UNIVERSITY FOR DEVELOPMENT STUDIES

PREVALENCE OF CARDIOVASCULAR RISKS FACTORS AMONG SCHOOL TEACHERS IN THE TAMALE METROPOLIS OF THE NORTHERN REGION OF GHANA.

BY

GRACE DALWO AYIJUNU

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DECEMBER, 2015

DECLARATION

I hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this university or elsewhere:

.... 25/11/2015 ....

GRACE DALWO AYIJUNU **DATE**

(STUDENT)

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University for Development Studies

.... 24/11/15 ....

DR. ABASS ALHASSAN **DATE**

(SUPERVISOR)

ABSTRACT

Introduction: There is a growing awareness that premature deaths from cardiovascular diseases (CVD) and other non-communicable diseases reduce productivity, curtails economic growth, and pose a significant social challenge in most countries. The impact of cardiovascular risk factors is very enormous especially on the budget of the health sector since there is an epidemiological change from pathogenic diseases to lifestyle diseases.

Objectives: The main aim of the study is to investigate the risk factors of cardiovascular risk factors among school teachers in the Tamale Metropolis.

Methodology: A cross sectional study was conducted among 200 school teachers in the Tamale Metropolis of Ghana. The respondents were selected using simple random sampling procedure. Data was collected on socio demographic characteristics of the respondents through interviews whilst anthropometric measurements and biochemical assessment were done using an Analyzer BT-3000 manufactured in Italy in 2008. Data on Blood Serum Cholesterol, Fasting Blood Sugar, Body Mass Index and Blood Pressure were collected.

Results: The study found that 12.5% of the study participants had high total cholesterol level whilst 9% had high triglycerides. Hyperglycemia was the highest in all the indices among the study participants (16%). High cholesterol levels were found among females, singles and Participants with Degrees and Postgraduate Degrees. The mean BMI of the female population was 25.48 ± 0.51 but not statistically different from that of the male 24.86 ± 0.61 ($P = 0.44$). Cholesterol levels increased with increasing age ($P<0.01$) and also increased as BMI increased but not statistically significant ($p=0.326$).

Conclusion Most of the study participants are at risk of developing diabetes, hypertension and coronary heart diseases due to the high levels of cholesterol

DEDICATION

This thesis is dedicated first to the almighty God for his love, grace and mercies shown me during my studies, and for the good health, strength peace of mind and resources needed for the successfully study and completion of this research. Also to my family especially my surviving mother; Madam Joana Jeribunga Kudona, my Dad, Mr Ayijunu Komba of blessed memory and Marcellinus Ayijunu my son for their understanding, love and support and finally to all teachers in Tamale Metropolis who allowed their blood samples taken for this research.

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LIST OF ACRONYMS

ATP	ADENOSINE TRIPHOSPHATE
BGL	BLOOD GLUCOSE LEVEL
CVD	CARDIOVASCULAR DISEASE
CHOL	CHOLESTEROL
LDL	LOW DENSITY LIPOPROTEIN
LVH	LEFT VENTRICULAR HYPERTROPHY
HDL	HIGH DENSITY LIPOPROTEIN
FBS	FASTING BLOOD SUGURE
VLD	VERY LOW DENSITY LIPOPROTEIN
BMI	BODY MASS INDEX
TRIGLY	TRIGLYCERIDES
CR	CORONARY RISK
DBP	DIASTOLIC BLOOD PRESSURE
SBP	SYSTOLIC BLOOD PRESSURE
AIP	ATHEROGENIC INDEX OF PLASMA
WC	WAISTE CIRCUMFERENCE
WHO	WORLD HEALTH ORGANIZATION

LMIC LOW AND MIDDLE INCOME COUNTRIES

NCDs NON COMMUNICABLE DISEASES

DALYs DISABILITY ADJUSTED YEARS

TMA TAMALE METRO ASSEMBLY

TZ TUO ZAAFI

CI CONFEDENCE INTERVAL

SMHS SCHOOL OF MEDICINE AND HEALTH SCIENCES

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Cardiovascular Diseases (CVDs) are the leading cause of deaths in the majority of developed and developing countries. A century ago, CVDs were responsible for less than 10% of all deaths, but currently, it accounts for approximately 30% of deaths worldwide, 40% in high-income countries. And approximately 28% in low and middle-income countries. (Daniel P Capingana1, 2013)

The World Health Organization in collaboration with the World Heart Federation in a joint publication in 2011 intimated that Cardiovascular Diseases (CVDs) remain the biggest cause of deaths worldwide(WHO, 2011). Their report stated that more than 17 million people died from CVDs in 2008 and that more than 3 million of these deaths occurred before the age of 60 which they said could have largely been prevented(Federation, 2011)

The World Health Organization (WHO) also stated that the percentage of premature deaths from CVDs ranges from 4% in high-income countries to 42% in low-income countries, leading to growing inequalities in the occurrence and outcome of CVDs between countries and populations. The report also stated that there are new dimensions to this alarming situation nowadays with deaths from CVDs declining in high-income countries, but have increased at an astonishingly fast rate in low- and middle-income countries (LMIC) (Organization, 2012a)

The Global Status Report on Non communicable Diseases (NCDs) stated that CVDs are largely preventable. Both population wide measures and improved access to individual health care interventions can result in a major reduction in the health and socioeconomic burden caused by these diseases and their risk factors. The report further stated that these interventions, which are evidence based and cost effective, are described as best buys in the world(Federation, 2010). In Ghana, (Owiredu R, 2010) reported that CVD is one of the top two causes of death after diarrhea diseases. The report stated that in Accra, CVD rose from being the seventh and tenth cause of death in 1953 and 1966 respectively, to the number one cause of death in 1991 and 2001 and it has continued as the major cause of mortality in the country since then. Due to the increase in deaths from CVD and other non-communicable diseases (NCDs), the Ministry of Health in 2012 drew a national policy to deal with this public health issue in order to reduce the morbidities and mortalities from these diseases, (Ministry of Health 2012).

The dominant assumption among lay communities and experts in Ghana is that CVD is rare and does not pose serious public health challenges. Furthermore, Ghana's health system is weak in terms of finances and human resources, and it struggles to address the double burden of NCDs and acute communicable diseases (Olutabi A, 2014). Presently, public health services in developing countries are overstretched by increasing demands to cope with heart diseases, stroke, cancer, diabetes and chronic respiratory diseases. At the same time, health care systems in many LMIC are let down by a model based on hospital care focused on the treatment of diseases, often centered around high-technology hospitals that provide extensive treatment for only a small minority of citizens (World Health Organization, 2014). Hospitals consume huge amounts of resources, and health ministries may spend more than half their budgets on treatment services which depend on hospitals. A large proportion of people with high cardiovascular risk remain undiagnosed, and even those diagnosed have insufficient access to treatment at the primary health-care level; while evidence suggests two-thirds of premature deaths due to NCDs including CVDs can be prevented by primary prevention and another one-third by improving health systems to respond more effectively and equitably to the healthcare needs of people with NCDs (Feigin VL Barreto SM, 2009).

(Smith CS, 2008) stated that there is a growing international awareness that premature deaths from CVDs and other NCDs reduce productivity, curtails economic growth, and pose a significant social challenge in most countries. Again, there is now unequivocal evidence that "best buy" interventions to reduce the toll of premature deaths due to CVDs and other NCDs are workable solutions and that they are excellent economic investments -- including in the poorest countries (World Heart Federation 2013).

(Roerecke M, 2010) stated that as the magnitude of CVDs continue to accelerate globally; the pressing need for increased awareness and for stronger and more focused international and country responses is increasingly recognized.

According to(WHO, 2009) examples of CVDs include diseases of the heart, vascular diseases of the brain and diseases of blood vessels. CVDs due to atherosclerosis include: ischaemic heart disease or coronary heart disease (CHD) (e.g. heart attack), is caused by atherosclerosis, a condition in which cholesterol, that is fat and fibrous tissues build up in the walls of large and medium sized arteries. As atherosclerosis progresses, the coronary arteries may narrow and make it difficult for oxygen- rich blood and nutrients to reach the heart muscle. Reduced blood supply to the heart can result in chest pain (angina pectoris). Other symptoms, if a narrowed blood vessel is completely blocked by a blood clot, the area of the heart just beyond the blockage is denied oxygen and nourishment, resulting in a heart attack (mycocardial infarction). The situation is often completed by the development of an irregular heart rhythm (arrhythmia) and or heart failure in which the heart's power to pump blood is inadequate to meet the body's needs. Other CVDs include; cerebrovascular disease (e.g. stroke), diseases of the aorta and arteries, including hypertension and peripheral vascular disease. The report again cited other CVDs which include; congenital heart disease, rheumatic heart disease, cardiomyopathies and cardiac arrhythmias.

Several factors have been cited as risk factors of CVDs. (Yang H, 2006) argued that stress, especially work stress, has drawn increasing attention to be one of the causes of CVDs. Examples of stressful occupational activities which were mentioned are firefighting and school teaching. A study conducted by(Deyanov D, 1994) in Bulgaria, found that the estimated relative risk of arterial hypertension for female teachers was 1.5 compared with other female employees (designers, researchers) served as controls. This study therefore assessed the relationship between arterial hypertension and CVDs.

Another study conducted to illustrate the global burden of CVDs found that most of the disease burden caused by high blood pressure is borne by low-income and middle-income countries, by people in middle age, and by people with pre-hypertension (Lawes CM, 2008).

According to Lerner and(C, 1986) elevated blood pressure or blood cholesterol levels increase the risk for premature CVD morbidity and mortality. Other major CVD risk factors include cigarette smoking, diabetes mellitus, a low high density lipoprotein cholesterol level, severe obesity, male sex, and a family history of CVD.

Epidemiological data from the (Services, 1990) have demonstrated that individuals with fewer or lower levels of CVD risk factors are less likely to suffer a cardiovascular event. In addition, the greater the level of any single CVD risk factor, the greater the chance of incurring disease. Moreover, a combination of risk factors creates a synergistic effect further increasing risk.

Conversely, reducing cardiovascular risk factors prevents death and disability from cardiovascular diseases (U.S Department of Health Services, 2000)

According to (G, 1995)accurate population-based data on CVD risk factors are not generally available. His study stated that demographic, socioeconomic and nutritional changes over the last three decades are precipitating factors resulting in a rise in the magnitude of CVDs. The study further cited diabetes, hypertension and hyperlipidemia as major risk factors of CVDs.

(Tawfik MG, 1998) stated that cigarette smoking is a major risk factor for the occurrence of CVD, stroke and peripheral vascular disease. It is known to increase the risk of morbidity and mortality in both men and women and for all racial groups. It is estimated that approximately one pack of cigarettes per day doubles the CHD risk. The picture is more apparent in patients with hypertension, high blood cholesterol and diabetes.

The aim of this study was to do biochemical assessments and anthropometric factors and their relationship with CVDs among teachers in the Tamale Metropolis.

1.2 Problem Statement

The increasing prevalence of Cardiovascular Disease (CVDs) account for the majority of mortality globally and in Ghana for that matter. These diseases are responsible for one quarter of all deaths worldwide and have adversely affected many individuals including Teachers.

The number of reported new cases of cardiovascular diseases in outpatient public health facilities in Ghana increased more than ten-fold between 1988 and 2007. The number of cases increased from 49,087 in 1988 to 505,180 in 2007.

Risk factors for CVDs are many (Social, economic and Cultural)

Hypertension which is one of the several risk factors also increased from 1.7% of total reported outpatient cases in 1988 to 4.0% of total outpatient cases in 2007. Stroke and hypertension were also reported to be the leading causes of hospital admissions and mortalities (Service, 2008) These cases have been attributed to the changing lifestyle among the majority of Ghanaians and also increasing urbanization and physical inactivity.

In the Tamale Teaching Hospital, the number of reported cases of CVD; hypertension, stroke and diabetes among teachers at all levels in the Metropolis increased from 548 in 2011 to 595 in 2012 for in-patient and 1020 in 2011 to 1419 in 2012 for out-patients (Annual Report 2012). The economic impact of cardiovascular diseases is very enormous especially on the budget of the health sector institutions and at the individual level. There is however very little scientific data on the prevalence of cardiovascular risk factors among apparently teachers in the general population within the Tamale Metropolitan area. This study thus seeks to determine the risk factors of CVDs among school teachers in the Tamale Metropolis.

1.3 Objectives of the Study

1.3.1 General Objective

The general objective of the study is to assess the prevalence of CVDs and their relationship with anthropometric and biochemical factors of teachers.

1.3.2 Specific Objectives

Specifically, the study sought;

1. To determine the prevalence of risk factors of CVDs among school teachers in the Tamale Metropolis
2. To examine the serum lipid profile and the atherogenic index among teachers in Tamale Metropolis
3. To determine the relationship between socio-demographic characteristics and the prevalence of CVDs among teachers in Tamale Metropolis
4. To examine the relationship between gender and CVDs risk factors among teachers in Tamale Metropolis

1.4 Research Questions

The relevant research questions are as follows

i. What is the prevalence of CVDs among teachers in the Tamale Metropolis?

ii. What is the atherogenic index among teachers in the Tamale Metropolis?

iii. Is there a relationship between socio demographic factors and prevalence of CVDs among teachers in Tamale Metropolis?

iv. What is the relationship between CVDs and blood lipid profile and blood glucose levels?

v. What are the risk factors of CVDs among school teachers in the Tamale Metropolis?

1.5 Significance of the Study

The(Ghana, 2011)reported that lifestyle diseases and conditions are on the ascendancy with both younger and older people suffering from diabetes, hypertension and other cardiovascular diseases. The report stated that the Regenerative Health programme that was introduced has not been able to totally curtail the lifestyle diseases among the Ghanaian populace.

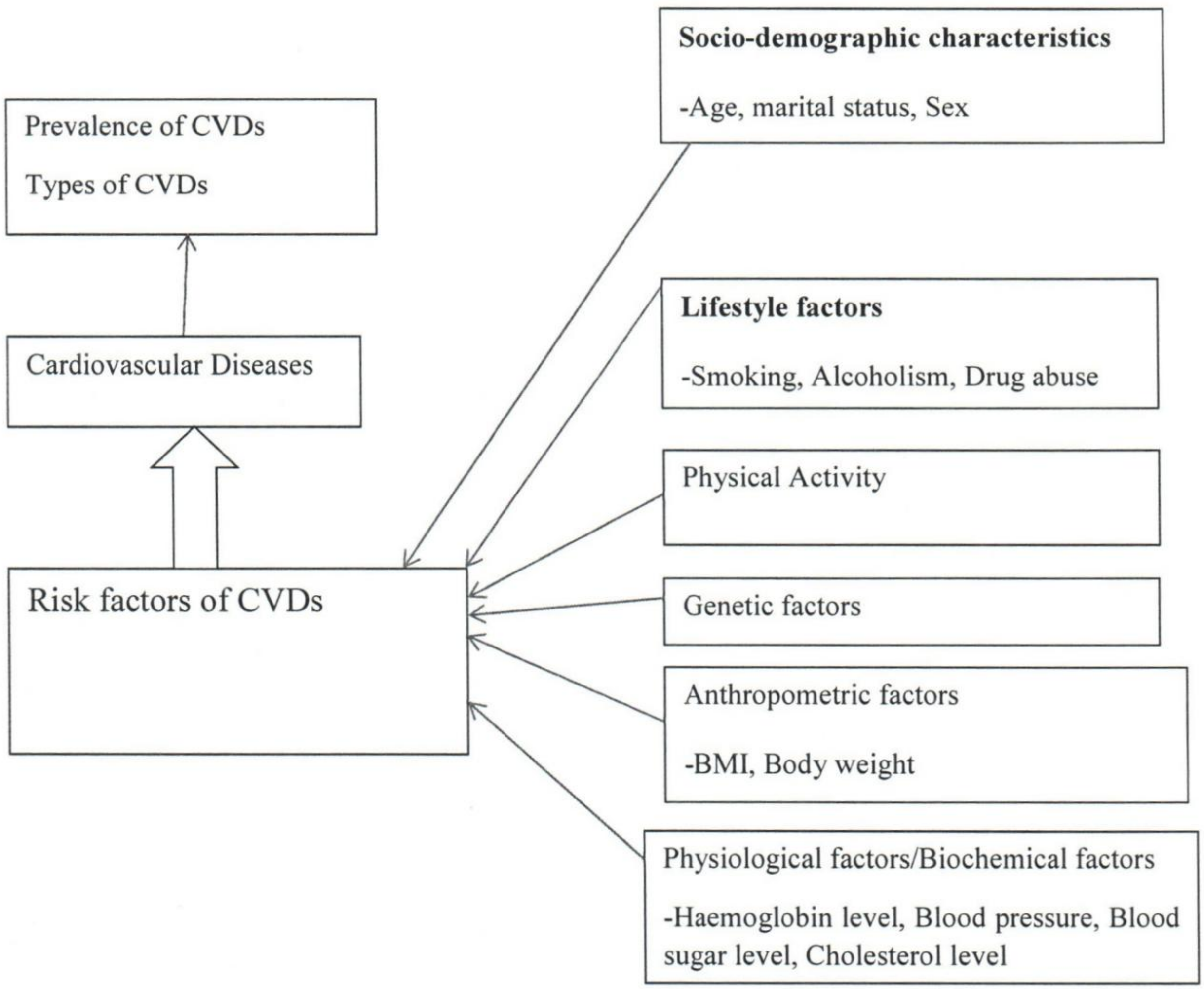
The findings of this study would be useful in providing information on the risk factors of CVDs to agencies or departments that are operating in the area of public health or preventive medicine to direct their resources into preventing CVDs.

The study would also be useful to the teachers who are the study population considering the fact that people rarely go for periodic medical examination. Since the study will involve measurement of blood pressure, blood sugar levels, BMI and haemoglobin levels, it will give a report on the health status of the individuals who are going to take part in the study.

This study will also provide a baseline data on the prevalence of cardiovascular risk factors which will form the basis for the further research in this area

1.6 Conceptual framework of CVDs risk factors.

The study was conducted based on the conceptual framework of CVDs risk factors as presented below.



Source: Author's Construct

The risk factors of CVDs that would be explored by the study are presented in figure 1.1 above

The conceptual framework provided a road map for the study. It shows the interconnectedness of the various risk factors of CVDs as the study sought to explore. The main risk factors of CVDs that were explored by the study include socio-demographic factors, lifestyle factors, genetic factors, physical activity, anthropometric factors and the physiological factors of the respondents.

Socio-demographic Characteristics: The study examined the relationship between socio-demographic factors and their contribution to CVDs. The study assessed the relationship between age, marital status, educational level and gender and the level of blood sugar level, blood cholesterol level, the concentration of triglycerides and low density lipoproteins in the body. The study explored the linkage or contribution of these demographic variables to cardiovascular risk factors.

The influence of genetic factors on the prevalence of CVD risk factors was also assessed by this study. This was assessed by tracing the prevalence of CVDs in the families of respondents. Family records of CVDs were used to assess whether respondents were liable to developing the risk factors.

The levels of physical activity of an individual are reported by several studies to have an impact on the general health status of the person. This study compared the activity levels of respondents and the prevalence of CVDs risk factors. Physical activity was assessed by considering the distance walked by individuals on foot, the physical exercises and other activities that are seen to be strenuous and energy-dissipating.

Lifestyle conditions: Lifestyle conditions such as alcoholism, smoking and drug abuse and their influence on the insurgence of cardiovascular diseases would be assessed by this study.

Certain physiological factors such as blood sugar level and blood cholesterol levels have influence on the prevalence of CVDs risk factors. This study will determine the relationship between these physiological factors and cardiovascular risk factors.

Anthropometric Factors; The two anthropometric factors considered by this study Body Mass Index (BMI) and body weight. Some studies have linked cardiovascular diseases to body mass and body weight. This study therefore tried to assess the link between BMI and body weight and the CVDs risk factors. Their effect on blood sugar level, triglyceride concentrations and low density lipoproteins were assessed.

1.6.3 Organization of the Thesis

This thesis has been organized into six chapters.

Chapter one includes the introduction to the study, background to the study, the problem statement, the study objectives, the significance of the study, conceptual framework and the operational definition of terms of the study.

The second chapter will review relevant literature in relation to the study. Chapter three will form the methodology, which comprises the study design, study type, study variables (independent and dependent variables), data collection instruments, sampling procedure and sample size, study population, data collection methods, determination of knowledge of CVDs, quality control measures, ethical considerations as well as plan for dissemination of results.

The fourth chapter will contain the results and findings of the study whilst the discussion of the results and findings of the study would be done in chapter five. The conclusion and recommendations of the study would be presented in chapter six. A sample of the study questionnaire and some tables from the analyses would be presented as appendices.

CHAPTER TWO

LITERATURE REVIEW

This chapter reviews relevant literature with regards to the study. The literature review covers the objectives and conceptual framework of the study.

2.1 An Overview of Cardiovascular Diseases

Cardiovascular disease (CVD) is the leading cause of death worldwide, but rates vary considerably among countries. Published studies clearly show that CVD is no longer a ''man disease''. It is reported that two-thirds of sudden death occur among women with no history of heart disease (Kanel, 2011)

Of the 57 million global deaths in 2008, 36 million (63%) were due to NCDs and 17.3 million (30%) were due to CVDs (Federation, 2009). Nearly 80% of NCD deaths occur in LMICs and is the most frequent cause of death in most countries, except in Africa (Gupta R, 2011). In Africa, NCDs are rising rapidly and are projected to exceed communicable, maternal, perinatal and nutritional diseases as the most common causes of death in another two decades. Over 80% of cardiovascular and diabetes deaths occur in LMICs. While 29% of NCD deaths occurs among people below the age of 60 in LMICs, in high-income countries only 13% of deaths occur below the age of 60 (Feigin VL Barreto SM, 2009)

According to (Gaziano S, 2010)the global burden of cardiovascular disease (CVD) has been increasing overtime. At the beginning of the 20th century, CVD accounted for less than 10 percent of all deaths worldwide. By the start of the 21st century, it was responsible for about 30 percent of all deaths globally with more than 80 percent of those occurring in low- and middle- income countries. (A, 2007)in his study stated that cardiovascular diseases have been the leading cause of death in high income countries for the past decades but now are fast becoming the leading cause of death in low- and middle-income countries. This rapid increase in CVD deaths is coupled with the continuing and significant risk of death from infectious diseases in these countries, thereby causing this part of the world to experience a double burden of infectious and chronic diseases.

Cerebrovascular disease, also called stroke, is the second leading cause of death in adults worldwide and is a major contributor to disability and reduced quality of life.(G, 1996). The global burden of disease assessment for the years 2002–3 showed rather bleak projections of the worldwide burden of stroke. (Strong BG, 2007), although available data on stroke mortality are limited, it is now well documented that stroke is a major cause of death in middle- and low-income countries.(Connor, 2007) and approximately 87% of all deaths by stroke occur in these countries. Two community-based studies in sub-Saharan Africa (SSA) show that stroke is the cause of 5% to 10% of all deaths. This parallels the increasing prevalence of hypertension – the major risk factor for stroke (Addo-Yobo EO, 2007)

Evidence in Saudi Arabia suggests that case fatality rates for stroke may be higher than those in high-income countries, and contribute significantly to the burden of disease.(EA, 2001). This may be due to limited healthcare facilities and high rates of risk factors such as hypertension (Agyemang C, 2012).

According to (H, 2006), Ghana is undergoing a rapid epidemiological transition. Consequently, the last few decades have seen major causes of death shifted from solely communicable diseases to a combination of communicable and chronic non-communicable diseases. The increasing rates of cardiovascular disease (CVD) mortality, particularly stroke, have been unprecedented. For example, in Accra, CVD rose from being the seventh and tenth cause of death in 1953 and 1966 to number one cause of death in 1991 and 2001(Addo-Yobo N, 2002). In another study of adult patients from Komfo Anokye Teaching Hospital (KATH), Kumasi, 17.9% of acute medical admissions were ascribed to cardiovascular causes including hypertension, heart failure and stroke(AG, 2007)

A study by (Amoah PN, 2007) reported that in-patient causes of death in 32 sentinel hospitals in the 10 regions of Ghana revealed that stroke was the fourth leading in-patient cause of death. This was further supported by (Anand SR, 2007) who stated that the increasing prevalence of hypertension in Ghana, particularly in urban centres, clearly suggests that the burden of hypertension will continue to increase unless urgent action is taken to halt the rising prevalence of hypertension. (Annon, 2008)stated that the increasing burden of stroke in Ghana will put a huge burden on the already overstretched health care resources. The neglect of the extent of the problem as reflected on the low policy priority and low interest from development partners indicates that many people will continue to bear the brunt of the disease. In a study conducted at Korle-Bu teaching hospital, Accra, by(Britwum, 2012) from 2004 to 2011, about 69% of stroke patients died within 24 hours of the onset of stroke. This figure is said to be overly high when compared to countries in Europe and North America, and may reflect inadequate healthcare facilities and uncontrolled CVD risk factors. Similar to many African countries, (K, 2010) stated that information on stroke is very limited in Ghana. The study reported that it is unclear whether the high stroke mortality rate within 24 hours of admission in Accra reflects the patterns in other major hospitals in Ghana.

All cardiovascular deaths diagnosed at autopsy during the 5-year period beginning January 2006 and ending December 2010 showed that CVD constituted about one-fifth (22.5%) of all causes of deaths at KBTH within the 5-year period. Also, the proportionate mortality ratio (PMR) for CVD increased with age, rising steeply in the mid-life to peak in the very old, accounting for almost 50% of deaths examined by age 85 years((Olutobi T, 2011)In terms of attributable deaths, the leading CVD risk factor is raised blood pressure (to which 13% of global deaths is attributed), followed by tobacco use (9%), raised blood glucose (6%), physical inactivity (6%) and overweight and obesity (5%) (Control, 2011b)

2.2 Risk Factors of Cardiovascular Diseases

According to the (Foundation, 2008) majority of cardiovascular disease (CVD) is caused by risk factors that can be controlled, treated or modified, such as high blood pressure, cholesterol, overweight/obesity, tobacco use, lack of physical activity and diabetes. The report however, stated that there are also some major CVD risk factors that cannot be controlled

Knowledge of the causative factors and methods of prevention of CVDs are essential to reduce morbidity and mortality. A study by (Khattab MS, 1999) of the prevalence of cardiovascular risk factors, attitudes and behavior for Saudis 20 years and above, showed that only 15.7% with high dietary fat intake perceived their diet to be a health risk, 16.5% of obese people perceived their body build to be a health risk and 22.6% of inactive people perceived their inactivity as harmful to health. The same study revealed a high prevalence of smoking (35.4%) and obesity (23.4%) in males, with even a higher prevalence of obesity in females (52.3%).

According to (Attia Z Taha *et al.*, 2004) proper knowledge of risk factors for CVDs can help teachers to adopt healthy lifestyle throughout their lives. This will eventually lead to disease prevention and avoidance of premature morbidity and mortality. Therefore health education programs in schools may be an effective primary prevention strategy.

Classic CVD risk factors such as hyperlipidemia, hypertension, cigarette smoking, physical inactivity, diabetes mellitus, certain lipoproteins and obesity apply to both sexes, but they affect women differently (Johansen R, 1990). The strongest risk factors for women appear to be advancing age, low high-density lipoprotein cholesterol (HDL-c) concentrations, tobacco use and diabetes mellitus(Judelson, 1994).

Hospital-based studies in Saudi Arabia showed that smoking, hypertension, and diabetes mellitus were the common risk factors among patients with acute myocardial infarction(Al-Gindan SE, 1990)

(Disease, 2008) reported that tobacco smoking, physical inactivity, unhealthy diets and the harmful use of alcohol are the main behavioral risk factors of CVDs. These risk factors are shared by other major NCDs such as cancer, diabetes and chronic respiratory disease. Long-term exposure to behavioral risk factors results in raised blood pressure (hypertension), raised blood sugar (diabetes), raised and abnormal blood lipids (dyslipidaemia) and obesity. Major cardiovascular risk factors such as hypertension and diabetes are also reported to link CVD to renal disease.

A study in Washington, USA by (Williams DP, 1992) revealed that body fatness in White and Black children and adolescents was a significant predictor of cardiovascular disease risk factors. A study of 391 Western Australians adolescents of both sexes (mean age 15.8 years) showed that nutritional knowledge, particularly concerning fat, was deficient (Gracey T, 1997). The study demonstrated that ignorance about nutrients was one of the important barriers to healthy eating.

According to (Kita A, 2009) among people below the age of 70, CVDs were responsible for the largest proportion (39%) of NCD deaths. There has been a doubling of CVD rates in LMICs during recent decades, with rates, for example, for stroke and heart attack exceeding those in high-income countries.

A study of cigarette smoking behavior among South African Indian high school students showed that smoking was associated with heart disease. The study showed that a sizable proportion of students who were aware that abandonment of smoking and practice of physical exercise is an important preventive measure against development of coronary heart disease. The same awareness was observed among teachers who were also able to perceive that proper control of hypertension and diabetes mellitus will also have a preventive effect toward development of coronary heart disease (Bayat R, 1998)

(DE *et al.*, 2006) stated that one of the main underlying pathological processes that leads to heart attacks (coronary heart disease) and strokes (cerebrovascular disease) is known as atherosclerosis. The early changes of atherosclerosis develop in childhood and adolescence due to the overall effect of a number of risk factors. They include tobacco use, physical inactivity, unhealthy diet, harmful use of alcohol, hypertension, diabetes, raised blood lipids, obesity, and poverty, low educational status, advancing age, male gender, genetic disposition and psychological factors.

(Tan, 2011,) also stated that a family's history of CVD indicates a person's risk. If a first-degree blood relative has had coronary heart disease or stroke before the age of 55 years (for a male relative) or 65 years (for a female relative), the risk increases.

According to (Davis, 2005)atherosclerosis is an inflammatory process affecting medium- and large-sized blood vessels throughout the cardiovascular system. When the lining (endothelium) of these blood vessels is exposed to raised levels of low-density lipoprotein cholesterol (LDL cholesterol) and certain other substances, such as free radicals, the endothelium becomes permeable to lymphocytes and monocytes. These cells migrate into the deep layers of the wall of the blood vessel.

Several studies and community-based programs have shown the effectiveness of long-term health education and other interventions on the prevention and control of CVDs risk factors (Taylor CB *et al.*, 1991), (Fortmann SP *et al.*, 1990), (Farquhar JW *et al.*, 1990), (Apostolides AY *et al.*, 1980). Studies from Saudi Arabia have documented the existence of faulty life style patterns and obesity, and its association with problems of coronary heart disease, hypertension and diabetes mellitus (Osman AK, 2000)

Knowledge about and recognition of these risk factors will enable nurses and other health professionals to design more responsive and targeted clinical interventions for this vulnerable population (Sedgwick H, 1993)

In a randomized clinical trial, (Dun DR, 1997) demonstrated that lifestyle physical activity counseling is as effective as a traditional structured exercise program in reducing CVD risk factors among healthy, sedentary, middle-aged men and women. After 6 months of intervention, 78% of lifestyle participants and 85% of structured participants were engaging in 30 min or more of moderate-intensity physical activity on most days of the week. Both groups had significant reductions in total cholesterol, total cholesterol/high-density lipoprotein ratio, diastolic blood pressure, and percentage of body fat. These investigators concluded that these effective lifestyle physical activity and counseling strategies could be used in a wide variety of settings. High blood pressure is an independent risk factor for heart disease in women (Johansen R, 1990); (SC, 1994) Cardiovascular disease (CVD) is one of the leading causes of death and disability among women. According to Julia and (P, 2001) increased physical activity and advancing age are significant predictors of CVD; age confers more than a one-fold risk for developing heart disease and hypertension. (FM, 1993) in a study of risk factors among university students reported that almost three-quarters of the students were aware that smoking is a risk factor for coronary heart disease.

The study found that female university students in Riyadh showed 99.7% of awareness of the adverse effects of smoking.

Another study among male and female attendees of a primary health care center in Al Khobar city in Saudi Arabia showed that less than half of them had knowledge of causes and prevention of CVDs. The study also showed a poor knowledge of diabetes mellitus as a risk factor for CHD (Attia Z Taha *et al.*, 2004)

2.3 Hypertension (high blood pressure)

High blood pressure is defined as a repeatedly elevated systolic pressure of 140 or higher or a diastolic pressure of 90 or higher. One is said to have hypertension if readings on separate occasions consistently show the blood pressure to be 140/90mmHg or higher (World Health Organigation, 2007).

Hypertension is the leading cause of CVD worldwide. Globally, nearly one billion people have high blood pressure (hypertension); of these, two thirds are in developing countries ref Hypertension is one of the most important causes of premature death worldwide and the problem is growing; in 2025, an estimated 1.56 billion adults will be living with hypertension (Organization, 2012b)

People with hypertension are more likely to develop complications of diabetes. High blood pressure is called the "silent killer" because it often has no warning signs or symptoms, and many people do not realize they have it; that is why it's important to get blood pressure checked regularly (GD, 2006)

There is often no clear cause of high blood pressure but there are risk factors. According to (Abegunde DO, 2007) people who are overweight or smoke are at risk of developing hypertension.

This was explained by the fact that as one increases in body weight, there is an increase in the fat content of the body which obstruct the flow of blood.

(Jackson R, 2005) also found that people who are of African or Caribbean descent are at a higher risk of developing hypertension. However, their study did not assign reasons for this assertion.

According to (Australia, 2005) eating too much salt and low intake of fruit and vegetables with little or physical exercise can lead to hypertension.

Consumption of coffee (or other caffeine-based drinks) and too much alcohol consumption has also been associated with the development of hypertension (Anderson KM, 2011). (K, 2010) also found that people who are aged over 65 years are more likely to develop hypertension. As age increases the probability of developing hypertension also increases.

Based on the risk factors that have been found to be associated with hypertension, several studies have been conducted to make propositions by which one can prevent hypertension. According to (A, 2005b) and (Daar AS, 2007)stated that losing weight through physical exercises and reducing the amount of salt intake can help prevent hypertension. (EA, 2001) also reported that exercising regularly and eating a healthy diet are very essential in preventing hypertension.

Cutting back too much alcohol consumption, caffeine-based drinks and stopping smoking are essential preventive measures for hypertension prevention (Igweh JC, 2005)

2.4 Tobacco use

Smoking is estimated to cause nearly 10% of all CVD. The risk of developing CVD is higher in female smokers, young men, and heavy smokers. There are currently about 1 billion smokers in the world today. Within two years of quitting, the risk of coronary heart disease is substantially reduced, and within 15 years the risk of CVD returns to that of a non-smoker(prevention, 2008)

2.5 Raised blood glucose (diabetes)

The term "diabetes mellitus" describes a metabolic disorder of multiple aetiology characterized by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both. The effects of diabetes mellitus include long–term damage, dysfunction and failure of various organs (World Health Organisation, 1999)

(Organization, 2009) further reiterated that diabetes is a condition primarily defined by the level of hyperglycaemia giving rise to risk of microvascular damage (retinopathy, nephropathy and neuropathy. The (Organization, 2009)further reported that diabetes is a chronic disease that occurs when the pancreas does not produce enough insulin, or when the body cannot effectively use the insulin it produces. Hyperglycaemia, or raised blood sugar, is a common effect of uncontrolled diabetes and over time leads to serious damage to many of the body's systems, especially the nerves and blood vessels.

(Control, 2011a) reported that diabetes is defined as having a fasting plasma glucose value of 7.0 mmol/l (126 mg/dl) or higher. The report further stated that diabetes was responsible for 1.3 million deaths globally in 2008 whilst the global prevalence of diabetes was estimated to be 10 % in 2008. CVD accounted for about 60% of all mortality in people with diabetes in 2008. The risk of cardiovascular events is from two to three times higher in people with type 1 or type 2 diabetes and the risk is disproportionately higher in women. In some age groups, people with diabetes have a two-fold increase in the risk of stroke.

Patients with diabetes also have a poorer prognosis after cardiovascular events compared to people without diabetes. (R, 2006) stated that cardiovascular risk increases with raised glucose values. Lack of early detection and care for diabetes results in severe complications, including heart attacks, strokes, renal failure, amputations and blindness. Primary care access to measurement of blood glucose and cardiovascular risk assessment as well as essential medicines including insulin can improve health outcomes of people with diabetes.

2.6 Physical inactivity

According to (Lemogoum G, 2005) insufficient physical activity can be defined as less than five times 30 minutes of moderate activity per week, or less than three times 20 minutes of vigorous activity per week, or equivalent. Their study which was conducted among sedentary workers in Nepal also reported that insufficient physical activity is the fourth leading risk factor for mortality.

(WHO, 2011) also reported that approximately 3.2 million deaths and 32.1 million Disability Adjusted Years (DALYs – representing about 2.1 percent of global DALYs) – each year are attributable to insufficient physical activity. The report further stated that people who are insufficiently physically active have a 20 to 30 percent increased risk of all-cause mortality compared to those who engage in at least 30 minutes of moderate intensity physical activity most days of the week.

(CDC, 2009) also stated that, 31.3% of adults aged 30 years or older (28.2% men and 34.4%) were insufficiently physically active in 2008. Again, the prevalence of insufficient physical activity was reported to be higher in high-income countries compared to low-income countries due to increased automation of work and use of vehicles for transport in high-income countries.

According to (Wurthwein C, 2010) high-income countries have more than double the prevalence of insufficient physical activity compared to low-income countries for both men and women, with 41% of men and 48 percent of women being insufficiently physically active in high-income countries compared to 18 percent of men and 21% of women in low-income countries.

(Ashton G, 2000) examined the relationship between reported physical activity and a range of CHD risk factors in 1407 females aged 30–64 years. Their results indicated that increasing activity was associated with lower systolic and diastolic blood pressures, total triglycerides, cholesterol and body mass index. Emerging evidence suggests that cardiovascular health benefits can also be realized in non-conventional physical activity programs

2.7 Unhealthy Diet

According to (Frenk J *et al.*, 2000) high dietary intakes of saturated fat, trans-fats and salt, and low intake of fruits, vegetables and fish are linked to cardiovascular risk.

The (Organization, 2008b) also reported that approximately 16 million (1.0 percent) DALYs and 1.7 million (2.8 percent) of deaths worldwide are attributable to low fruit and vegetable consumption.

(HM, 2008) stated that the amount of dietary salt consumed is an important determinant of blood pressure levels and overall cardiovascular risk and the WHO recommends a population salt intake of less than 5 grams/person/day to help the prevention of CVD.

(Agyemang C, 2012) in their study reported that frequent consumption of high-energy foods, such as processed foods that are high in fats and sugars, promotes obesity compared to low-energy foods. High consumption of saturated fats and trans-fatty acids is linked to heart disease;

Elimination of trans-fat and replacement of saturated with polyunsaturated vegetable oils lowers coronary heart disease risk.

According to (Ogeng, 2011) adequate consumption of fruit and vegetables reduces the risk of CVD. A healthy diet can contribute to a healthy body weight, a desirable lipid profile and a desirable blood pressure. It is estimated that decreasing dietary salt intake from the current global levels of 9–12 grams/day to the recommended level of 5 grams/day would have a major impact on blood pressure and CVD.

2.8 Blood lipids

Raised blood lipids increase the risk of heart disease and stroke. Globally, one third of ischemic heart disease is attributable to high cholesterol. Overall, raised cholesterol is estimated to cause 2.6 million deaths (4.5% of total) and 29.7 million Disability Adjusted Years (DALYs), or 2 percent of total DALYS globally. A global report showed that the prevalence of raised total cholesterol among adults – defined as total cholesterol of 6.2 mmol/l (240 mg/dl) or higher – was 9.7% (8.5 % for males and 10.7% for females) (Organization, 2011).

According to (A, 2005a)lowering raised blood cholesterol reduces the risk of heart disease. (F, 2009) also reported that the global prevalence of raised total cholesterol among adults was 39 % (37 % for males and 40 % for females) in 2008. The prevalence of raised total cholesterol noticeably increases according to the income level of the country. According to their study, in low-income countries, around 25 percent of adults have raised total cholesterol, while in high-income countries; over 50 % of adults have raised total cholesterol.

2.9 Overweight and obesity

The Global Atlas on cardiovascular disease prevention and control published by the(Organization, 2011) stated that obesity is strongly related to major cardiovascular risk factors such as raised blood pressure, glucose intolerance, type 2 diabetes and dyslipidaemia. The report further stated that worldwide, at least 2.8 million people die each year as a result of being overweight or obese, and an estimated 35.8 million (2.3%) of global DALYs are caused by overweight or obesity.

According to (F, 2009) 34 % of adults over the age of 20 in Saudi Arabia were overweight with a body mass index (BMI, a measure of weight relative to height) in 2008. In that same year, about 9.8 percent of men and 13.8 percent of women were obese (with a BMI greater than or equal to 30 kg/m^2), compared to 4.8 percent for men and 7.9% for women in 1980.

(Temple D, 2008) stated that to achieve optimal health, the median BMI for adult populations should be in the range of 21–23 kg/m2, while the goal for individuals should be to maintain a BMI in the range 18.5– 24.9 kg/m2. The prevalence of raised BMI increases with income level of countries, up to upper-middle income levels. The prevalence of overweight in high-income and upper-middle-income countries was more than double that of low- and lower-middle-income countries. (Kelly T, 2011) stated that prevalence of obesity tripled from 7 percent for both males and females in lower-middle-income countries to 24 % in upper-middle- income countries in 2008. They further stated that in addition to the modifiable risk factors, there are some risk factors that cannot be changed. However, people in these high-risk categories can enhance their health through regular check-ups and changed lifestyle.

2.10 Abdominal Obesity

Abdominal obesity, also known as beer belly, beer gut, pot belly or clinically as central obesity, is when excessive abdominal fat around the stomach and abdomen has built up to the extent that it is likely to have a negative impact on health (K, 2011; Yusuf TB, 2004). There is a strong correlation between central obesity and cardiovascular disease (Razay, 2006). According to (F, 2007) abdominal obesity is not confined only to the elderly and obese subjects and central obesity has been linked to several diseases such as Alzheimer's disease and other metabolic and vascular diseases.

(Stanhope C, 2010) reported that visceral and central abdominal fat and waist circumference show a strong association with type 2 diabetes. Visceral fat, also known as organ fat or *intra-abdominal fat*, is located inside the peritoneal cavity, packed in between internal organs and torso, as opposed to subcutaneous fat, which is found underneath the skin, and intramuscular fat, which is found interspersed in skeletal muscle (Elliott A, 2002). Visceral fat is composed of several adipose depots including mesenteric, epididymal white adipose tissue (EWAT) and peri-renal fat (Perez-Pozo M, 2010).

A study by (Ibrahim, 2009) stated that scientists have come to recognize that body fat, instead of body weight, is the key to evaluating obesity. The study recounted that researchers first started to focus on abdominal obesity in the 1980s when they realized that it had an important connection to cardiovascular disease, diabetes, and dyslipidemia. (Ibrahim, 2009) gain argued that abdominal obesity is more closely related with metabolic dysfunctions connected with cardiovascular disease than was general obesity. (Y, 2009) stated that techniques such as computed tomography and magnetic resonance imaging make it possible to categorize mass of adipose tissue located at the abdominal level into intra-abdominal fat and subcutaneous fat.

The cause of abdominal obesity is complex. According to (B, 2006) the currently prevalent belief is that the immediate cause of obesity is net energy imbalance – the organism consumes more usable calories than it expends wastes, or discards through elimination. Some studies by (Smith D, 2007) and (Knowles M, 2011) indicate that visceral adiposity, together with lipid dysregulation and decreased insulin sensitivity, is related to the excessive consumption of fructose. Other environmental factors, such as maternal smoking, estrogenic compounds in the diet, and endocrine-disrupting chemicals may be important. Obesity plays an important role in the impairment of lipid and carbohydrate metabolism shown in high-carbohydrate diets(Parikh G, 2007). It has also been shown that quality protein intake during a 24-hour period and the number of times the essential amino acid threshold of approximately 10 g has been achieved is inversely related to the percentage of central abdominal fat (Cláudia, 2013).

Quality protein uptake is defined as the ratio of essential amino acids to daily dietary protein (Méthot F, 2010)

A program called the (Program, 2002) in the USA reported that visceral fat cells will release their metabolic by-products in the portal circulation, where the blood leads straight to the liver. Thus, the excess of triglycerides and fatty acids created by the visceral fat cells will go into the liver and accumulate there. In the liver, most of it will be stored as fat. This concept is known as 'lipotoxicity'.

In another study, (Misra DS, 2010) reported that hypercortisolism, such as in Cushing's syndrome, also leads to central obesity. Their study also argued that many prescription drugs, such as dexamethasone and other steroids, can also have side effects resulting in central obesity, especially in the presence of elevated insulin levels.

(Y, 2008) and (FR, 2009) stated that the prevalence of abdominal obesity is increasing in western populations, possibly due to a combination of low physical activity and high-calorie diets, and also in developing countries, where it is associated with the urbanization of populations.

An assessment of abdominal obesity could be done using BMI values. According to (CF, 2011) waist measurement is more prone to errors than measuring height and weight. It is therefore recommended to use both standards. BMI will therefore illustrate the best estimate of total body fatness, while waist measurement gives an estimate of visceral fat and risk of obesity-related disease.

2.11 Age and Gender

According to (Tan, 2011,) the occurrence of CVD becomes increasingly common with advancing age. As a person gets older, the heart undergoes subtle physiologic changes, even in the absence of disease. The heart muscle of the aged heart may relax less completely between beats, and as a result, the pumping chambers become stiffer and may work less efficiently. When a condition like CVD affects the heart, these age-related changes may compound the problem or its treatment. According to (Perez-Ferrer C *et al.*, 2010), a man is at greater risk of heart disease than a pre-menopausal woman. Once past the menopause, a woman's risk is similar to a man's. Risk of stroke, however, is similar for men and women.

In the mid-1990s, age-standardized cardiovascular mortality rates in women ranged from a high of 633 deaths per 100,000 populations in the Russian Federation to a low of 139.9 per 100,000 populations in France (World Health Organization, 1998) Among the 22 selected countries, England and Wales ranked 4th and 8th in ischemic heart disease (IHD) and CVD for women, respectively (Crofton, 2000).

In Canada, mortality from CVD for women (World Health Organization, 1998), and ischemic heart disease accounted for 49.7% among women (Canada, 2000). Frequently, women fail to recognize the personal relevance of heart disease. The (Organization, 2011) further reported that the number of cardiovascular related deaths in women will most likely surpass deaths in men in the near future. Coronary heart disease (CHD) in women has not been studied as comprehensively as in men. Results from studies of men have frequently been generalized to women, which may not always be appropriate or even dangerous. The above assertion shows that women are at higher risk of developing a CVD. Taking cognizance of this fact, (Blair IA, 1989) reported that women with the lowest fitness had a relative risk of death nearly five times higher than the physically fit women

While there is considerable knowledge about major risk factors of CHD, less is known about the effects of altering these factors on reduction of CHD mortality and morbidity among women. A paucity of data on the sex-specific trends in CVD risk factors warrants population-based investigations (J, 1993); (Gurwitz RE, 1996).

In a study conducted by (Lemaitre. D *et al.*, 1995) found a reduction in myocardial infarction risk by 50% in older age was evident with modest leisure-time activities, equivalent to 30–45 min of walking three times weekly. This observation was also confirmed by (Kushi Y, 1997) who demonstrated a graded inverse association between physical activity and all-cause mortality in postmenopausal women.

A study in the town Framingham showed that for coronary disease, hypertensive women and men have almost identical risk ratios: 2.2 for women versus 2.0 for men at 36 years' follow-up (V, 1996). Investigation of (Levy D, 1990) showed that for all cardiovascular deaths and deaths from all causes, women with LVH had a greater increase in relative risk than men. In addition, these investigators also found that women with isolated systolic hypertension had more than twice the odds of having LVH as did their male counterparts. Hypertension studies conducted in Europe and the United States involving over 13,000 women aged 30–69 reported a decrease in all causes of mortality among treated versus control women (Council, 1985); (Hypertension and Detection Follow-up Program, 1979). In general, trials that have included a large number of women have shown favorable effects of hypertensive therapy in terms of CAD events for older women (SHEP, 1991); (Dahlof DR, 1991).

2.12 Prevention of CVDs

The (Diseases, 2008) reported that if the rising trends of CVDs are to be halted and reversed, current approaches to addressing them need to be reformed. At present, the main focus of health care for CVD in many LMICS is tertiary care based. Tertiary care, including stroke units, coronary care units and rehabilitation units, play an important role in improving outcomes of people who suffer CVD events. However, balancing investment in primary, secondary and tertiary care is vital for sustainability of CVD programmes.

According to the (Organization, 2011) currently, a large proportion of people with high cardiovascular risk remains undiagnosed and often even those diagnosed have insufficient access to treatment. When diagnosis is made, it is frequently at a late stage of the disease, when people become symptomatic and are admitted to hospitals with acute myocardial infarction or stroke and when costly high-technology interventions are required for treatment. Examples of such costly health-care interventions include coronary artery bypass surgery and other types of vascular surgery for unstable angina and cerebrovascular disease.

Early detection is key to improving outcomes of CVDs. Affordable tools (e.g. clinical measurements, laboratory investigations, cardiovascular risk assessment charts, affordable blood pressure measurement devices) are available for early detection of people with disease and those at high risk (Parati CE, 2010).

According to (Abegunde DO, 2007) since CVDs are asymptomatic in early stages, such tools or devices need to be proactively utilized to detect those at risk of developing heart attacks or strokes. As population-wide screening is not affordable for LMICs, targeted screening of people in different settings (e.g. adults over a certain age screened at primary care facilities, worksites and community settings) could be an effective approach used for early detection and diagnosis. Addressing cardiovascular risk has been demonstrated to be more efficient when a total-risk approach is used.

The primary health care approach places equity as a central value across all health system functions: governance, health information, workforce, service delivery, providing essential medicines and technologies (R, 2011).

Universal health coverage is receiving increasing priority as part of the agendas of health systems strengthening. The health sector could address health inequities related to CVD by taking steps towards universal health coverage, starting with the implementation of a set of high-impact essential CVD interventions (Lim SS, 2007). Strengthening primary health care also requires ensuring performance, quality and effectiveness of service delivery. Equitable health system financing and the location of health-care services as well as the motivation and training of the health workforce are crucial to positively impact health inequities (Evans GR and Etienne, 2010). The shortfall of physicians in many parts of the world calls for engaging non-physician health workers in service delivery for NCD/CVD, particularly in primary care. A participatory approach by communities in service delivery is also important for reducing health inequities (Murray SE, 2003). (HS, 2009) reported that the CVD epidemic is progressing relentlessly in LMICs. There is a large disease burden worldwide attributable to heart attacks and strokes. Policy-makers and investors often ask whether CVD can be tackled and, if so, where the focus of attention should be. There is clear evidence that prevention interventions work and that improved access to health care can reduce the burden of morbidity, disability and premature mortality. However, in 2006, the WHO argued that in making a decision, policy-makers also want to know what evidence there is to show that interventions will represent a cost-effective use of resources in the settings in which they are to be implemented and that scaling up these interventions is appropriate, affordable and feasible before the right decisions could be made.

On the issue of cost effectiveness of an intervention, (Binka T, 2008) stated that, it is the efficiency with which an intervention produces health outcomes. According to their study, the feasibility of an intervention depends on: (i) reach (the capacity of the health system to deliver an intervention to the targeted population); (ii) technical complexity; (iii) capital intensity (the amount of capital required for an intervention); and (iv) cultural acceptability.

A set of interventions exists for the prevention and control of CVD that has a significant public health impact and is highly cost effective, inexpensive and feasible to implement; these interventions can be considered as "best buys" for investors. A range of other interventions that

Constitute "good buys" can also be identified(Organization, 2010).

The (Organization, 2012a) again reported that implementing population-wide interventions for tobacco control, control of the harmful use of alcohol, reduction of salt content in processed foods and substitution of partially hydrogenated trans-fat with polyunsaturated fats have the potential to prevent millions of deaths per year. In addition, promoting physical activity through the media (in combination with a healthy diet) has been estimated to be a low cost and highly feasible option. (HM, 2008) also argued that the above population-wide preventive strategies can be combined with more targeted approaches to improve health gains. Individual interventions that are best buys include (i) providing aspirin to people with an acute heart attack – this saves the lives of one in five of those with a heart attack; (ii) providing a simple multidrug treatment to people following a heart attack or stroke (or transient ischaemic attack or angina) in order to prevent recurrent ischaemic events – this results in a reduction in recurrent heart attacks and strokes of up to 75% –

and also decrease mortality; (iii) reducing the cardiovascular risk (controlling blood pressure, blood cholesterol and blood sugar; tobacco use) in people, including those with diabetes, who are at high risk of heart attacks and strokes; and (iv) controlling glucose levels in people with diabetes – this investment reduces cardiovascular complications, blindness and kidney failure in people with diabetes.

CHAPTER THREE

3.0 METHODOLOGY

The methodologies that were used to collect and analyze the data in this study have been presented in this section. A description of the study area is given in this chapter and also the sample size, sampling procedure, data collection and analyses and the quality control measures are stated in this chapter

3.1 Study Area

The study was conducted in Tamale Metropolis. Tamale is the capital town of Northern Region of Ghana and shares common boundaries with Savelugu/ Nanton District on the North and Tolon Kumbungu on the North-West. It is also bordered by West and Central Gonja district on the South and East Gonja, and Yendi district on the east. Tamale Metropolis occupies approximately 922 square kilometers of land that is 13% of the total land area of the Northern Region. Although the capital has attained a metropolitan status, the geographical setting still has a blend of typical rural communities embedded within the urban areas (TMA, 2003) (Not published)

The major economic activity of women in the Tamale Metropolis is trading. Poverty levels are high due to a number of factors. These include discriminatory inheritance of land and property, extensive farming being for subsistence, high domestic responsibility, low capital level, high birth rates, and high illiteracy level in the urban and peri-urban areas. Tuo Zaafi (TZ) is usually the meal taken at supper, whilst a maize based porridge or tea is taken at breakfast. In these areas, lunch is mostly not usually prepared at home hence the people choose from a wide variety of foods available. In the rural areas, TZ is usually the lunch and supper meal with a maize or guinea corn-based porridge at breakfast (TMA, 2003).

The Tamale Metropolis has a population of 371,351 (185,995 males, 185,356 females) with a population density of 318.6 persons per square kilometer which is about 12 times higher than the regional average density of 25.9 persons per square kilometer. The Metropolis has a population growth rate of 1.6%. There exists a vast difference between the densities of the urban and rural areas in Tamale. This is an indication of movement into urban Tamale, giving credence to the assertion that facilities and opportunities for modern employment are concentrated in few localities (TMA, 2003).

3.2 Study Type.

The study was an institutional-based cross sectional study conducted in 42 schools in the entire Metropolis. The choice of the number of institutions was informed by the fact that there are 22 circuits in the Metropolis and each circuit needed to be represented with at least a school.

3.3 Sample Size Determination

A sample size of 200 was used in this study. This was determined based on the number of schools that were used in this study.

$$n= p0\ (1-p0)\ [z\alpha + (z1-\beta)\sqrt{p1(1-p1)/p0(1-p0)}^2/ K^2$$

The Ghana Health Service (2012) reported that CVDs crude prevalence is between 25% and 48%. This study therefore used a threshold of 25% in calculating the sample size.

Where: p0 = National prevalence rate of CVDs is 25%

p1 = since the prevalence of CVDs among teachers is not known it is assumed based on 50% which is acceptable by convention in cross sectional studies.

α = probability of type I error and $z\alpha = 1.96$ (at $\alpha = 5\%$ 2-tailed) β = probability of type II error and $z1\text{-}\beta = -0.157$ (at 80% power 2-tailed) = 0.03 (sum of binomial probabilities for exact methods for one sample tests) $n = 0.177/0.0009$ $n = 196.67$

A final sample size of 200 was then used for the study.

A total of 5 teachers were selected from each of the selected school. The number of teachers selected was done with the assumption that every school does not have less than 6 teachers therefore the number of teachers selected was uniform or equally distributed in all the schools.

3.4 Study Population

The study population was teachers at the three level of education (primary, JHS and SHS) in the Tamale Metropolis 102 males and 98 females with 82 teachers from primary school, 61 from JHS and 57 from SHS.

3.5 Sampling Procedures

An institutional-based cross sectional study was conducted in 42 institutions of the Metropolis. The number of institutions was selected using Cluster and simple random sampling procedures to select the schools and subjects. Again, 5 teachers were interviewed in each of the 40 institutions making the study to be 40 x 5 institutional based survey. The schools were selected using population proportional to size (PPS) whilst the teachers were selected using simple random sampling.

3.6 Data Collection

Data was collected using a structured questionnaire. Data was collected on the socio-demographic characteristics of the respondents, use of substances such as tobacco and alcohol, level of physical activity and their family history of CVDs. Blood samples, blood pressure and Anthropometric measurements were taken by a nurse. Serum examination was done in a laboratory to measure blood cholesterol and blood glucose. Results were given back to subjects and interpretation made by the nurse

3.7 Measurement of Blood Serum cholesterol

The blood serum cholesterol test measures the total amount of cholesterol in blood. This test is part of a "cardiovascular risk profile" which may help assess for an increased risk of heart and blood vessel disease. Elevated levels of cholesterol increase the risk for coronary heart disease (CHD). Cholesterol is measured to help assess the patient's risk status and to follow the progress of patient's treatment to lower serum cholesterol concentrations.

3.7.1 Specimen collection and Patient preparation.

About 2-3mls of venous blood of patient with an overnight fast of 9-12 hours was collected into a plain/gel tube and allowed to clot. Serum was obtained by spinning the clotted sample at 3000 rpm n a centrifuge. All the biochemical parameters were analyzed using automated chemistry analyzer (BT-3000, Italy, 2008).

3.7.2 The Principle of Blood Cholesterol Measurement

Cholesterol is measured enzymatically in serum or plasma in a series of coupled reactions that hydrolyze cholesteryl esters and oxidize the 3- OH group of cholesterol. One of the reactions by products, H2O2 is measured quantitatively in a peroxidase catalyzed reaction that produces a color. Absorbance was measured at 500 nm. The color intensity is proportional to cholesterol concentration. Desirable cholesterol levels are considered to be those below 200 mg/dL in adults and below 170 mg/dL in children. These values were therefore used as reference points in the measurement of cholesterol levels of the respondents.

3.8 Measurement of Blood Glucose

Glucose ($C_6H_{12}O_6$) is an important source of energy for the human body, by being the essential precursor in the synthesis of ATP (adenosine triphosphate). The ATP can then be used to drive processes requiring energy, including biosynthesis, and locomotion or transportation of molecules across cell membranes.

3.8.1 Participants preparation and sample collection

About 2 ml of participants' blood was collected by venipuncture into a tube containing fluoride oxalate after 14-16 hours of fasting. The sample was gently mixed with the fluoride oxalate to obtain a uniform mixture and span at 1,500 rpm for 2 minutes to obtain the plasma for analysis.

3.8.2 The Principle of Blood Glucose Measurement

Glucose oxidase is an enzyme extracted from the growth medium of Aspergillus niger. Glucose oxidase catalyse the oxidation of Beta D- glucose present in the plasma to D glucono -1 ,5 - lactone with the formation of hydrogen peroxide; the lactone is then slowly hydrolysed to D-gluconic acid. The hydrogen peroxide produced is then broken down to oxygen and water by a peroxidase enzyme. Oxygen then react with an oxygen acceptor such as ortho toluidine which itself is converted to a coloured compound, the amount of which can be measured colorimetrically. Desirable glucose levels for fasting state should be 3.5-6.2 mmol/L and 3.5-10 mmol/L for random state.

3.9 Blood Pressure measurement by Mercury Sphygmomanometers

First explain and reassure the procedure to be undertaken to the client

Remove any tight clothing from neck and arm, to ensure arm is relaxed and supported at heart level. Apply pressure cuff at the upper arm above palpated pulse, Inflate in the air and feel the pulse till the pulse stops beating. Apply the stethoscope at the site of the emergency vein. Lower column slowly (deflate the air) gradually whilst listening to high beat of the heart and the lower beat. The first point from which the heart beat start is recorded as the systolic and the last beat recorded as diastolic (disappearance of sounds)

3.9.1 Anthropometric Measurements

The study collected data on anthropometric measurements of the respondents. These measurements were used to determine the relationship of these anthropometric measurements to CVDs. Height of the respondents was measured using a Microtois. This was stretched against a wall and respondents were asked to stand against it with their soles flat on the surface.

The weight of respondents was measured using a digital unit scale. The scale was set to the zero point and each respondent was asked to stand on the scale for his/her weight to be measured.

The BMI of each of the respondents was calculated using the standard formula for calculating BMI which is stated as BMI = Weight/Height sq.

Respondents with a BMI value of less than 18 were considered underweight while those with a BMI value between 18 and 24.9 were considered to have a normal weight. Those with a BMI value of 25-29.9 were considered to be overweight whilst respondents with a BMI value greater than 30.0 were considered to be obese.

3.7 Data Processing and Analysis

Bio data and clinical data were entered into Microsoft excel, prior to analysis, using Graph pad Prism version 5.2. All categorical data was analysed using Chi –Square and Fisher Exact Test. Continuous variables were analyzed using unpaired student t-test. In all statistical analysis $p < 0.05$ was considered significant

The data were analyzed using univariate and bivariate statistics where appropriate. Bivariate analysis was done to find association between socio demographic characteristics and the prevalence of CVDs. Chi square values of these bivariate analysis were considered to be statistically significant with $P < 0.05$ and a confidence level of 95 %. Independent variables found to be statistically significant at the 0.1 level based upon the results of the bivariate tests, were entered as potential variables included in a logistic regression models.

Statistical difference was considered significant if the P-value is less than 0.05 and 95 % Confidence Intervals (CI) were calculated for all main outcome measures that met the normality and homogeneity criteria.

Multiple logistic regression analysis was done to find out the risk factors of CVDs among teachers.

3.9 Quality Control Measures

The measurement of blood pressure and blood sugar levels was done by nurses to ensure accuracy.

Pre-testing of questionnaires: The study questionnaires were pretested in a pilot survey at Choggu Demonstration Primary School, before the actual administration of the final questionnaires to find out difficulties that were likely to be encountered by teachers

Double entries of data: Double entry of the data was done after which the two data sets were compared at the analysis stage. This helped in identifying some omissions during the data entry.

3.10 Ethical Considerations

Permission from the Regional Health Directorate's Ethics Committee was sought since the study involved the use of blood samples of the respondents. An introductory letter from the SAHS (UDS) was sent to schools and permission and individual consent sought from the teachers before the commencement of the data collection. The objectives and significance of the study were clearly stated and explained to the prospective respondents.

Anonymity and confidentiality of the actual source(s) of information obtained from the study was ensured by not indicating the names of schools and individual teachers who took part in the study. Names were not provided on the data collection tools and therefore no clues were provided for someone to trace the source of information.

CHAPTER FOUR

4.0 RESULTS

This chapter presents analysis of the result from the study,

Two hundred teachers consisting of 102 males (51%) and 98 females (49%) from four Senior high, eight junior high and eight basic schools all in the Tamale Metropolis participated in the study. The overall age range was 20-60 with a mean age of 37.00. The mean age for males is ±1.01SD years and that for females is ± 3.02 SD years. There was no significant difference between the mean age of males and that of females. Majority of the study population (32.5%) were between the ages of 31-40 years and about 31.0% were between the ages of 20-30 years (Table 1). About 61.0% of the subjects were married with only about 33.4% being single. Most of the study population (66% had at least an undergraduate degree with only 34.0% having a diploma certificate in Teaching

4.1 Basic anthropometric and clinical characteristic of the study population

In general about 12.5%, 9.0%, 16.0% and 13.0% of the study population had high total cholesterol, high triglycerides, high LDL and high fasting blood sugar (hyperglycemia) respectively (Table 4.1). About 7.5% and 2.5% of those with high cholesterol were within the age brackets of 20-30 years and 41-50 years respectively. In addition about 4.75% of those with high cholesterol were females and 3.97% were males.

Table 4.1: Socio-demographic and clinical characteristics of the study population

Variable	N (%)	High CHOL	High Trig	LDL	Hyperglycemia (FBS)
Age					
20-30	62(31.00)	15(7.50)	7(3.50)	7(3.50)	7(3.50)
31-40	65(32.50)	0(0.00)	9(4.50)	9(4.60)	4(2.00)
41-50	49(24.50)	5(2.50)	3(1.50)	3(1.50)	2(1.00)
51-60	24(12.00)	5(2.50)	1(0.50)	1(0.50)	5 (2.50)
SEX					
Male	102(51.00)	58(29.00)	2(1.00)	6(3.00)	8(4.00)
Female	98(49.00)	45(22.50)	7(3.50)	10(5.00)	5(2.50)
Marital Status					
Single	67(33.50)	49(23.00)	8(4.00)	13(6.50)	13(6.50)
Married	121(60.50)	39(19.50)	1(0.50)	2(1.00)	2(2.00)
Widow	12(6.00)	4(2.00)	0(0.00)	1(0.50)	4(2.00)
Educ. Level					
Diploma	68(34.00)	38(19.00)	1(0.50)	2(1.00)	2(1.00)

Degree/Post degree	132(66.00)	64(31.00)	8(4.00)	14(7.00)	7(3.50)

Source: Field Work 2013

4.2 Clinical and Biochemical parameters stratified by Gender

The result of the study shows that females had higher mean values for fasting blood sugar, total cholesterol, LDL cholesterols, and VLDL. There was a high significant difference when the mean values for total cholesterols and LDL in females were compared to that of the males ($P<0.0001$) as shown in table 4.2. The mean cardiovascular risk factor was significantly higher among females compare to males ($P = 0.002$). Body mass index (BMI) was used as a measure of obesity. The mean BMI of the female population was 25.48 ± 0.51 which was not statistically different from that of the male 24.86 ± 0.61 ($P = 0.44$). Females also had higher systolic and diastolic blood pressure compare to the males even though the differences was not statistically significant as shown in table 4.2.

Table 4.2: Clinical and Biochemical parameters stratified Gender

Parameter	MALE(N=102)	FEMALE(N=98)	P VALUE
FBS	5.13 ± 0.12	5.65 ± 0.40	0.2
CHOL	3.97 ± 0.10	4.75 ± 0.07	< 0.0001
TRIGLY	1.15 ± 0.06	1.09 ± 0.05	0.48
HDL	1.08 ± 0.04	1.10 ± 0.02	0.68
LDL	2.37 ± 0.09	3.16 ± 0.06	< 0.0001
VLDL	0.52 ± 0.03	0.55 ± 0.07	0.65
BMI	24.86 ± 0.61	25.48 ± 0.51	0.44
CR	6.10 ± 0.14	5.43 ± 0.168	0.002
DBP	73.75 ± 1.04	76.39 ± 1.12	0.08
SBP	118.30 ± 1.40	117.20 ± 1.60	0.59

Source: Field work 2013

FBS: Fasting Blood Glucose, CHOL: total cholesterol, HDL: High density lipoprotein cholesterol, LDL: Low density lipoprotein cholesterol, VLDL: Very low density lipoprotein, BMI: Body mass index, CR: Coronary risk, DBP: Diastolic blood pressure: SBP: Systolic blood pressure.

4.3 Effect of age on clinical and biochemical parameters

The mean fasting blood sugar as stratified by age showed that people within the age brackets of 51-60 years had significantly high blood sugar compare to the other age groups. There was also an increasing trend in the mean total cholesterol levels as the age of the study population increases, becoming highly significant with the age group of 41-50 years (P<0.01) and 51-60 years (P<0.001) as indicated in table 4.3. The mean values for LDL was significantly higher among all the other age groups compare to those in the 20-30 year group.

Table 4.3: Clinical and Biochemical Characteristics Stratified by Age of the Subject

Parameter	Total (N = 200)	20-30	31-40	41-50	51-60
FBS	5.38 ± 0.20	4.57	5.53	4.96	7.88***
CHOL	4.34 ± 0.07	3.82	4.32*	4.79**	4.78***
TRIGLY	1.12 ± 0.04	1.06	1.14	1.05	1.31
HDL	1.09 ± 0.02	1.11	1.07	1.13	1.02
LDL	2.74 ± 0.06	2.17	2.77***	3.15****	3.16****
VLDL	0.54 ± 0.04	0.48	0.52	0.59	0.67
BMI	25.15 ± 0.41	23.59	26.29*	24.06	27.17*
CR	5.79 ± 0.41	5.51	5.80	5.45	6.68**
DSB	74.89 ± 0.81	73.51	73.21	75.12	78.87
SBP	117.7 ± 1.14	115.80	114	119.90	122.90

Source: Field Work 2013

FBS: Fasting blood glucose, CHOL: Total cholesterol, TRIGLY: Triglycerides, HDL: High density lipoprotein, LDL: Low density lipoprotein, VLDL: Very low density lipoprotein, BMI: Body mass index, CR: Coronary risk, DBP: Diastolic blood pressure, SBP: Systolic blood pressure.

4.4: Comparison of clinical and biochemical parameters stratified by BMI

When the subjects were classified based on BMI, that is, underweight, normal weight, overweight and obese, the mean age of the subjects showed that as participants increased in age, their BMI also increases. This is similar to the findings of (Onyesom *et al.*, 2013) found positive and statistical significant correlation between BMI and BGL among subjects in the age group of 21-25 years

Serum Fasting sugar concentration showed a significant incremental association with increasing BMI (p=0.0001) and higher in the obese age group than in the underweight, normal weight, overweight, as shown in table Triglyceride was higher among the overweight (1.31±0.75) as compared to obesity (1.28±0.50), normal weight (0.96±0.42) and underweight (0.84±0.37) and the mean difference is statistically significant (p=0.0001). Cholesterol level also increased as BMI increased even though it was not statistically significant (p=0.326).The HDL cholesterol was higher among the underweight compared to the normal weight, over weight and obese subject (p=0.011).

AIP also increased with BMI and higher among the obese group (0.077±0.21) compared to the overweight (0.036±0.26), normal weight (¯0.07±0.23) and underweight (¯0.18±0.20) though difference in value is not statistically significant (p=0.98).

Table 4. 4: Comparison of Clinical and Biochemical Parameters Stratified By BMI

Parameter	Underweight	Normal weight	Overweight	Obese	P-Value
Age	23.27±0.65	30.31±3.45	41.94±3.69	52.60±2.92	
FBS	4.63±0.58	4.96±064	5.65±3.34	6.231±4.67	0.0001
CHOLESTEROL	3.91±0.84	4.19±0.90	4.42±1.09	4.72±0.90	0.326
TRIGLYCERIDE	0.84±0.37	0.96±0.42	1.31±0.75	1.28±0.50	0.0001
HDL	1.23±0.32	1.10±0.36	1.08±0.27	1.03±0.23	0.011
AIP	¯0.18±0.20	¯0.07±0.23	0.036±0.26	0.077±0.21	0.454
LDL	2.11±0.86	2.67±0.79	2.74±0.59	3.13±0.53	0.762
VLDL	0.38±0.17	0.50±0.67	0.59±0.34	0.58±0.23	0.0001
CORONARY RISK	5.19±1.71	5.66±1.39	5.55±1.71	6.44±1.64	0.75
SBP	114.4±18.42	71.50±12.1	116.9±15.69	124.8±22.57	0.0001
DBP	70.73±11.46	74.37±9.79	72.95±13.14	80.20±10.84	0.098

Source: Field Work 2013

FBS: Fasting Blood Glucose, HDL: High Density Lipoprotein, LDL: Low Density Lipoprotein, AIP: Atherogenic index of plasma, VLDL: Very Low Density Lipoprotein, SBP: Systolic Blood Pressure, Diastolic Blood Pressure

4.5 Correlation between anthropometrics and biochemical parameters

A correlation between anthropometric and biochemical parameters of the study population revealed that there is a strong correlation between AGE, FBS, CHOL, VLDL, though the correlation is not statistically significant. However the correlation between age and CR is statistically significant (0.001). There is also a low negative correlation between age, TRIGLY, and HDL, but no correlation existed between age and LDL. BMI correlated strongly with TRIGLY (0.001), but there was no strong correlation with FBS, CHOL, HDL, LDL, VLDL and CR. A low positive correlation existed between HEIGHT, FBS, CHOL, TRIGLY, HDL, LDL, VLDL and CR and a low positive correlation also existed between HEIGHT and HDL. A strong positive correlation exist between WEIGHT, CHOL (p=0.001) TRIGLY, (p=0.001) and LDL (p=0.001). There is a statistically insignificant correlation between VLDL and CR and a low negative significant with HDL. A strong positive correlation co-efficient existed between WC and CHOL (p=0.001), TRIGLY (P=0.001) and LDL (p=0.001). Statistically insignificant relationships existed between FBS, VLDL and CR and a low negative correlation existed between WC and HDL. SBP correlates strongly with CHOL and CR and statistically significant with CR (p=0.001). There is a correlation between SBP, TRIGLY, HDL and LDL though the correlation is not statistically significant. A strong positive correlation existed between FBS, CHOL, TRIGLY, HDL, LDL and VLDL. It is statistically significant at CR (p=0.001) as shown in table 4.5

Table 4.5 Correlation between Anthropometrics and Biochemical Parameters

PARAMETER	FBS	CHOL	TRIGLY	HDL	LDL	VLDL	CR
AGE	0.09	0.09	-0.11	-0.03	0.14	0.01	0.19**
BMI	0.13	0.16*	0.2**	-0.12	0.18*	0.05	0.10
HEIGHT	0.03	0.11	0.04	-0.12	0.14*	0.03	0.02
WEIGHT	0.18*	0.31***	0.29***	-0.18	0.32***	0.11	0.11
WC	0.13	0.32***	0.32***	-0.05	0.31***	0.17*	0.23**
SBP	0.06315	0.1294	0.03212	0.0383	0.1373	0.0383	0.3259***
DBP	0.08251	0.08986	0.02171	0.01181	0.0708	0.04392	0.2256**

Source: Field Work 2013

BMI: Body Mass Index, WC Waist Circumference, SBP: Systolic Blood Pressure, DBP: Diastolic Blood Pressure, FBS: Fasting Blood Sugar, CHOL: Total Cholesterol, TRIGLY: Triglycerides, HDL: High Density Lipoprotein, LDL: Low Density Lipoprotein, VLDL: Very Low Density Lipoprotein, CR: Coronary Risk

CHAPTER FIVE

DISCUSSIONS

5.0 Introduction

The discussion of the results of the study is presented in this chapter. The findings have been discussed in relation to findings of similar studies in Ghana and the entire world. In areas where the findings contradicts or are not in agreement with that of other studies, reasons are given for the possible causes of the disparities in the findings

5.1: Basic anthropometric and clinical characteristic of the study population

5.1.1 Gender and its Effect on Anthropometric and Clinical Characteristics.

In the present studies, females had higher mean values for fasting blood sugar, total cholesterol, LDL cholesterols, and VLDL as compared to their male counterparts. There was a high significant difference when the mean values for total cholesterols and LDL in females were compared to that of the males (p=2). The mean cardiovascular risk factor was significantly higher among females compare to males. These findings are in agreement with the that of (Organization, 2012a), (Al-Nozha MM, 2007b) and (Esteghamati A, 2008) who found that women are prone to being hyperglycemic than males which implies that diabetes is more prevalent in women than men. This is attributable to the low physical activities among women. It could further be argued that anatomically, females have a high body fats due to reproductive roles and the deposition of adipose tissue in the pelvis and chest regions. These have the tendency of increasing the BMI. Also, this current study found that the mean BMI of the female population was slightly higher (25.48 ± 0.51) than that of their male counterparts (24.86 ± 0.61). This finding is however not in conformity with that of (Raom, 2013) who found that male BMI was higher than that of females in a study conducted in Brazil. In the present study females also had higher systolic and diastolic blood pressure compared to the males even though the differences were not statistically significant. This supports the assertion by Lerner and (Kannel C, 2010) that females are prone to getting hypertension than males because of the high systolic and diastolic pressure.

The observed association between biochemical parameters and gender from this study is similar to observations made by other studies (Van Der Sande *et al.*, 2001) Strong et al, 2007 (Nwagha R, 2010) that isolated elevation in triglycerides increases CHD risk factors more in women than in men., <0.0001.Triglycerides, HDL, LDL, VLDL, BMI, and DBP are also relatively higher in females than in males except CR and SBP that is higher in males than in females with an insignificant difference.

5.1.2 Age and its Effect on Anthropometric and Clinical Characteristics

In this study, the relationship between age, FBS, CHOL, and VLDL and anthropometric and biochemical factors were assessed. It was found that there is a strong positive correlation between AGE, FBS, CHOL, VLDL and CR. This means that as an individual advance in age there is a corresponding increase in these parameter which has been shown by other studies to be the most common risk factors for cardiovascular diseases. This is consistent with the findings of (W H O 2007) and (Leenen FH, 2008) who found that as age increases the level of FBS may also increase due to the less physical activity which is more likely to occur among older people. Again, their studies found that age influences the level of cholesterol in the body. Older people above 60 years were found to have low cholesterol as reported by (Leenen FH, 2008). This was attributed to the shrinking of the body cells at old age and the high level of dehydration among the aged. In this current study, it was again found that the correlation between age and CR is statistically significant. The strength of association was high which corroborates the findings of (A, 2005a) who reported that CR was strongly influenced by age. As age increases, the level of CR also increases because of the reduce elasticity of the arteries and veins to supply blood.

However, it was found that there is a low negative correlation between age, TRIGLY, and HDL. These findings contradicts with that of (Agyemang C, 2012) who found that age and HDL are positively correlated and was attributed to the low nutritional requirements of the aged.

In the current study, it was established that as participants increased in age, their BMI also increased thereby increasing the chance of CVDs. This is similar to the findings of(Onyesom W, 2013) who found a positive and statistical significant correlation between BMI and Blood Glucose Level among subjects in the age group of 21 - 25 years. Since this study was conducted among people who were 20 years and above, this trend could be attributed to the food consumption pattern of the study participants. In the West African sub-region, (Ngoji E, 2010) found that majority of people are able to afford the luxuries of life after 30 years of age. As people increase in age, they become independent and are therefore able to eat whatever they prefer to eat which has a direct relationship with their body weight.

This means that the biochemical characteristics like high cholesterol increased with age up to a particular point, reduce at age 40—50 and increase at 50-60. Triglycerides degreased as the subjects increased with age LDL increased and reduced drastically as they increased in age. There was a decreasing trend in FBS as the subjects increased in age. This is in conformity with several studies ((Lavados *et al.*, 2005);(Wolfe *et al.*, 2005) and (Hartmann *et al.*, 2001)

The experimental associations between cardiovascular risk factors and the duration of cardiovascular diseases among the study participants from this study validate comparable explanations made in several studies(Agyemang *et al.*, 2005); (Whelton *et al.*, 2002) and (Addo *et al.*, 2008)

Many studies have identified older age as independent risk factor for cardiovascular diseases (CVD). According to (Tan, 2011,) the occurrence of CVD becomes increasingly common with advancing age. As a person gets older, the heart undergoes subtle physiologic changes, even in the absence of disease. The heart muscle of the aged heart may relax less completely between beats, and as a result, the pumping chambers become stiffer and may work less efficiently. When a condition like cardiovascular risk factor affects the heart, these age-related changes may compound the problem or its treatment. However older age ≥ 50 years was considerably concomitant with cardiovascular diseases. This study therefore supports that age from the start adopts the presence or absence of cardiovascular risk factors. As the participants advanced in age, their blood glucose increased as well as cholesterol, HDL, LDL, SBP, DBP TRGLY and CR. This could be attributed to the weakening of the pancreas as a person advances in age. This could lead to poor metabolism of glucose in the blood leading to the release of high glucose into the blood.

5.1.3 Marital Status and its Effect on Anthropometric and Clinical Characteristics

Interestingly, it was found that the prevalence of high cholesterol was more among singles than those who were married (23% versus 19%). This finding could be attributed to the high consumption of junk foods among singles which was established by (Opare A, 2011). In their study, they found that the consumption of junk foods (Fast Foods) was high among people living in the major cities of Ghana. This was attributed to their inability to prepare their own foods at home.

5.1.4 Educational Level and its Effect on Anthropometric and Clinical Characteristics

This study also found that study participants with a University Degree and Postgraduates were having high levels of cholesterol, high LDL and were also hyperglycemic. This means that, respondents with high educational level were more prone to getting CVDs than those with lower levels of education thus as the level of education increases, the risk factors of CVDs also increased. This could be attributed to the sedentary lifestyles, and the ability to afford luxurious lifestyles among this class of people. These findings are consistent with that of (Organization, 2010) and (Esteghamati A, 2008) and developing countries. This is due to the nature of work which they do. As the level of education increases, the more likely they assume administrative duties which are less strenuous and therefore are more likely to be less active.

The study found that about 12% of the study participants were having high total cholesterol. Low density lipoprotein (LDL) cholesterol is a risk factor of CVDs especially arteriosclerosis which is the deposition of fat on the walls of the arteries. This condition impedes the flow of blood by narrowing the diameter of the lumen and reduces blood supple to areas that the arteries is supposed to supple. This finding is consistent with the findings of (Yang H, 2006) who conducted a study in Pakistan among sedentary workers and found that about 13% of them were having high total cholesterol. This was attributed to the low physical activity or exercises among the participants. In this current study, the high level of total cholesterol could be attributed to the dietary pattern especially the consumption of high fats food.

Several studies by (Malta DC, 2009) and (Rosa EC, 2005) found high education to be associated with less overweight, smoking, more physically active, and have food habits assumed to be less atherogenic (i.e., drink less coffee, use soft margarine and low-fat milk, and eat fruits and vegetables daily) than persons with low education.

In male and female, mean serum total cholesterol and systolic blood pressure were adversely associated with educational level, while high density lipoprotein (HDL) cholesterol was positively associated with education in females. This is in contrast with the findings of(Karen F, 1988). They found that the less education people reported, the more atherogenic was their risk factor profile, including higher systolic blood pressure, low density lipoprotein (LDL) cholesterol, triglycerides, fasting glucose values, body mass indices, and lower high density lipoprotein (HDL) cholesterol and HDL/LDL ratio; the more often they reported being cigarette smokers, taking little physical exercise, and consuming alcohol less than one day a week; more often angry, pessimistic, depressed, and dissatisfied with paid work, and having little social support and self-esteem. Overall, heart disease declined as education increased, with highly educated men in high-income countries showing the lowest level of disease.

In effect education may confer protective effects against heart disease in high income countries because it leads to higher personal income and improved access to health care. Those with more education may also be better informed about good health promotion practices and may adopt healthier behaviors.

5.2: Comparison of clinical and biochemical parameters stratified by BMI

The BMI of a person is a major proxy used in determining whether a person is underweight, overweight, and obese or has a normal weight. Obesity is an unrelated disease connected with life treating comorbidities such as diabetes, hypertension, and dyslipidaemia (Owiredu *et al.*, 2008). It is a popular prompting factor for CVD especially considering its part in the expansion of other risk factors like diabetes mellitus, hypertension and high blood cholesterol level. Obesity increases the menace of cardiovascular disease in adults and has been strongly related with insulin resistance in normoglycemic persons and in individuals with type 2 diabetes.

Blood sugar level has been associated with diabetes and cholesterol. Studies by (Deyanov C, 2004) and (Hassan DE, 2009) showed that Serum Fasting sugar concentration is significantly related to the BMI of a person. This finding is consistent with that of the present study where it was found that Serum Fasting sugar showed a significant incremental association with increasing BMI and higher in the obese age group than in the underweight, normal weight and overweight. According to a report by the (Organization, 2008a) on *Global Cardiovascular Diseases* obese people are at a higher risk of suffering CVDs due to the high level of cholesterol, LDL and blood sugar level. The report of the WHO further reported that triglycerides are high among overweight and obese persons due to high body adiposity. In the current study it was established that triglycerides were higher among the overweight as compared to the obese and normal weight. It was also found that triglycerides were low among participants who were underweight. This could be attributed to the depletion of nutrients in their bodies and poor feeding practices which could lead or led to underweight. This corroborates the finding of (Al-Nozha MM, 2007a) who found that underweight people have lower levels of adiposity, triglycerides and blood sugar level. They also attributed their findings to the lower food consumption level which leads to underweight or disease conditions among such persons.

The level of cholesterol was found to increase with increasing BMI of participants. This supports the findings of (Azrya DS, 2006) and (Damien T, 2008) who found that cholesterol level increased with increasing level of BMI. This was attributed to the high body mass which has a relationship with the cholesterol content of the body. Again, it was found that, HDL cholesterol was higher among the underweight compared to the normal weight, over weight and obese subject. HDL is considered a good cholesterol and it is said to confer protection against CVD. The higher an individual HDL cholesterol the less likely that they would develop CVD. This does not support or agree with the finding of (A, 2007)that HDL is lower among underweight persons and high among obese and underweight persons.

CHAPTER SIX

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

6.1 Summary of Main Findings

The study revealed the major risk factors of cardiovascular

a. High Fasting Blood Glucose

b. High Low Density Lipoprotein Cholesterol

c. High Total Cholesterol

d. Increasing age

e. Gender

f. Educational status

g. Obesity as measured by Body mass index

- About 12.5% of the study participants had high total cholesterol level whilst 9% had high triglycerides
- Hyperglycemia was the highest in all the indices among the study participants. A total of 16 % is LDL.

- Majority of the study participants who had high level of cholesterol were within the age group of 20-30 years. High cholesterol levels were found among females than males.
- It was also established that high cholesterol levels was found among singles than those who were married (23% versus 19%)

- The study also found that, as education level of participants increased the higher the cholesterol level. Participants with University Degrees and Postgraduate Degrees had high level of cholesterol than those with Diploma or lower certificates (31% versus 19%).
- The study found there was a high significant difference when the mean values for total cholesterols and LDL in females were compared to that of the males (P<0.0001). The mean cardiovascular risk factor was significantly higher among females compare to males (P = 0.002). The mean BMI of the female population was 25.48 ± 0.51 but not statistically different from that of the male 24.86 ± 0.61 (P = 0.44).
- There was an increasing trend in the mean total cholesterol levels as the age of the study population increases, becoming highly significant with the age group of 41-50 years (P<0.01) and 51-60 years (P<0.001).
- Cholesterol level increased as BMI increased even though it was not statistically significant (p=0.326).
- AIP also increased with BMI and higher among the obese group (0.077±0.21) compared to the overweight (0.036±0.26), normal weight (¯0.07±0.23) and underweight (¯0.18±0.20) though difference in value is not statistically significant (p=0.98).

6.2 Conclusion

Cardiovascular diseases have been described as neglected diseases and silent killers. Many people do not recognize that they have a CVD until it becomes serious with lethal consequences. The findings of this current study confirm that majority of people living in Ghana are prone to developing CVDs due to the lifestyles and anthropometric factor. In this current study which was conducted among school teachers, it was found that, majority of them were at risk of developing a cardiovascular disease. This is based on the premise that over 10% of the teachers had high total cholesterol level whilst 16% had HDL which implies that most of the study participants are at risk of developing diabetes and hypertension and coronary heart disease due to the high levels of cholesterol. Females were found to be at a higher risk of developing CVDs because all the anthropometric and biochemical assessment indicates that the risk factors were high among females than males. This is of great concern due to vital roles played by females in the upkeep of families.

It can therefore be concluded that risk factors of CVDs are high among school teachers in the Tamale Metropolis which can increase complications later in life. This has dire consequences on the health care system in the Tamale Metropolis.

6.3 Recommendations

Based on the findings of this study, the following recommendations are made;

1. The Ghana Health service should sensitize people through health education programmes on the need for healthy lifestyles. This could be through the media and in the schools or other social gatherings.
2. The need for physical exercises should be emphasized among people who are not doing strenuous jobs. Sedentary lifestyles could aggravate the risk factors of CVDS. This should be done by the health promotion units of the Ghana Health Service.
3. Dietary education should be intensified especially among unmarried people because the risk factors of CVDs were found to be high among unmarried people. Dieticians and nutrition officers should educate people on the need for dietary diversification and vegetables/fruits consumption.
4. Since majority of the study participants were hyperglycemic, it is therefore recommended that the consumption of starchy and sugary foods is reduced among school teachers.

6.4 Suggestion for Further Research

The findings of the study showed that risk factors of cardiovascular diseases are high among the selected school teachers in the Tamale Metropolis; It is therefore suggested that further research is conducted among other professional groupings like bankers and hospital staff such as doctors and nurses to ascertain the actual presence or prevalence of CVDs among people living in the Tamale Metropolis using a much larger sample size.

APPENDIX

CARDIOVASCULAR RISK FACTORS AMONG TEACHERS IN TAMALE METROPOLIS

QUESTIONNAIRE FOR DATA COLLECTION

DEMOGRAPHIC INFORMATION

ID Number:

1. Gender : A. Male B. Female
2. Age of respondent……………………..
3. Religious Status A) Islam B Christianity C) ATR D) Others
4. Educational qualifications ……………………………
5. Marital status: A. [Single] B. [married] C. [widowed] D. [Divorce] E. Consensual relationship

PHYSICAL MEASUREMENT

6 Height: …………

7 Weight:_____ Kg

8 BMI (weight in Kg/height in metres2)

9 Waist circumference in inches

BP STATUS

10 Have you ever been told your BP is high………………

11 If yes are you on medication to reduce it………………

12 How often do you check your BP

BP MEASUREMENT

13 Systolic Pressure (mm of Hg): ______

14 Diastolic Pressure (mm of Hg):.______

RANDOM/FASTING BLOOD SUGAR

15. Have you ever been told you have diabetes? Yes / No.

16. If **yes** are you on any medication for diabetes? Yes / No.

CLINICALS

17 .FASTING/RANDOM SUGAR

18. LID PROFILE

Total cholesterol

Triglyceride

HDL

LDL

Coronary Risk

SMOKING/ TOBACCO USE

19. Do you **use** any tobacco product such as cigarettes? A. Yes B. No.

20. If yes which type of cigarette do you smoke?

21. How many sticks do you smoke in a day? ___________

22. If no, have you ever used tobacco in any form? A. Yes B. No.

23. If yes for how long did you smoke?

24. How many sticks a day did you smoke? ___________

25. How old were you when you started using tobacco? ____ years old.

26. For how long did you smoke?

27. Have you ever been exposed to smoking?

28. For how long?

29. For how many hours were you exposed daily?

ALCOHOL COMSUMPTION

30. Do you **consume** any alcoholic products such as Beer, Guinness, Pito? Yes / No.

31. On an average, what is the frequency of consumption?

A. Equal to or more than 5 days per week

B .1 – 4 days per week

C. 1 – 3 days a month

D. Occasionally

32. How old were you when you started consuming alcohol ?____years old.

33. When did you give up consuming alcohol? _____Years / months / days ago.

PHYSICAL ACTIVITY

34. What means of transport do you use to school?..

35. What is the distance from your house to your school?...

36. Do you do any form of physical exercise?

……………………………………………………………

37. If yes what type of physical exercise do you

……………………………………………………..

38. How many minutes a day do you do physical exercise?

……………………………………………………………………….

39. How many days a week do you exercise?

....

FAMILY HISTORY

40. Has anybody in your family ever had any CVD? A. Yes B. No
41. Has any of your parents ever had a CVD? A. Yes B. No
42. If yes, which of the following did your parents suffered? A. Hypertension B. Diabetes C. Atherosclerosis D. Stroke E. Heart attack F. Rheumatic heart disease G. Coronary heart disease.
43. When was the last time you went for medical examination? A. Past one month B. Past three months C. A year ago D. Never

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