).

In this study, a peculiar distribution of hypertension along BMI quartiles was evident among the population, with significantly higher prevalence of hypertension at the upper quartiles of BMI, third and fourth, compared to the second and third. The observed distribution of hypertension among BMI quartiles contrasts with studies which found significantly higher prevalence of hypertension at extreme quartiles of BMI, first and fifth, compared to the second and third and suggests that under nutrition, where it is widely prevalent, may be an important risk factor for hypertension.

Our study reveals that elevated BP was consistently associated with a high BMI. A linear relationship between mean BMI and blood pressure is commonly demonstrated in areas without a malnutrition problem (Stamler et al., 1978; Macmohan et al., 1987; Cassano et al., 1990). The epidemiologic feature of malnourished populations where

Hypertension is associated with low BMI was not found in the present population. Tesfaye et al., (2007) found that Hypertension often exists in a background of under nutrition in developing countries where extremely low or high BMI levels may both be associated with increased risk of hypertension. The relationship between BMI and BP in this study might be potentially confounded by dietary salt intake and physical activity levels, both of which are very difficult to standardize and measure. The survey has revealed a high prevalence of cardiovascular risk factors in the municipality. A prevalence rate of current smokers of 22% is higher than studies conducted with a similar methodology in sub-Saharan Africa as well as the country as a whole [Eritrea 15.7%], even though it is lower than prevalence estimates in other developing countries, such as Singapore with 26.5% or Kuwait with 17% (Memon *et al.*, 2000). The findings were, however, similar to findings from both these countries in terms of sex differences, in which smoking prevalence is higher in males than females. Considering the governing role of men in the family unit, this result should also raise concerns about the effect of passive smoking on others, particularly children. But it was much lower than in a study carried out using WHO STEPS in Indonesia, in which 54% of men and 27.6% of the total population were current daily smokers. The main difference in methodology was that the Indonesian study enrolled an age range of 15–74 years, but this may not adequately explain the different results. More than one-third of the population in this study had a low level of physical activity, which was higher among women and higher age groups. Similar results were found in a study from the Middle East, in Azerbaijan (Seyffarshad *et al.*, 2007;

Sadeghi-Bazargani *et al.*, 2011). Those having higher activity also had lower BMI. Such an association is in line with previous studies (Sibai *et al.*, 2003; Slattery *et al.*, 2006; Kelishadi *et al.*, 2007; Kelishadi *et al.*, 2008).

The prevalence of overweight and obesity was 25.3%. This estimate lies in a range reported by studies in some developing countries. Similar to our findings, other studies have also shown that obesity is less common in early adulthood and advances faster among women (Seyffarshad *et al.*, 2007). Body-mass index alone has been found to be a strong independent predictor of hypertension (Forman *et al.*, 2009b). A stable linear relation between adiposity and blood pressure has been reported, independent of age and body-fat distribution across developed and developing countries (Doll *et al.*, 2002b). In Chinese women from rural areas followed up for 28 months, the risk of progression to hypertension was associated with advancing age, body-mass index, salt intake, and low physical activity (Sun *et al.*, 2010a). Abolfotouh and colleagues (2011) reported that high blood pressure was significantly associated with overall obesity in Egyptian adolescents. Adolescents with high blood pressure were 3·5 times more likely to be overweight or obese compared with adolescents with normal blood pressure.

Mean daily servings of both fruit and vegetables in this study is reasonable compared with those in some other countries. Fruit and vegetable consumption has always been an important scientific health recommendation (Lichtenstein *et al.*, 2006). Gaskin's study showed that 62% ate two or fewer servings of fruits or vegetables daily (Gaskins *et al.*, 2007).

5.6 Limitations of the study

In order to delimit the findings of this study, and make it relevant to the target population in Ghana, the study should be sufficiently representative of the entire population of the district. While it may be impossible to survey the entire target population, owing to time constraint and logistical challenges, a balance must be found by the research team in order to successfully meet research objectives. It was anticipated that one potential limitation of this study would have to do with the choice of an appropriately representative study design and data collection technique. In cluster sampling, the precision of the study may be sacrificed for a given sample size compared to systematic randomized sampling. In this study, cluster sampling was chosen as a result of budget and logistic constraints.

Also, the investigators made a few assumptions in the course of the study that must be borne in mind when interpreting study findings. The population selected for the study is representative enough of the Municipality and the Region to allow us to be able to generalize our conclusions about the risk factors for hypertension in the Municipality. The exact risk status of the study population is not known from any previous peerreviewed publication. Adults and aged are included in the study because behavior patterns of adults and old aged are associated with hypertension. Despite all these, the researcher is of the opinion that the data obtained and presented here sufficiently cover the study objectives and would provide a solid foundation for further research.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.0 Conclusions

Using the highly cited and standardized WHO STEPwise instrument, we estimated the prevalence of Hypertension in the Dormaa Municipality, in the Brong Ahafo region of Ghana. The overall prevalence of hypertension (SBP $\geq$ 140 and/or DBP $\geq$ 90 mmHg) was 40% and the prevalence of isolated systolic hypertension was 11.2% among the study population. Advancing age, smoking, and low physical activity among others were identified as the major risk factors for hypertension among the population.

Prevalence rate of daily smoking was 12% with variations among age and sex. A high prevalence of low fruit and low vegetable intake was also observed. Percentage who ate ≥5 combined servings of fruit and vegetables per day only 26.8%. Alcohol drinking was 39.6%. The prevalence of obesity was low at 4.7%. Combined risk factor analysis showed that 2.8% of participants were in the low-risk group (up to 5.1% among men and 0.5% among women). In addition, 21.5% of participants were in the high-risk group of developing hypertension.The results of the present study provide useful data on hypertension prevalence and associated risk factors in Dormaa and the Brong Ahafo region.

6.1 Recommendations

Drawing from the key findings of the study, the following recommendations are made for consideration and implementation by Policy-makers, institutions and all relevant stakeholders.

Government:

- Strengthening integration of chronic NCD care into Public Health Care services
- Establishment of a health facility-based screening programs in the Municipality and Sub-Districts.
- Hospitals and clinics should be well trained on early detection of asymptomatic hypertension condition.
- Improve the existing facilities for hypertension detection and management at local levels.
- Integration of NCD prevention programs into the school curriculum to ensure reduction of risk behaviours among school going adults.

- Formulate and strengthen of policies to control the incidence of tobacco smoking and alcohol use in schools, workplaces and other public places.

Municipal Health Management Team (MHMT):

- Embark on community based health education programs on the risk factors for Hypertension.
- Strengthen action to promote healthy diet and physical activity in schools.
- Strengthen the initiation of home-based programs on healthy diet and indoor and outdoor physical exercises.
- Routine public education on awareness through educational campaigns for promoting healthy life styles.
- Establish a stepwise surveillance system to monitor the trend of hypertension over time.
- Formation of keep-fit clubs should be encouraged within the communities.

Municipal Assembly:

- Provision of funds for research into hypertension in the Municipality.
- Assist the MHMT to establish community clinics for hypertension screening programs.

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APPENDIX I MAP OF GHANA

Figure 0-1: Map of Ghana showing the study location (tagged). Source Google Maps

APPENDIX II MAP OF DORMAA MUNICIPALITY

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Figure 0-2: Map of Dormaa. Source: Dormaa Municipal Assembly(MOFEP, 2013).

APPENDIX III

WHO STEPS Instrument

Table 0-1: WHO STEPS Instrument

Survey Information		
Consent, Interview Language and Name	**Response**	**Code**
Consent has been read and obtained	Yes 1 No 2 **If NO, END**	I5
Time of interview (24 hour clock) hrsmins		I7
Name	Contact phone number	I8, I9

Step 1 Demographic Information			
CORE: Demographic Information			
Question	**Response**		**Code**
Sex (*Record Male / Female as observed)*	Male 1	Female 2	C1
How old are you?	Years └─┴─┘		C3
In total, how many years have you spent at school and in full-time study (excluding pre-school)?	Years └─┴─┘		C4

What is the **highest level of education** you have completed?	No formal schooling 1 Less than primary school 2 Primary school completed 3 JSS/ Middle school completed 4 SHS/ High school completed 5 College/University completed 6 Post graduate degree 7 Refused 88	C5
What is your *ethnic group*?	*Akan* 1 *Ga Adangbe* 2 *Ewe* 3 Other [please state] Mole Dagbani 4	C6
What is your **marital status**?	Never married 1 Currently married 2 Separated 3 Divorced 4 Widowed 5 Cohabitating 6 Refused 88	C7

Which of the following best describes your **mainwork** status over the past 12 months?	Government employee 1 Non-government employee 2 Self-employed 3 Non-paid 4 Student 5 Homemaker 6 Retired 7 Unemployed (able to work) 8 Unemployed (unable to work) 9 Refused 88		C8

Step 1 Behavioural Measurements
CORE: Tobacco Use
Now I am going to ask you some questions about tobacco use.

Question	.esponse	Code
Do you **currently** smoke any **tobacco** products, such as cigarettes, cigars or pipes?	Yes 1 No 2 *If No, go to T8*	T1
Do you currently smoke tobacco products **daily**?	Yes 1 No 2	T2
How old were you when you **first started** smoking?	Age (years) └─┴─┘ Don't know 77	T3
Do you remember how long ago it was?	In Years └─┴─┘	T4a
	OR in Months └─┴─┘	T4b
	└─┴─┘	T4c
On average, **how many** of the following products do you smoke **each day/week?** *(IF LESS THAN DAILY, RECORD WEEKLY)* *(RECORD FOR EACH TYPE)* *Don't Know 7777*	DAILY↓ WEEKLY↓	
	Manufactured cigarettes └─┴─┴─┴─┘ └─┴─┴─┴─┘	T5a/T5aw
	Other └─┴─┴─┴─┘ └─┴─┴─┴─┘	T5f/T5fw
During the past 12 months, have you	Yes No 1 2	T6
tried toIn the past, did you **stop smokingeversmoke**? any	Yes 1	T8

tobacco products?	No 2	
In the past, did you **ever** smoke **daily**?	Yes 1	T9

No 2

CORE: Alcohol Consumption		
The next questions ask about the consumption of alcohol.		
Question	**Response**	**Code**
Have you **ever** consumed any alcohol such as beer, wine, spirits or *palm wine*?	Yes 1 No 2	A1
Have you consumed any alcohol within the **past 12 months**?	Yes 1 *If Yes, go to A4* No 2	A2
Have you stopped drinking due to health reasons, such as a negative impact on your health or on the advice of your doctor or other health worker?	Yes 1 No 2	A3
During the past 12 months, **how frequently** have you had at least one standard alcoholic drink?	Daily 5-6 days 1 per week 2 3-4 days per week 3 1-2 days per week 4 1-3 days per month 5 Less than once a 6	A4
Have you consumed any alcohol within the **past 30 days**?	Yes 1 No 2 *If No, go to A13*	A5
During the past 30 days, when you drank alcohol, how many **standarddrinks on average** did you have during one drinking occasion?	Number Don't know 77 └─┴─┘	A7

During the past 30 days, what was the **largest number** of standard drinks you had	Largest number Don't Know 77 └─┴─┘	A8
During each of the **past 7 days**, how many standard drinks did you have each day? *Don't Know 77*	Monday └─┴─┘	A10a
	Tuesday └─┴─┘	A10b
	Wednesday └─┴─┘	A10c
	Thursday └─┴─┘	A10d
	Friday └─┴─┘	A10e
	Saturday └─┴─┘	A10f
	Sunday └─┴─┘	A10g

CORE: Diet		
The next questions ask about the fruits and vegetables that you usually eat. I have a nutrition card here that shows you some examples of local fruits and vegetables. Each picture represents the size of a serving. As you answer these questions please think of a typical week in the last year.		
Question	**Response**	**Code**
In a typical week, on how many days do	Number of days *1* └─┴─┘ *If Zero*	2 D1
How many **servings** of fruit do you eat on	Number of servings └─┴─┘	3 D2
In a typical week, on how many days do	Number of days *4* └─┴─┘	D3
How many **servings** of vegetables do you	Number of servings └─┴─┘	D4

CORE: Physical Activity
Next I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person. Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study/training, household chores, harvesting food/crops, fishing or hunting for food, seeking employment. *[Insert other examples if needed]*. In answering the following questions 'vigorousintensity activities' are activities that require hard physical effort and cause large increases in breathing or heart rate, 'moderate-intensity activities' are activities that require moderate physical effort and cause small increases in breathing or heart rate.

Question	Response	Code
Work		
Does your work involve vigorous-intensity activity that causes large increases in	Yes 1 No 2 *If No, go to P 4*	5 P1
In a typical week, on how many days do	Number of days └─┘	6 P2
you do vigorousHow much time do you spend doing -intensity activities as part vigorous-intensity activities at work on a typical day?	Hours : minutes └─┴─┘ : └─┴─┘ hrsmins	P3
Does your work involve moderate-intensity activity, that causes small increases in	Yes 1 No 2 *If No, go to P 7*	P4
In a typical week, on how many days do	Number of days └─┘	P5
you do moderate-intensity activities as part How much time do you spend doing moderate-intensity activities at work on a	Hours : minutes └─┴─┘ : └─┴─┘	P6

typical day?	hrsmins	

Travel to and from places		
The next questions exclude the physical acti ities at work that you have already mentioned. Now I would like to ask you about the usual way you travel to and fro places. For example to ork, for shopping, to market, to place of worship.		
Do you walk or use a bicycle *(pedal cycle)* for at least 10 minutes continuously to get to and from places?	Yes 1 No 2 *If No, go to P 10*	P7
In a typical week, on how many days do you walk or bicycle for at least 10 minutes	Number of days └─┘	P8
How much time do you spend walking or bicycling for travel on a typical day?	Hours : minutes └─┴─┘ : └─┴─┘ hrsmins	P9 (a-b)
CORE: Physical Activity, Continued		
Question	**Response**	**Code**
Recreational activities		
The next questions exclude the work and tra isport activities that you have already mentioned. Now I would like to ask you about sports, fit1ess and recreational activities (leisure)		
Do you do any vigorous-intensity sports, fitness or recreational *(leisure)* activities	Yes 1 No 2 *If No, go to P 13*	P10
In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational *(leisure)* activities?	Number of days └─┘	P11
How much time do you spend doing vigorous-intensity sports, fitness or	└─┴─┘ : └─┴─┘ Hours : minutes hrsmins	P12

recreational activities on a typical day?		
Do you do any moderate-intensity sports, fitness or recreational *(leisure)* activities	Yes 1 No 2 *If No, go to P16*	P13
In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational *(leisure)* activities?	Number of days └─┘	P14
How much time do you spend doing moderate-intensity sports, fitness or recreational *(leisure)* activities on a typical day?	└─┴─┘ : └─┴─┘ Hours : minutes hrsmins	P15 (a-b)

CORE: History of Raised Blood Pressure		
Question	**Resp nse**	**Code**
Have you ever had your blood pressure measured by a doctor or other health	Yes 1 No 2 *If No, go to H6*	H1
Have you ever been told by a doctor or other health worker that you have raised	Yes 1 No 2 *If No, go to H6*	H2a
Have you been told in the past 12 months?	Yes 1 No 2	H2b
In the past two weeks, have you taken any drugs (medication) for raised blood pressure prescribed by a doctor or other health worker?	Yes 1 No 2	H3

Have you ever seen a traditional healer for raised blood pressure or hypertension?	Yes 1 No 2	H4
Are you currently taking any herbal or traditional remedy for your raised blood	Yes 1 No 2	H5

CORE: History of Diabetes		
Have you ever had your blood sugar measured by a doctor or other health	Yes 1 No 2 *If No, go to H12*	H6
Have you ever been told by a doctor or other health worker that you have raised	Yes 1 No 2 *If No, go to H12*	H7a
Have you been told in the past 12 months?	Yes 1 No 2	H7b
In the past two weeks, have you taken any drugs (medication) for diabetes prescribed by a doctor or other health worker?	Yes 1 No 2	H8
Are you currently taking insulin for diabetes prescribed by a doctor or other health worker?	Yes 1 No 2	H9
Have you ever seen a traditional healer for diabetes or raised blood sugar?	Yes 1 No 2	H10
Are you currently taking any herbal or traditional remedy for your diabetes?	Yes 1 No 2	H11

CORE: History of Raised Total Cholesterol

Have you ever had your cholesterol (fat levels in your blood) measured by a doctor	Yes 1 2 *If No, go to H17* No	H12
Have you ever been told by a doctor or other health worker that you have raised	Yes 1 2 *If No, go to H17* No	H13a
Have you been told in the past 12 months?	Yes 1 No 2	H13b
In the past two weeks, have you taken any oral treatment (medication) for raised total	Yes 1 2 No	H14
Have you ever seen a traditional healer for raised cholesterol?	Yes 1 2 No	H15
Are you currently taking any herbal or traditional remedy for your raised	Yes 1 2 No	H16
CORE: History of Cardiovascular Diseases		
Have you ever had a heart attack or chest pain from heart disease (angina) or a stroke (cerebrovascular accident or incident)?	Yes 1 No 2	H17
Are you currently taking aspirin regularly to prevent or treat heart disease?	Yes 1 No 2	H18
Are you currently taking statins (Lovastatin/Simvastatin/Atorvastatin or any other statin) regularly to prevent or treat heart disease?	Yes 1 No 2	H19
CORE: Lifestyle Advice		

7 During the past three years, has a doctor or other health worker advised you to do any of the following?*(RECORD FOR EACH)*

Quit using tobacco or don‘t start	Yes 1 No 2	H20a
Reduce salt in your diet	Yes 1 No 2	H20b
Eat at least five servings of fruit and/or vegetables each day	Yes 1 No 2	H20c
Reduce fat in your diet	Yes 1 No 2	H20d
Start or do more physical activity	Yes 1 No 2	H20e
Maintain a healthy body weight or lose weight	Yes 1 No 2	H20f
CORE (for women only): Cervical Cancer Screening		
The next question asks about cervical cancer prevention. Screening tests for cervical cancer prevention can be done in different ways, including Visual Inspection with Acetic Acid/vinegar (VIA), pap smear and Human Papillomavirus (HPV) test. VIA is an inspection of the surface of the uterine cervix after acetic acid (or vinegar) has been applied to it. For both pap smear and HPV test, a doctor or nurse uses a swab to wipe from inside your vagina, take a sample and send it to a laboratory. It is even possible that you were given the swab yourself and asked to swab the inside of your vagina. The laboratory checks for abnormal cell changes if a pap smear is done, and for the HP virus if an HPV test is done.		
Question	**Response**	**Code**
Have you ever had a screening test for	Yes 1	CX1

cervical cancer, using any of these methods	No 2 Don‘t 77	

described above?

Step 2 Physical Measurements

CORE: Blood Pressure		
Question	**Response**	**Code**
Cuff size used	Small 1 Medium 2 Large 3	M3
Reading 1	Systolic (mmHg) ___ ___ ___	M4a
	Diastolic (mmHg) ___ ___ ___	M4b
Reading 2	Systolic (mmHg) ___ ___ ___	M5a
	Diastolic (mmHg) ___ ___ ___	M5b
Reading 3	Systolic (mmHg) ___ ___ ___	M6a
	Diastolic (mmHg) ___ ___ ___	M6b
CORE: Height and Weight		
For women: Are you pregnant?	Yes 1 *If Yes, END* No 2	M8
Height	in Centimetres (cm) ___ ___ ___ . ___	M11
Weight *If too large for scale 666.6*	in Kilograms (kg) ___ ___ ___ . ___	M12
CORE: Waist		
Waist circumference	in Centimetres (cm) ___ ___ ___ . ___	M14
Hip circumference	in Centimetres (cm) ___ ___ ___ . ___	M15