DIETARY HABITS AND RISK OF CARDIOVASCULAR DISEASES AMONG KEEP FIT CLUB MEMBERS IN DANSOMAN

BY

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DECLARATION

I, Belinda Osei Onwona, author of this dissertation, do hereby declare that it was done by me under the supervision of Prof. A.G.B Amoah and Dr. Matilda Asante. All references cited in this work have been duly acknowledged.

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ABSTRACT

Background: Epidemiological transitions characterized by increasing urbanization and changing lifestyle factors have resulted in an increase in the incidence of non-communicable diseases, especially cardiovascular diseases (CVD) in sub-Saharan Africa. The WHO country profile for Ghana shows that 18% of deaths in 2010 were as a result of CVD. In Africa more than 40% (and up to 50%) of adults in many countries are estimated to have high blood pressure. Other risk factors such as obesity and overweight and diabetes are also on the increase in Ghana. It is widely reported that lifestyle modification including regular physical activity and a healthy diet reduces the risk of CVD.

Aim: To determine the risk for cardiovascular diseases (CVD) among middle aged keep fit club members 18 years and above and age and gender matched control group at Dansoman in Accra

Method: A case control study consisting of 55cases and 29 controls aged 18 years and above was carried out. A questionnaire was administered to assess socio-demographic factors, brief medical history, diet history, physical activity, smoking and alcohol status. Anthropometric measurements were taken and blood pressure was measured. About 3ml of fasting blood was taken by a trained phlebotomist for analysis of fasting plasma glucose, serum triglycerides, total cholesterol, LDL cholesterol and HDL cholesterol. A glucose drink containing 75gm of anhydrous glucose in 300ml of water was given to the subjects without prior diabetes and 2ml of blood was drawn 2-hours after the glucose drink. Serum and plasma from blood samples were kept on ice and transported to the Diabetes Research and Chronic Disease Reference Laboratory, University of Ghana Medical School for analysis.

Results: There was no significant difference in physical activity level between the KFC and NKFC members**.** Both groups attained moderate to high physical activity in metabolic equivalence per week. The KFC members exhibited a significantly low total cholesterol (4.62 vs. 5.22, *p*=0.03) and LDL-cholesterol (3.26 vs. 3.95, *p*=0.01). The NKFC members showed a significantly lower fasting plasma glucose levels (4.79 vs. 5.14, *p*=0.01). The prevalence of overweight and obesity was higher in both groups while hypertension and obesity prevalence was higher in KFC members. No significant differences were found in energy and macronutrient intake by both groups; however, per cent mean daily intake of saturated fat in both groups exceeded the RDI (14.9% vs. 10.4%,*p*=0.32). A relatively high percentage of the participants took two main meals daily (53.6%) and about a quarter of the subjects took meals prepared outside of home on average five times in the week (26.6%).

Conclusion: KFC and NKFC members had similar CVD risk. KFC members did not have higher physical activity despite their membership as the NKFC members engaged more in occupational physical activity. Majority of both case and control met the recommended weekly physical activity requirement in metabolic equivalence. The habit of taking two main meals in a day and eating outside of home needs to be improved. This is because their level of physical activity in conjunction with a healthy diet will offer better protection against CVD.

DEDICATION

I dedicate this work to my husband, Sena Coffie Damali, for sharing in my dreams and supporting me all the way through. To Andréanna, my beautiful princess for being my inspiration.

A special feeling of gratitude goes to my parents, siblings and my in-laws for their love, encouragement and sacrifice.

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INTERPRETATION OF ACRONYMS

BMI – Body Mass Index

NCD – Non-Communicable Disease

CVD – Cardiovascular Diseases

CV - Cardiovascular

SFA – Saturated Fatty Acid

PUFA – Poly Unsaturated Fatty Acid

MUFA – Mono- Unsaturated Fatty Acid

Tc – Total Cholesterol

LDL – Low Density Lipoprotein

HDL – High Density Lipoprotein

FPG – Fasting Plasma Glucose

2HPG – 2-hour Plasma Glucose

KFC – Keep Fit Club

NKFC – Non Keep Fit Club

WHR – Waist to Hip ratio

CHD – Coronary Heart Disease

DALY – Disability Adjusted Life Years

Hc – High Carbohydrate

SBP – Systolic Blood Pressure

DBP – Diastolic Blood Pressure

PA – Physical activity

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Non-communicable diseases (NCDs) such as cardiovascular diseases (CVD), diabetes and cancer are the leading global causes of death, causing more deaths than all other causes combined, and NCDs strike hardest at the world's low and middle-income populations (World Health Organization, 2010). The percentage of premature deaths from CVD ranges from 4% in high-income countries to 42% in low-income countries (World Health Organization, 2011).

The most important risk factors for CVD include high blood pressure, high concentrations of cholesterol in the blood, diabetes, unhealthy diet, being overweight or obese, physical inactivity and tobacco use (World Health Organization Report, 2002). 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%), overweight and obesity (5%) (World Heart Federation, 2011). Five of these risk factors are closely related to diet and physical activity.

Within developing countries, the emergence of these risk factors can be attributed to the nutrition transition towards diets that are richer in saturated fats and poorer in complex carbohydrates and dietary fibre. As populations become more urban and incomes rise, unique traditional food habits are being replaced by sugar sweetened soft drinks, westernized fast foods, energy drinks, and increased intake of meat (Drewnowski, 2000). There has also been a shift from consuming food prepared at home to the purchasing of food away from home (Cortez and Senauer, 1996). Diet is one of the key factors which when changed will impact all other CV risk factors.

The growth of urban lifestyle involving less physical exertion together with the promotion and rising consumption of tobacco and alcohol has become the greatest health challenge of the 21st century all of which increases a person's risk of getting a CVD (Popkin , 2004). Participation in health-enhancing physical activity is a key determinant of energy expenditure and leads to improved cardiovascular and metabolic fitness as well as enhanced bone health (Janssen *et al*, 2010). Persistent physical inactivity, on the other hand, is detrimental to health and well-being and it was shown to be associated with a less healthy lifestyle (Aarnio *et al*, 2004). Interventions need to be developed that target reductions in sedentary behavior. Diet, physical activity and sedentary behaviors should be considered simultaneously in the prevention of cardiovascular diseases (Platat *et al*, 2006).

1.2 PROBLEM STATEMENT

Epidemiologic and nutrition transitions are increasing CVD in Ghana. CVD is projected to become a leading cause of death in Ghana in next few decades (World Health Organization, 2011). Already there are relatively high burden of CV risk factors such as hypertension, diabetes, obesity and to a lesser extent smoking and dyslipidaemia. Diet and behaviour influence CV risk. Changes in dietary and physical activity patterns usually accompany urbanization and an increase in income affects health. There is little data on the association of dietary habits and physical activity and CV risk factors in

Ghana. Keep fit clubs are in Accra and other parts of the country. The purpose of these clubs is to provide the avenue for adults with busy and sedentary lifestyles to have some form of exercise (physical activity) usually on Saturdays. The clubs thus offer an opportunity to study the link between physical activity, behaviour and diet and CV risk factors, hypertension, diabetes, dyslipidaemia, smoking, alcohol and obesity and its indices

1.3 SIGNIFICANCE OF STUDY

The rapidly increasing burden of cardiovascular diseases is appearing early in the epidemiologic transition in Ghana. The per capita resources needed to create an effective public health and health care infrastructure are generally not available with per capita health care expenditures less than $50 per year (World Health Organization, 2000). In addition, a number of other national priorities, including the stimulation of economic growth, social and political change, and the devastation wrought by communicable diseases, compete for limited funding (Howson *et al*, 1998). Rising CVD rates is thus exerting a drag on economic growth and may contribute to increased poverty. This is because of the high health care expenses and the loss to disability adjusted life years (DALY) that can reduce the countries work force.

This proposed study will contribute to knowledge by providing information that may assist policy makers, community health workers, Non-Governmental Organizations (NGOs) to plan, develop and implement programmes to create more awareness about CVD and subsequently reduce mortality due to it. Evidence based recommendations can thus be made geared towards healthy eating and physical activity habits in this working population.

1.4 HYPOTHESIS

There is no difference in the level of risk of cardiovascular factors among keep fit club members and non members.

1.5 THE AIM OF THE STUDY

To determine the risk for cardiovascular diseases (CVD) among keep fit club members aged 18years and above and an age and gender matched control group at Dansoman in Accra.

1.5.1 The Specific Objectives

The specific objectives will be to:

1. Measure the anthropometric indices:

   (a) Body Mass Index using height and weight, percent body fat, visceral fat, WHR using waist and hip circumference.

2. Assess:

   (a) Diet history using a 24-hour recall.

   (b) Physical activity level using a validated questionnaire

   (c) Fasting Plasma Glucose, Oral Glucose Tolerance Test (OGTT) Serum Triglyceride, HDL- and LDL-cholesterol and total cholesterol.

   (d) Blood Pressure

3. Compare the prevalence of CV risk factors among keep fit club members and the control group.

CHAPTER 2

2.0 LITERATURE REVIEW

2.1 INTRODUCTION

Cardiovascular disease (CVD) is a general term that describes diseases of the heart or blood vessels (World Health Organization, 2003). Blood flow to the heart, brain or body can be reduced as a result of a blood clot (thrombosis) or build-up of fatty deposits inside an artery, leading to hardening and narrowing (atherosclerosis) (NHS, 2012). The types of CVD include coronary heart disease (heart attacks), cerebrovascular disease (stroke), hypertension (raised blood pressure), peripheral artery disease, rheumatic heart disease, congenital heart disease and heart failure based on World Health Organizations classification.

2.2 EPIDEMIOLOGIC TRANSITION

It has long been recognized that as societies modernize, significant changes occur in patterns of health and disease (Omran, 1971). The epidemiologic transition describes changing patterns of population age distributions, mortality, fertility, life expectancy, and causes of death (McKeown, 2009). Over the past two centuries the industrial and technological revolutions witnessed have resulted in an intense shift in the causes of illness and death. Infectious diseases and malnutrition were the most common causes of death before the 1900s however improved nutrition and public health measures have gradually replaced these public health problems with CVD and cancer in most high-income countries (World Health Organization, 2002a). According to Gaziano *et al.*, (2006), CVD was responsible for less than 10% of all deaths worldwide at the beginning of the 20th century and about a year into the 21st century the figure had risen to 30%. As improvements in infectious disease and malnutrition continued to spread to developing countries, CVD mortality rates also started increasing. Currently, 80% of the global burden of CVD death occurs in low- and middle-income countries (Murray and Lopez, 1996). This dramatic shift is known as epidemiological transition and it is highly associated with modifications in personal and collective wealth (economic transition), social structure (social transition) and demographics (demographic transition). In 1971, Omran described this transition with a model that divides the transition into three stages: pestilence and famine, receding pandemics and degenerative and human-created diseases. Over a decade later, Olshansky and Ault (1986) added a fourth stage as delayed degenerative diseases. The table below shows the different stages and how it pertains to CVD by regions.

TABLE 2.1 Stages of the Epidemiological Transition and Its Global Status, by Region

	Phases	Socio-economic development	Life expec-tancy	Change in broad disease categories	Change within broad disease categories (proportionate mortality)
1*	Age of pestilence (infection) and famine	+	~30	Infections Nutritional deficiencies	CVD: 5-10% related to nutrition/infection (e.g. RHD, Chagas)
2*	Age of receding pandemics	++ (developing countries)	30-50	Improved sanitation : ↓ infections, ↑ diet (salt), ↑ aging	CVD: 10-35% Hypertensive heart disease, stroke. sequels of RHD and CHF
3*	Age of degenerative and man-made diseases	+++ (countries in transition)	50-55	↑ aging, ↑ lifestyles related to high SES (diet, activity, addiction)	CVD: 35-65%. Obesity, dyslipidemias, HBP, smoking → CHD, stroke, often at early age ; PVD (first in ↑ SES)
4**	Age of delayed degenerative diseases	++++ (western countries)	~70	↓ reduced risk behaviors in the population (prevention and health promotion) and ↑ new treatments	CVD <50% (delayed ↓ total CVD due to aging population & ↑ prevalence due to better treatment)

Source: Omran (1971) ; Olshansky and Ault (1986).

Different countries enter the stages described above at different times; however, the progression from one stage to the next tends to proceed in a predictable manner. Developing countries with improved economy, nutrition and public health are gradually moving from one stage to the other. African countries for example are moving from the stage of famine and pestilence to the second stage of receding pandemics with an increase in chronic diseases and hypertension. There is more reason to suspect an impending epidemic of CVD in Sub-Saharan Africa. Since 2001, CVD particularly, hypertension, stroke, cardiomyopathy and rheumatic valve disease have been a growing threat to the health of Africans (Gaziano *et al*., 2006).

An intriguing aspect of the epidemiology of vascular disease around the world is the consistent report that stroke is an important cause of morbidity, disability, and death in adults of black African origin, whether living in Africa, the Caribbean, US, or the UK (Poulter *et al.*, 1997). Gillum (1999) suggested six stages of the epidemiological evolution of patterns of cardiovascular disease among black people of sub-Saharan African origin. This he did after studying trends in stroke mortality in the US among African Americans. The evolution is characterized by advancing acculturation, urbanization, and affluence with a progressive increase in salt intake, smoking habit, and saturated fat intake. The earlier stages (from 2 to 4) see the appearance of hypertension (and associated stroke) as the predominant form of cardiovascular disease whilst atherosclerosis (and associated ischaemic heart disease) is predominant in the later stages (4 and 5). In stage 6 Gillum then postulates a decline in morbidity and mortality from vascular disease attributable to better prevention and management (Gillium, 2001).

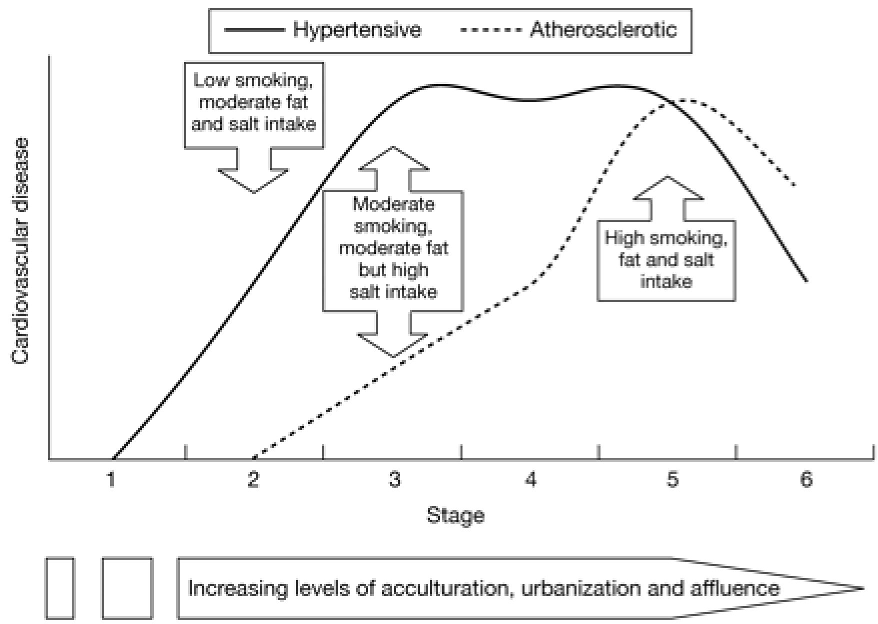

Figure 2.1 Gillum's stages in the epidemiological evolution of patterns of cardiovascular disease among people of sub-Saharan African origin (Gillium, 2001).

Recent findings have shown that poor socioeconomic conditions in childhood determine CVD in middle age as strongly as do CVD risk factors in middle age in the same individuals (Lawlor, 2002). Furthermore, according to the Barker Hypothesis, poor fetal growth has been shown to be associated with hypertension, and CVD, in later life. However, a study carried out in Nigeria failed to demonstrate this effect (Law *et al.*, 2001). The current impoverishment of much of Sub-Saharan Africa may paradoxically result in an epidemic of CVD in middle age for those who survive the ravages of poverty-associated communicable diseases, such as AIDS, tuberculosis, pneumonia, and malaria (Mbewu and Mbanya, 2006). Since fetal growth retardation is associated with chronic under nutrition among women, improvement in the nutrition and health of girls and young women may be important in preventing CVD in developing countries (Mbewu and Mbanya, 2006). Another alarming reason is the increase in childhood obesity that has led to large increases in diabetes and hypertension (Franks *et al.*, 2010). A review of multidisciplinary research on culture, development, health, and disease in Accra since the late nineteenth century, as well as relevant work on Ghana's socio-economic and demographic changes and burden of chronic disease was done by Adjei-Mensah and Aikins (2010). They indicated that the epidemiological transition in Accra reflects a protracted polarized model showing a "protracted" double burden of infectious and chronic disease which constitutes the major cause of morbidity and mortality. This double burden is polarized across social class. While wealthy communities experience higher risk of chronic diseases, poor communities experience higher risk of infectious diseases and a double burden of infectious and chronic diseases. Urbanization, urban poverty and globalization are key factors in the transition (Adjei-Mensah and Aikins, 2010). Obesity is the most commonly measured health outcome due to shifts in the structure of diet. Overweight and obesity are common in Ghanaians, particularly among females, the elderly and urban dwellers (Amoah, 2003a). The prevalence of obesity in women (7.4%) was found to be higher than men (2.8%) in an epidemiological study of obesity in Ghana (Britwum *et al.*, 2005). This high prevalence may be due to the rapid growth in the economy and changes in lifestyle occurring in the region. Lifestyle changes have also led to a transition in health with the emerging new pattern of illness in urban populations in the country. Another study in Accra showed overweight and obesity as a common condition among adult women in the region and it was significantly linked to major health illnesses (Duda *et al*., 2007). According to Amoah (2003b) the rise in obesity and overweight may be due to reduction in the physical activities in the Ghanaian population. He further noted that an increase in television stations and extension of transmission hours which resulted in an increase in the hours spent in daily viewing has also contributed to the rise in obesity in the country.

2.3 GLOBAL TRENDS, PREVALENCE AND MORTALITY OF CARDIOVASCULAR DISEASES

The epidemic of CVD is a global phenomenon, and the magnitude of its increase in incidence and prevalence in low and middle-income countries has potentially major implications for those high-income countries that characterize much of the developed world (Gersh *et al*., 2010). In recent years, the dominance of chronic diseases as major contributors to total global mortality has emerged (Adeyi *et al*., 2007; WHO, 2008b). CVD accounts for a large proportion of all deaths and disability worldwide (Bhagat and Ghosh, 2011). An estimated 17.3 million people died from CVDs in 2008, representing 30% of all global deaths (World Health Organization, 2011). Of these deaths, an estimated 7.3 million were due to coronary heart disease and 6.2 million were due to stroke (World Health Organization, 2011). Low- and middle-income countries are disproportionally affected: over 80% of CVD deaths take place in low- and middle-income countries and occur almost equally in men and women (World Health Organization, 2011). The number of people, who die from CVD, mainly from heart disease and stroke, will increase to reach 23.3 million by 2030 (Mathers and Loncar, 2006) (World Health Organization, 2011). CVD is projected to remain the single leading cause of death (Mathers and Loncar, 2006).The projected trends in CVD mortality and the expected shifts from infectious to chronic diseases over the next few decades are shown in Figure 2.1.

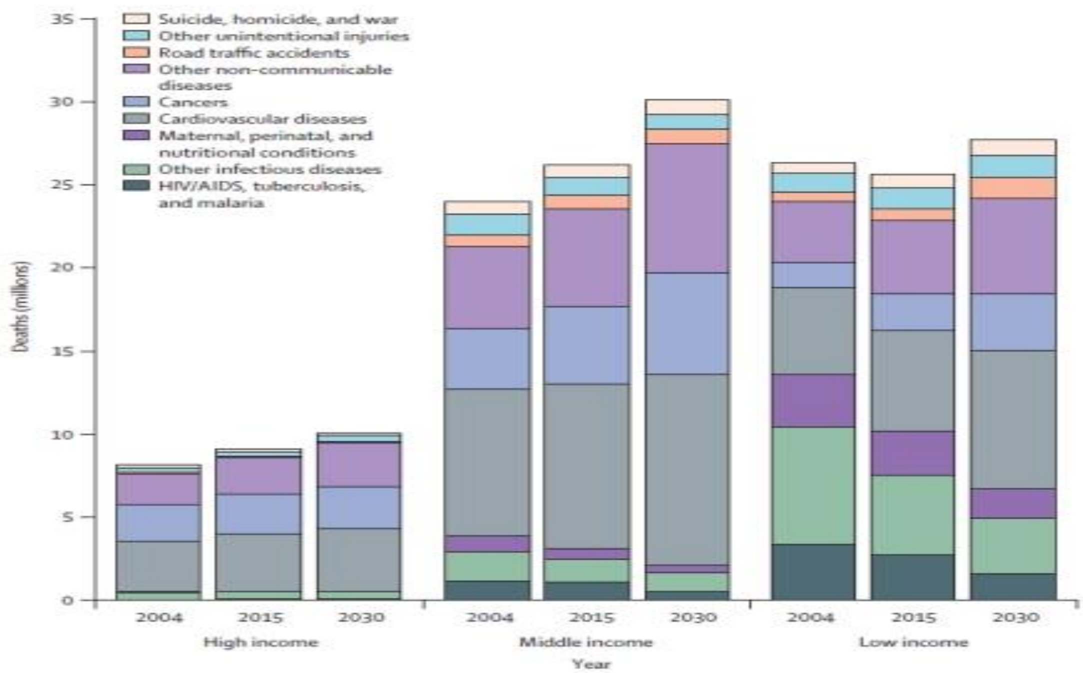

FIGURE 2.2 Projected global deaths by cause SOURCE: Beaglehole and Bonita, 2008.

The epidemic of cardiovascular disease (CVD) is a global phenomenon, and the magnitude of its increase in incidence and prevalence in low and middle-income countries has potentially major implications for those high-income countries that characterize much of the developed world. Africa has not been spared this global tide of CVD. In most African countries CVD is now the second most common cause of death after infectious disease, accounting for 11 percent of total deaths (World Health Organization, 1999). Projections from the Global Burden of Disease Project suggest that from 1990 to 2020, the burden of CVD faced by African countries will double. A large proportion of the victims of CVD will be middle-aged people (Mbewu and Mbanya, 2006). The financial and social costs of this CVD epidemic are likely to have a negative impact on development and the alleviation of poverty (Mbewu and Mbanya, 2006).

In the African region CVD is the leading cause of death in those over the age of 45 (Gaziano, 2008). CVD also accounts for 7-10% of all adult medical admissions to hospitals in Africa, with heart failure contributing to 3-7% (Antony, 1980; Oyoo and Ogola, 1999). The reported hospital mortality by cardiovascular disease is high reaching 9.2% in Cameroon and 21.9% in Tanzania (Tantchou Tchoumi *et al*., 2011, Maro and Kaushik, 2009). Stroke has a disproportionately higher burden, with lower national income being associated with higher relative mortality (Kim and Johnston, 2011).

The Ghana Health Service performance and annual reports for both 2003 and 2007 showed that there were increasing trends of non-communicable diseases. The 2007 annual report revealed that CVDs and diabetes were among the top ten causes of mortality and morbidity in Ghana with hypertension accounting for 4.7% of deaths. 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 (Adjei-Mensah and De-graft, 2010). The increasing rates of CVD mortality, particularly stroke, have also been unprecedented. 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 (Plange-Rhule *et al.*, 1999). The 2003 data on 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. The increasing prevalence of hypertension in Ghana, particularly in urban centers, clearly suggests that the burden of stroke will continue to increase unless urgent action is taken to halt the rising prevalence of hypertension (Cappuccio *et al.*, 2004, Agyemang and Owusu-Dabo, 2008, Agyemang C., 2006, Addo *et al.*, 2006). Outpatient department attendance due to hypertension ranged from 1.4% in the Northern and Upper East region and 6% in the Volta region with Greater Accra region reporting 4.3%. There was also an increased load, predominantly made up of infectious diseases such as tuberculosis, acute respiratory infection, diarrhea, acute skin and eye infection and HIV prevalence in the population. These results confirm reports that Ghana is experiencing a double burden of disease (De-Graft, 2007).

2.4 PLASMA LIPIDS AND LIPOPROTEINS

Cholesterol is an organic molecule. It is a sterol and an essential structural component of animal cell membranes that is required to establish proper membrane permeability and fluidity (US National Library of Medicine, 1991). In addition to its importance within cells, cholesterol also serves as a precursor for the biosynthesis of steroid hormones, bile acids, and vitamin D (Hanukoglu, 1992). Most cells in humans are able to synthesize cholesterol; the majority is synthesized in the liver.

A lipoprotein is a biochemical assembly that contains both proteins and lipids, bound to the proteins (Olson, 1998). The lipoproteins serve to emulsify the fat or lipid molecules, which enable fats to be carried in the blood stream, the transmembrane proteins of the mitochondrion and the chloroplast, and bacterial lipoproteins (Olson, 1998, Ohvo *et al.*, 2001). Many enzymes, transporters, structural proteins, antigens, adhesins, and toxins are lipoproteins (Ohvo *et al.*, 2001). They include the plasma lipoprotein particles classified under high-density (HDL) and low-density (LDL) lipoproteins (Yeagle, 1991). Cholesterol is a component of lipoproteins, which are required for transport of triglycerides (Lecerf and Lorgeril, 2011). Cholesterol is transported in plasma primarily in the form of LDL. The principal route for its removal from tissues to the liver is the

HDL followed by excretion in the bile. Plasma cholesterol has long been known to be associated with cardiovascular risk. This is because the total plasma cholesterol correlates with the presence of LDL which is small and dense. LDL may become trapped in the intima of arteries to form atherosclerotic plaque. (Center for Disease Control, 2012). Cholesterol and lipoprotein abnormalities play a major role in the development and progression of CVD. Regular exercise results in an increase in exercise capacity and lowers myocardial oxygen demand leading to cardiovascular benefits (NCEP, 1993). Low levels of high density lipoprotein cholesterol and high levels of low density lipoprotein cholesterol have been identified as independent CVD risk factors (Wilson *et al.*, 1988).

2.5 CARDIOVASCULAR RISK FACTORS

Certain biological characteristics and behavioural actions are strongly related to the probability of the onset of CVD (Kannel *et al.*, 1991). The majority of CVD is caused by risk factors that can be controlled, treated or modified (World Heart Federation, 2011). They are considerable health benefits at all ages, for both men and women when modified (World Health Organization, 2004). These modifiable risk factors include high blood pressure, tobacco use, alcohol, diabetes, physical inactivity, unhealthy diet, abnormal cholesterol/lipids and overweight and obesity (World Heart Federation, 2011). There are however some other risk factors that cannot be changed and they are referred to as non-modifiable risk factors. It includes age, gender, ethnicity and family history (World Heart Federation, 2011). Although age and one’s family history are important in determining the risk of CVD, their predisposition shows a permissive rather than a determinant role especially where exposure to a poor lifestyle is observed (Kannel *et al.*, 1991).

2.5.1 MODIFIABLE RISK FACTORS

2.5.1.1 High Blood Pressure

Blood pressure is the pressure of your blood against the inner walls of your arteries as it is pumped around the body by your heart. As your heart pumps, the flow of blood in your arteries and your blood pressure rises and falls in a regular wave pattern. Blood pressure peaks when the heart pumps and it's called systole and falls when the heart relaxes called diastole (National Heart Foundation, 2010). Hypertension or high blood pressure is generally defined as blood pressure readings that have a consistent systolic pressure above 140 and diastolic pressure above 90 millimeters of mercury (mmHg) when measured over a period of time (World Heart Federation, 2011). One's risk of a CVD doubles for every 10 point increase in diastolic blood pressure or every 20 point increase in systolic blood pressure (World Health Organization, 2004).There are often no symptoms or signs of high blood pressure as such one can have high blood pressure and feel well. This makes it a silent killer.

The Framingham Heart Study is the earliest and most reliable study that revealed that the rise of both systolic and diastolic blood pressure increases an individual's risk of developing coronary heart disease, stroke, congestive heart failure, peripheral vascular disease and kidney problems (Kannel *et al.*, 1991). The association is strongest for stroke even though it is highly significant for other CVD. Globally, nearly one billion people have high blood pressure, and two-thirds of this population live in developing countries

(World Health Organization, 2011). Worldwide, raised blood pressure is estimated to cause 7.5 million deaths, about 12.8% of the total of all deaths (World Health Organization, 2008) and ranked third as a cause of disability-adjusted life-years (DALYs) (Eazziti *et al.*, 2006). This account for 57 million DALYs or 3.7% of total DALYS. Hypertension is the leading cause of CVD worldwide (World Health Organization, 2011). One in three adults worldwide has raised blood pressure (World Health Statistics, 2012) and yet over half of them do not know they have the condition, meaning they are not receiving treatment that could significantly reduce their risk of heart disease and stroke (World Heart Day, 2013). Africa showed the highest prevalence of high blood pressure of about 46% with the lowest prevalence of 35% occurring in the Americas of about 35% (World Health Organization, 2008). Men in the Americas had higher prevalence than women (39% for men and 32% for women) but almost similar prevalence in Africa for both sexes. In all WHO regions, men have slightly higher prevalence of raised blood pressure than women (World Health Organization, 2008). Across the income groups of countries, the prevalence of high blood pressure was consistently high in low, lower middle and upper middle countries all having rates of around 40%. The prevalence in high income countries was lower, at 35% (World Health Organization, 2008). The WHO estimates that by 2025, about 1.56 billion adults will be living with hypertension

A cross sectional study by Hendriks *et al* (2012) in four urban and rural communities in Africa showed that hypertension was the most frequently observed risk factor for CVD in both urban and rural communities. The crude prevalence of hypertension ranged from

19.0% in Tanzania to 32.0% in Namibia. The prevalence of hypertension increased with age with alarmingly low levels of control observed (Hendriks *et al.*, 2012).

In Ghana, 11 population-based studies conducted on hypertension between 1973 and 2009 by Addo *et al* (2012) showed that, the prevalence of hypertension was higher in urban (54.6%) than rural areas (19.3%). The prevalence of hypertension among urban populations in Ghana was comparable to that reported from Europe and North America (Wolf-Maier *et al.,* 2003).The prevalence also increased with increasing age. The levels of hypertension detection, treatment and control were generally low (control rates ranged from 1.7% to 12.7%).

A study conducted on hypertension in 1998 showed higher prevalence rates across different groups in different regions: 28.7% in Kumasi (Ashanti Region); 32% in Bawku/Zebilla (Upper East Region); 36.9% in Keta-Dzelukope (Volta Region) (Cappuccio et al., 2004; Hill et al., 2005; Pobee, 2006)). In other studies 47.8% was recorded among a cohort of women in Accra (Cappuccio *et al.*, 2004; Hill *et al.*, 2005; Pobee, 2006). It was reported in an earlier study that the prevalence of hypertension was higher in men than in women aged less than forty years (Pobee, 1993) but recent study has shown prevalence higher in women than in men (Amoah 2003a). In another study among residents in Ashanti region, the overall prevalence was 28.7%, with 29.9% and 28% in men and women respectively (Cappuccio *et al.,* 2004). People with poorly controlled hypertension are more likely to develop complications such as diabetes, heart attack, stroke, heart failure or kidney disease (Sowers *et al.,* 2001).

2.5.1.2 Diabetes

Diabetes mellitus more commonly referred to as diabetes, is a condition that is characterised by blood sugars rising to dangerous levels (America Heart Association, 2007); that is fasting blood glucose of 126 milligrams per decilitre (7.0 mmol/l) or more. Insulin is a hormone produced by the pancreas and used by the body to regulate glucose (sugar). Diabetes occurs when the body does not produce enough insulin, or cannot use it properly, leading to too much sugar in the blood. Symptoms include thirst, excessive urination, tiredness, and unexplained weight loss (NHS, 2011).

There are two main types of diabetes. Type 1 diabetes in which the pancreas stops making insulin accounts for 10% to 15% of cases. Type II diabetes accounts for 90% of all diabetes cases in the world (WHO, 2003) and is preventable because it is largely associated with physical inactivity, excess calorie intake and obesity. It is common in people above 35 years of age. The global prevalence of diabetes is estimated to be 10 % and responsible for 1.3 million deaths (WHO, 2008). A large body of epidemiological and pathological data documents that diabetes is an independent risk factor for CVD in both men and women (Wilson, 1998). Wingard *et al* (1993) in their study found that, when patients with diabetes develop clinical CVD, they sustain a worse prognosis for survival than CVD patients without diabetes. According to Unachukwu *et al* (2012), the condition is a major risk factor for CVD which is the primary cause of death in people with diabetes. Two of three diabetic patients will die as a result of cardiovascular complications, and approximately 30% of patients treated in cardiovascular intensive care units have diabetes (Kengne *et al*., 2005). Increased susceptibility to CVD in diabetes is related to poor control of glycaemia, blood pressure and dyslipidaemia which together hasten the development of atherosclerosis. Chronic hyperglycaemia can cause arteries to narrow or lose elasticity (Bell, 2003).

Epidemiological data from at least two African countries suggest that in predominantly urban areas, the prevalence of diabetes have increased markedly over the past 5–10 years. A recent estimate indicates that 5–8% of urban adult populations in Dar es Salaam, Tanzania and in South African townships are affected with diabetes (Edwards *et al.*, 2000, Aspray *et al.*, 2000, Fourie *et al.*, 1995).

The Ghana Diabetes Association in its early 1990s diabetes screening proposed a prevalence of 2-3% in urban areas of southern Ghana. In the late 1990, a prevalence rate of 6.4% for diabetes and 10.7% for impaired glucose tolerance (IGT) was also recorded in a community in Accra (Amoah *et al.*, 2002). A study performed in the Greater Accra area to determine the prevalence of diabetes, impaired fasting glycaemia (IFG) and impaired glucose tolerance (IGT) in a random cluster sample of 4,733 Ghanaians aged 25 years and above indicated a prevalence of diabetes at 6.3% (Amoah *et al.*, 2002). Diabetes was found to be more common in males than females (7.7 vs. 5.5%) in the Greater Accra region. Worsening glycaemia status tends to be associated with increase in age, body mass index, systolic and diastolic blood pressures (Amoah *et al.*, 2002).

2.5.1.3 Hyperlipidemia (High Blood Cholesterol)

Cholesterol is a soft, waxy substance found among the lipids in the bloodstream and in all the body's cells. It is needed to form cell membranes and hormones, and for other bodily functions.

High blood cholesterol refers to elevated levels of cholesterol in the blood (NIH, 2012). The body can make cholesterol, or can obtain it from animal food products (World Health Report, 2002). .Raised blood cholesterol increases the risks of heart disease and stroke (World Health Organization, 2012). High blood cholesterol is estimated to cause 2.6 million deaths and 29.7 million DALYs (World Health Organization, 2012). In 2008, the global prevalence of raised total cholesterol among adults was 39% (37% for males and 40% for females). Across the WHO regions Africa recorded the lowest prevalence of 22.6% with Europe and the Americas recording the highest prevalence of 54% and 48% respectively (World Health Organization, 2008). The prevalence of high blood cholesterol noticeably increases according to the income level of the country. In low income countries, the prevalence of high blood cholesterol is about 25% of adults i compared to over 50% of adults in high-income countries.

Cholesterol is transported around the body in two kinds of lipoproteins: low-density lipoprotein (LDL) and high density lipoprotein (HDL). A high level of total blood cholesterol, triglycerides and LDL can lead to clogging of the arteries, increasing the risk of heart attack and ischaemic stroke (Roeters van Lennep *et al.*, 2002). HDL however reduces the risk of coronary heart disease and stroke (Rubins *et al.,* 1999). A blood cholesterol level less than 5.2 mmol/L is ideal for both foremost and ancillary prevention of CHD. Likewise an LDL level below 2.6 mmol/L and a triglyceride level below 1.7 mmol/L are considered optimal. HDL level above 1.6 mmol/L provides protection against CHD risk. The ratio of HDL cholesterol to the total cholesterol level is usually expressed as a percentage. A level of more than 20% for men and 25% for women is considered to provide protection against developing atherosclerosis (Adult Treatment Panel III 2001).

2.5.1.4 Overweight and Obesity

Overweight and obesity has reached global epidemic proportions in both adults and children (Lavie *et al.*, 2009) and the excess body weight is associated with increased risk for CVD. The prevalence of overweight and obesity appear to be increasing rapidly in many countries and reflect an overall increase in general fatness (Siedell, 1997;Sorensen, 2000). Worldwide, at least 2.8 million people die each year as a result of being overweight or obese, and an estimated 35.8 million of global DALYs are caused by overweight or obesity. Overweight and obesity lead to adverse metabolic effects on blood pressure, cholesterol, triglycerides and insulin resistance. The effect of excess weight on cardiovascular disease and mortality is delayed and therefore often not evident in short term studies (Lavie *et al.*, 2009). Body mass index (BMI) is a measure of weight relative to height. A BMI of 25.0–29.9 is considered overweight and 30.0 and above is classified as obese (World Health Report, 2002). In 2008, 35% of adults aged 20 and above were overweight (34% men and 35% of women). The worldwide prevalence of obesity has nearly doubled between 1980 and 2008. In 2008, 10% of men and 14% of women in the world were obese, compared with 5% for men and 8% for women in 1980. An estimated 205 million men and 297 million women over the age of 20 were obese – a total of more than half a billion adults worldwide (World Heart Organization, 2008).

Across many sub-Saharan African countries, obesity has been linked to both urban residence and wealth, as a result of transitions in nutrition (Ntandou *et al.*, 2009) and energy expenditure (Bourne *et al.,* 2002) due to urbanization and other unknown factors (Joubert *et al.,* 2007). Excess visceral fat has also been associated with insulin resistance and other metabolic risk factors for CVD (Grundy *et al.,* 2004). Evidence supports that; adipose tissue synthesizes and secretes biologically active molecules that may affect CVD risk factors (Fain *et al.,* 2004). These chemical messengers include adiponectin, resistin, leptin, plasminogen activator inhibitor-1, tumor necrosis factor-alpha, and interleukin-6 (Fain *et al*., 2004). In overweight and obese individuals, weight loss may improve insulin sensitivity, leading to reduction in risk factors for CVD and, consequently, the potential for cardiovascular events. Agents that improve insulin sensitivity have been shown to reduce visceral obesity (Grundy *et al*., 2004). Decreases in visceral adipose tissue contribute to improvements in insulin sensitivity and blood pressure, while weight loss reduces serum levels of triglycerides and low-density lipoprotein cholesterol while increasing serum levels of high-density lipoprotein cholesterol (Sowers, 2003). A study by Amoah, (2006) in Accra showed that, obesity increased with age up to 64 years. Overweight and obesity were common in the urban high-class residents compared with the low-class residents and in urban than rural subjects. The Akan and Ga tribes also showed higher incidence of overweight and obesity compared to the Ewes. It was found in the same study that, subjects who did not engage in leisure-time physical activity were more obese than those who had three or more sessions of leisure-time physical activity per week (15.3 vs. 13.5%)(Amoah, 2003a). In another study, obesity was found higher among females (7.4%) compared to males (2.8%) and also more common among the married than unmarried. Obesity was highest among the employed compared to self-employed. Obesity was highest in Greater Accra

(16.1%) and virtually not present in Upper East or Upper West regions. By ethnicity, obesity was highest among Ga Adangbe, Ewes and Akans 14.6%, 6.6% and 6.0% respectively (Biritwum *et al.*, 2005).

2.5.1.5 Tobacco Use

Smoking is estimated to cause nearly 10 per cent of CVD and is the second leading cause of CVD, after high blood pressure (World Health Organization, 2011). The impact of tobacco smoke is not confined solely to smokers. Non-smokers who breathe second hand smoke have between 25–30 % increases in the risk of developing a CVD (U.S. Department of Health and Human Services, 2006). Nearly 6 million people die from tobacco use or exposure to second hand smoke, accounting for 6 per cent of female and 12 per cent of male deaths worldwide, every year. By 2030 tobacco-related deaths are projected to increase to more than 8 million deaths a year (World Health Organization, 2011). Tobacco acts in a number of ways to cause CVD. Its use, whether by smoking or chewing, damages blood vessels, temporarily raises blood pressure and lowers exercise tolerance. Moreover, tobacco decreases the amount of oxygen that the blood can carry and increases the tendency for blood to clot. Blood clots can form in arteries causing a range of heart diseases that ultimately result in a stroke or sudden death. Tobacco smoke is thus said to be both prothrombotic and atherogenic (World Heart Federation, 2011). Despite declines in smoking prevalence in many Western countries, tobacco use continues to grow in global importance as a leading preventable cause of CVD (Bullen C., 2008). For each 10 cigarettes per day there is an incremental increase in cardiovascular mortality in men (18%) and in women (31%) (Kannel and Higgins,1990).

Alberto *et al.,* (1996) conducted a study to investigate the acute effect of cigarette smoking on glucose tolerance, insulin sensitivity, serum lipids, blood pressure, and heart rate. Alberto *et al* (1996) concluded that smoking acutely impairs glucose tolerance and insulin sensitivity, enhances serum cholesterol and triglyceride levels, and raises blood pressure and heart rate. This supports findings about the pathogenic role of cigarette smoking on cardiovascular risk factors.

2.5.1.6 Diet

The role of diet is crucial in the development and prevention of cardiovascular disease. Diet is one of the key things that can be changed to impact all other cardiovascular risk factors (World Heart Federation, 2011). Traditional, largely plant-based diets have been replaced by high-fat, energy-dense diets with a substantial content of animal foods (Roberts and Barnard, 2005). According to the American Heart Association, alterations in diet have both positive and negative health implications (American Heart Association, 2006). Thus, change in an individual's diet may not only influence the person's present health but the development of diseases such as hypertension, diabetes, hyperlipidemia and coronary heart disease in later years. Specific recommendations for a healthy diet include: eating more fruit, vegetables, legumes, nuts and grains; cutting down on salt, sugar and fats. It is also advisable to choose unsaturated fats, instead of saturated fats and towards the elimination of trans-fatty acids (World Health Organization, 2008).

2.5.1.6.1 Nutrition transition

Human diet, activity patterns, and nutritional status have undergone a sequence of major shifts, defined as broad patterns of food use and their corresponding nutrition-related diseases (Misra and Khurana, 2008). Modernization, urbanization, economic development, and increased wealth lead to predictable shifts in diet. This is referred to as the nutrition transition (Popkin, 2006).

Large shifts have occurred in dietary and physical activity patterns. These changes are reflected in nutritional outcomes, including changes in average stature and body composition. Modern societies seem to be converging on a diet high in saturated fat, sugar, and refined foods and low in fiber, often termed the Western diet (Popkin,1999).

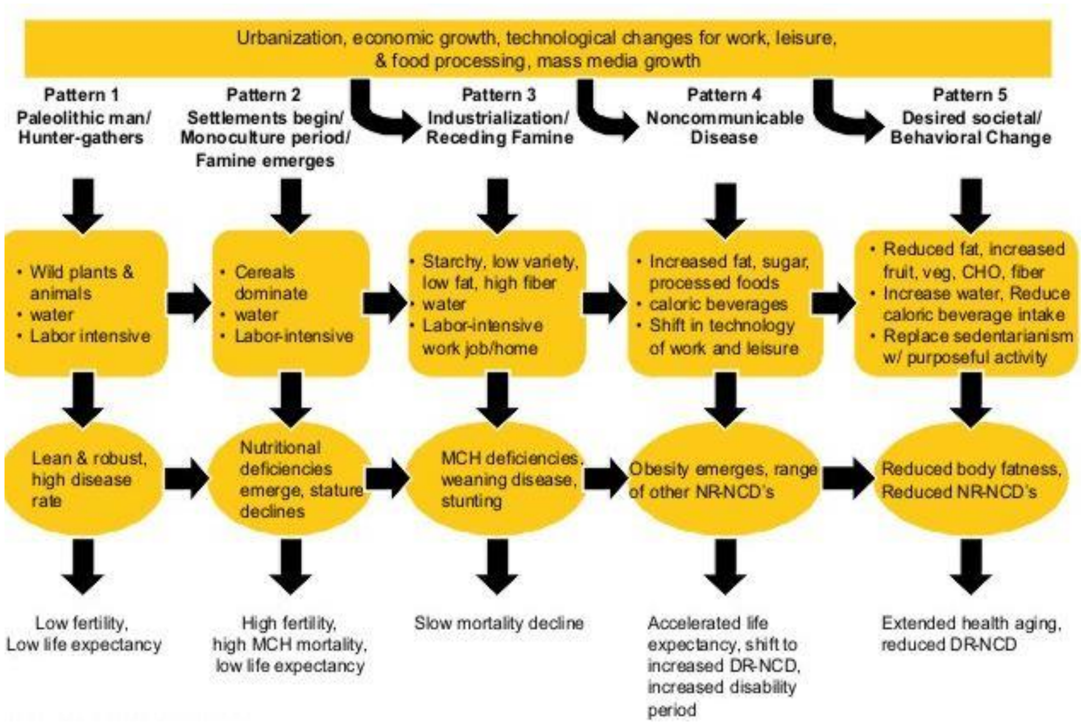

Figure 2.3 Patterns of Nutrition Source: Popkin BM, 2006

Currently, most low and middle income countries including Ghana are rapidly moving from pattern 3 (end of famine) to pattern 4 (consuming more energy-dense diets). This shift from traditional diets to Western-style diets has been a key contributor to the obesity epidemic in these countries (Misra and Khurana, 2008).Increased world access to cheaper vegetable oil is thought to have triggered off this accelerated and generalized trend, though animal food, rich in saturated fat, and imported or locally-made industrialized food also play a role (Bernard *et al.*, 2002). While increased national and household incomes facilitate the initial change, as the transition advances poor people progressively become the main victims, as has been observed in the more advanced developing countries. Metabolic imprinting due to intra-uterine and infant malnutrition, which are still common in these societies, is also thought to play a significant role in the increase in the expression of insulin resistance, obesity and chronic diseases when these children are exposed to abundant food and modern lifestyle, later in life (Bernard *et al.*, 2002). Treatment and secondary prevention of nutrition-related chronic diseases and associated disabilities have an ever rising cost in industrialized countries, which is far beyond the means of the still fragile economies of developing countries (Bernard *et al.*, 2002).

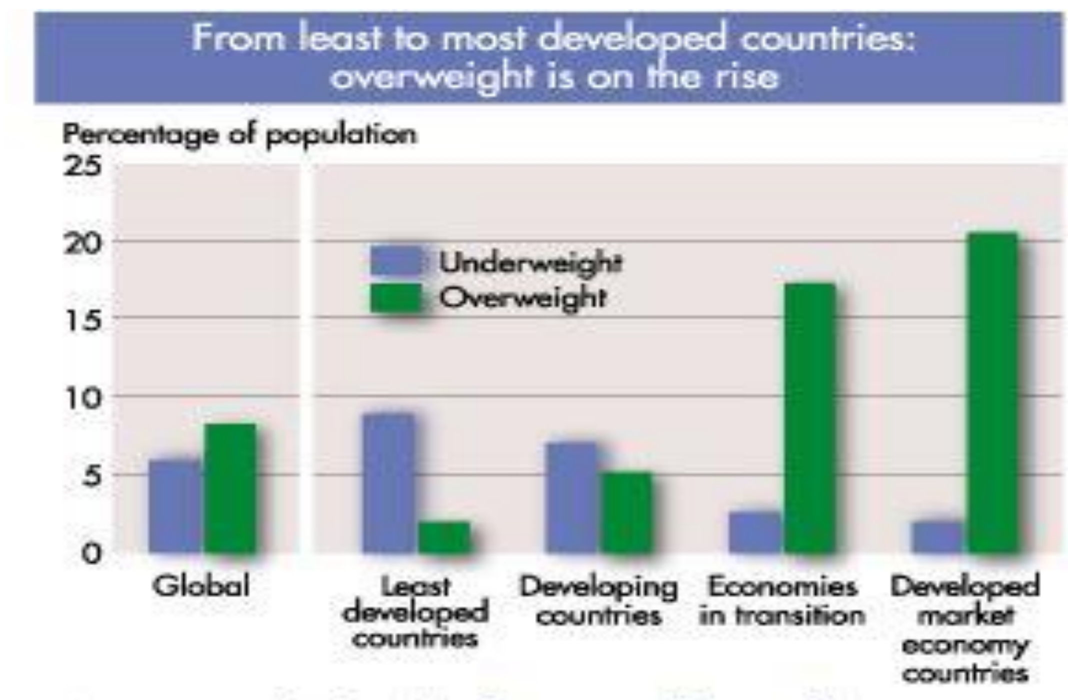

Figure 2.4: Rising trends in overweight. Source: World Health Organization, 2000

This double burden of infectious diseases and under nutrition that still exists, and of non-communicable diseases and over nutrition represents a threat to the frequently unprepared health care services in developing countries (Bernard *et al.*, 2002).

2.5.1.6.2 Dietary Fats

Fat is a major source of energy containing about 9 calories per gram of fat (Stern, 2008). They are broken down in the body to release glycerol and free fatty acids. The glycerol can be converted to glucose by the liver and used as a source of energy. It aids the body in digesting, absorbing and transporting fat-soluble vitamins (Mahan *et al.*, 2012). It is important for proper growth, development and keeping healthy. Fats help protect one's organs and regulate body temperature. It provides taste to foods as well as providing satiety. Dietary fat also plays a major role in cholesterol levels (Food and Drugs Administration,2013). The main types of fat in food are saturated fatty acid (SFA) and unsaturated fatty acid (USFA). Unsaturated fat is further classified into mono unsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA). Other types of fat are cholesterol and trans fats. Trans fat is formed during processing of unsaturated oils (i.e. hydrogenation) (Food and Drugs Administration, 2013).

The Nutrition Committee of the American Heart Association has proposed fat guidelines for healthy adults over the age two (AHA, 2012). Recent evidence indicates that diets with adequate energy providing less than 30% of energy from fat are sufficient to promote normal growth and normal sexual maturation (Lichtenstein *et al.*, 1998). Total fat intake should be about 25–35 % of total calories per day. SFA and trans fat intake should be limited to less than 7% and 1% of total daily calories respectively while PUFA and MUFA should be 10% and 15% respectively. Dietary cholesterol should be limited to less than 300 mg /day for most people (AHA, 2012)

High intake of saturated fats, trans fats, and cholesterol increases the risk of unhealthy blood lipid levels, which, in turn, may increase the risk of coronary heart disease (CHD). The amount of total fat and the contribution of SFA, MUFA and PUFA have differential impact on the various lipid indicators of CVD risk (Keys *et al.,* 1987). A high intake of fat (greater than 35 percent of calories) generally increases saturated fat intake and makes it more difficult to avoid consuming excess calories. A low intake of fats and oils (less than 20 percent of calories) increases the risk of inadequate intakes of vitamin E and of essential fatty acids and may contribute to unfavourable changes in high-density lipoprotein (HDL) blood cholesterol and triglycerides (Stanfield and Hui, 2010).

It is a widely accepted fact that dietary SFA and cholesterol cause an increase in serum total cholesterol (Kannel *et al.,* 1961), as well as low density lipoprotein-cholesterol (LDL-C) and thereby increase the risk of heart disease if consumed (Steinberg, 2005) in large amounts. Various evidence have indicated that types of fat in a diet have a more important role in determining risk of CHD than total amount of fat in the diet (Hu *et al.,* 2001). Metabolic studies have also established that the type of fat, but not total amount of fat, predicts serum cholesterol levels (Hu *et al.,* 2001). In the Seven Countries Study, intake of saturated fat as a percentage of calories was strongly correlated with coronary death rates across 16 defined populations in seven countries (Keys, 1980). In the same study, however, there was a weaker correlation between the percentage of energy from total fat and CHD incidence. Two other studies have also shown a significantly positive association between saturated fat intake and risk of CHD (McGee *et al.,* 1984) (Kushi *et al.,* 1985).

Predominant sources of SFA diet are found in animal foods i.e. diary and meat and have the most potent effect on LDL cholesterol. A large multi ethnic cohort study to find out if different food sources of SFA have different implications showed that, a higher intake of dairy was associated with lower CVD risk. In contrast, a higher intake of meat was associated with higher CVD risk (de Oliveira Otto *et al.,* 2012). They further explained that medium-chain SFAs, which are more common in dairy, raise HDL to a greater extent than does palmitic acid which makes up the majority of SFA in meats, producing favourable changes in the total cholesterol: HDL ratio (Mensink *et al.,* 2003). Other dairy nutrients including calcium, potassium, and phosphorus could have antihypertensive effects that may contribute to inverse associations with CVD risk (Alonso *et al*, 2010; Sacks *et al*, 1998; Geleijnse *et al*, 2003). Foods of plant origin such as coconut, palm kernel and palm oil contain SFA that promote hypercholesterolemia (Wijendran and Hayes, 2004).

PUFA and MUFA on the other hand have protective effects on CVD as Shekelle *et al* (1981) found significant inverse association between PUFA intake and CHD. Their dietary sources include unsalted nuts and seeds, fish especially oily fish, such as salmon, trout and herring (AHA, 2012). Keys *et al* (1965) and Hegsted *et al* (1965) analysed data from controlled feeding studies and found that MUFA did not affect total cholesterol levels but PUFA lowered total cholesterol levels. More recent analyses confirmed these findings. However, there is some suggestion that MUFAs elicit a cholesterol-lowering effect that is less than that observed for PUFAs (Mensink and Katan

1992; Yu *et al.,* 1995). Howard et al (1995) supported previous findings that there is a greater reduction in total cholesterol levels with PUFA than MUFAs in a controlled-feeding study. PUFA and MUFA however both lower total serum cholesterol and LDL. Diets high in oils enriched in MUFA lowers total cholesterol, LDL, and HDL cholesterol, whereas the PUFA enriched oil slightly lowers triglycerides (Gardner and Kraemer, 1995).

2.5.1.6.3 Dietary Energy and Carbohydrate

Maintaining a stable body weight requires achieving energy balance, where the amount of energy ingested equals the amount of energy expended. In adults, it is particularly important that the amount of energy ingested be matched to the amount of energy expended (Hill *et al.,* 2003). Maintenance of energy balance is important in order to avoid obesity and its associated co-morbidities such as diabetes and cardiovascular disease. Positive energy balance and obesity occur when total energy intake exceeds total energy expenditure, regardless of composition of the excess energy. However, the composition of the diet can affect whether and to what extent positive energy balance occurs (Hill *et al.,* 2003). Obesity, particularly central obesity, is a recognized risk factor for cardiovascular disease and is the consequence of a positive energy balance. The mechanisms responsible for this increased risk appear to be related to obesity itself and to a condition closely associated with it is insulin resistance. Insulin resistance is defined as a decreased response of peripheral tissues to insulin action, predisposes individuals to developing type 2 diabetes (Caterina *et al.,* 2006).

The composition of the diet can affect the ability to maintain energy balance. In particular, diets containing at least 55% of energy from a variety of carbohydrate sources, as compared to high fat diets, reduce the likelihood that body fat accumulation will occur (FAO, 1998). Substantial data suggest that diets high in fat content tend to promote consumption of more total energy than diets high in carbohydrates (Levine, 1994; Thomas *et al.*, 1992). This effect may be due to the low energy density of high carbohydrate diets, since total volume of food consumed appears to provide an important satiety cue (Stubbs *et al.*, 1995). There are no data to suggest that different types of carbohydrates differentially affect total energy intake. In addition to affecting the chance of having excess energy available, the composition of the diet also affects the proportion of excess energy that will be stored as body fat. The body has a large fat storage capacity and excess dietary fat is stored very efficiently in adipose tissue. Alternatively, the body's capacity to store carbohydrate is limited and excess carbohydrate is not efficiently stored as body fat (Flatt, 1993). Instead, excess carbohydrate tends to be oxidized, leading to indirect fat accumulation via reductions in fat oxidation (Horton *et al.*, 1995). High carbohydrate foods promote satiety in the short term. As fat is stored more efficiently than excess carbohydrate, use of high carbohydrate foods is likely to reduce the risk of obesity in the long term. Much controversy surrounds the extent to which sugars and starch promote obesity. There is no direct evidence to implicate either of these groups of carbohydrates in the aetiology of abdominal obesity, based on data derived from studies in affluent societies. Nevertheless, it is important to reiterate that excess energy in any form will promote body fat accumulation and that excess consumption of low fat foods, while not as obesity-producing as excess consumption of high fat products, will lead to obesity if energy expenditure is not increased (FAO,1998).

A study by Komiyama *et al*., (2004) to analyse the effect of high carbohydrate low fat diet on glucose tolerance and lipid profile showed that HDL-Cholesterol and body mass index (BMI) decreased significantly by a high carbohydrate diet (hc diet-70% carbohydrate). Insulin resistance index also showed a tendency to be decreased by a hc diet (Komiyama et al, 2004). It did not, however, increase triglyceride. Ma et al (2006) also confirmed the inverse association between percentage of calories from carbohydrate and HDL-C levels, total cholesterol and LDL-cholesterol. They however reported of an increase in triglycerides from a high carbohydrate diet (Ma *et al.*, 2006). They also reported on the possible unfavourable effect of increased intake of highly processed carbohydrate on lipid profile, which may have implications for metabolic syndrome, diabetes, and coronary heart disease (Ma *et al.*, 2006).

2.6 PHYSICAL ACTIVITY TRANSITION

Activity patterns at work, leisure, travel, and in the home are shifting rapidly toward reduced energy expenditure (Popkin, 2009). Physical activity is defined as at least 150 min of moderate-intensity physical activity per week (Bull, 2003; Pate *et al.*, 1995). World Health Organization (2010) also defines physical activity as any bodily movement produced by skeletal muscles that requires energy expenditure. Physical activity generally refers to movement that enhances health (Department of Health Services, 2008). Being physically active is one of the most important steps people of all ages can take to improve their health. Exercise is a type of physical activity that's planned and structured. Lifting weights, taking an aerobics class and playing on a sports team are examples of exercise. Physical activity is good for many parts of the body (Department of Health Services, 2008).

Physical inactivity is now identified as the fourth leading risk factor for global mortality. Physical inactivity levels are rising in many countries with major implications for the prevalence of non communicable diseases (NCDs) and the general health of the population worldwide (World Health Organization,2012). It is estimated that physical inactivity causes 6—10% of the major non-communicable diseases worldwide. Furthermore, this unhealthy behaviour causes 9% of premature mortality, or more than 5.3million of the 57 million deaths in 2008 (World Health Organization, 2012).

2.6.1 GLOBAL PREVALENCE OF PHYSICAL INACTIVITY

Approximately 3.2 million deaths and 32.1 million Disability Adjusted Life Years (DALYs) (representing about 2.1% of global DALYs) each year are attributable to insufficient physical activity (World Health Organization, 2011). People who are insufficiently physically active have a 20% to 30% 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. Participation in 150 minutes of moderate physical activity a week or its equivalent is estimated to reduce the risk of ischemic heart disease by approximately 30%, the risk of diabetes by 27%, and the risk of breast and colon cancer by 21%-25%. Additionally, regular physical activity lowers the risk of stroke, hypertension, and depression. It is a key determinant of energy expenditure and thus fundamental to energy balance and weight control (World Health Organization, 2010).

Globally, around 31% of adults aged 15 and over were insufficiently active in 2008 (men 28% and women 34%) (World Health Organization, 2008). Approximately 3.2 million deaths each year are attributable to insufficient physical activity. In 2008, prevalence of insufficient physical activity was highest in the WHO Region of the Americas and the Eastern Mediterranean Region. In both regions, almost 50% of women were insufficiently active, while the prevalence for men was 40% in the Americas and 36% in Eastern Mediterranean. The South East Asian Region showed the lowest percentages, 15% for men and 19% for women. In all WHO Regions, men were more active than women, with the biggest difference in prevalence between the two sexes in Eastern Mediterranean. This was also the case in nearly every country (World Health Organization, 2008).

2.6.2 TYPES OF PHYSICAL ACTIVITY

Physical exercise is any bodily activity that enhances or maintains physical fitness and overall health and wellness (Stampfer *et al.*, 2000). It is performed for various reasons including strengthening muscles and the cardiovascular system, honing athletic skills, weight loss or maintenance, as well as for the purpose of enjoyment. Frequent and regular physical exercise boosts the immune system, and helps prevent CVD, Type 2 diabetes and obesity (Stampfer *et al.*, 2000; Hu *et al.*, 2001). It helps improve mental health, prevent depression, promote or maintain positive self-esteem. It also helps to increase one's chances of living longer. Childhood obesity is a growing global concern and physical exercise may help decrease some of the effects of childhood and adult obesity. According to the NIH, there are four types of physical activity. This includes aerobic, muscle-strengthening, bone-strengthening and stretching (NIH, 2006).

Aerobic activity moves large muscles, such as those in the arms and legs make the heart beat faster and breathe harder than usual. Examples include running, swimming, walking, biking and dancing. It is also called endurance activity. Regular aerobic activity makes the heart and lungs stronger and able to work better over time (Wilmore and Knuttgen, 2005).Muscle-strengthening activities improve the strength, power, and endurance of your muscles. Doing pushups and situps, lifting weights, climbing stairs, and digging in the garden are examples of muscle-strengthening activities (NIH, 2006). .During bone-strengthening activities, the feet, legs, or arms support the body's weight, and muscles push against the bones. This helps make the bones strong. Running, walking, jumping rope, and lifting weights are examples of bone-strengthening activities (NIH, 2006). Muscle-strengthening and bone-strengthening activities also can be aerobic if it makes the heart and lungs work harder than usual. Running can be both an aerobic and a bone-strengthening activity (NIH, 2006). Stretching improves flexibility and the ability to fully move the joints. Touching the toes, doing side stretches, and doing yoga exercises are examples of stretching (O'Connor *et al.*, 2005).

2.6.3 LEVELS OF INTENSITY OF PHYSICAL ACTIVITY

Aerobic activity can be of light, moderate, or vigorous intensity (NIH, 2006). Intensity refers to the rate at which the activity is being performed or the magnitude of the effort required performing an activity or exercising (World Health Organization, 2004). It is categorized into three different intensity levels. They include low, moderate, and vigorous and are measured by the metabolic equivalent (METs). Moderate and vigorous intensity aerobic activity is better for your heart than light-intensity activity. Light-intensity activity is however better than no activity at all (NIH, 2006). Recommendations to lead a healthy lifestyle vary for individuals based on age, weight, and existing activity levels. According to the WHO, Global Recommendations on Physical Activity for Health, adults aged 18–64 should do at least 150 minutes of moderate-intensity aerobic physical activity throughout the week or do at least 75 minutes of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity (World Health Organization,2010).

2.6.4 EFFECTS OF PHYSICAL ACTIVITY ON SERUM LIPIDS AND SUGAR LEVELS

Evidence exists that increased levels of physical activity decrease the population burden of CVD (Monda *et al.*, 2009). There have been a number of both observational and experimental studies examining the relationship between physical activity and plasma lipids and lipoproteins. In 1996, the NIH declared physical inactivity to be a major risk factor for CVD, citing the noted improvement to HDL levels that has been associated with physical activity. Lee *et al* (2001), Hu *et al* (2004) and Li *et al* (2006) also suggested that the reduced CVD risk from physical activity has been shown to be independent of weight or body fat loss. Habitual physical activity can lower the prevalence of CVD by impeding the formation of atherosclerotic lesion, raise the vascularity of the myocardium, increase fibrinolysis and modify other risk factors (Mora *et al.*, 2007). In the Atherosclerosis Risk in Communities Study (ARCS) in 2009, they found that increases in the level of physical activity were associated with increases in HDL and decreases in triglycerides. Physical activity was also associated with a reduction in LDL and total cholesterol (Monda *et al.*, 2009).

2.7 NON MODIFIABLE RISK FACTORS

2.7.1 Age

According to American Heart Association computations, about 80% of people who die from cardiovascular disease are 65 years and older. Age itself increases your risk of developing heart disease. This is due to damaged and narrowed arteries and weakened or thickened heart muscle, which contribute to heart disease (AHA, 2012). Blood itself changes slightly with age. Normal aging causes a reduction in total body water. As a result, there is less fluid in the bloodstream leading to a reduction in blood volume (Minaker, 2011). The speed with which red blood cells are produced in response to stress or illness is reduced. This creates a slower response to blood loss and anaemia. There is also reduced ability to resist infection as white blood cells numbers are decreased (Minaker, 2011). Normally, the heart pumps enough blood to supply all parts of the body. However, an older heart may not be able to pump blood well making it work harder (Schwartz and Zipes, 2011). Certain medications, emotional stress, extreme physical exertion, illness, infections and injuries may also make the heart work harder (Schwartz and Zipes, 2011). Buildup of fatty plaques in the arteries which can be a lifelong process is another reason heart disease risk rises with age. Aging can result in blockages in the arteries, which may get larger and may cause problems (NCEP,2002).These blockages can reduce the amount of blood and oxygen that reaches the heart, causing chest pain or heart attack (NCEP,2002).

2.7.2 Gender

CVD develops seven to ten years later in women than in men but is still the major cause of death in women (Maas and Appelman, 2010).This is partly because many women younger than 55years have not yet gone through menopause and still have high levels of the female hormone estrogen in their blood(Rexrode *et al*., 2003; AHA,2006). The estrogen produced by the body is thought to help protect the heart (AHA, 2006).After menopause; however, the levels of estrogen in a woman's body drop significantly (Waters *et al*, 2004). On average, women have their first heart attack at age 70, while men have their first heart attack at age 66.6 (Lloyd-Jones *et al*, 1999) For women who live to age 70 without heart disease, their remaining lifetime risk is 25%, while for men it is more than 30% (Kannel and Levine, 2003). Women are more likely than men to die within a few weeks of having a heart attack, in part because they develop heart disease at an older age than men (AHA, 2005).

2.7.3 Family History

A family history of CVD represents the net effect of shared genetic, biochemical, behavioral, and environmental components (Colditz et al., 1991). In adults, epidemiologic studies have demonstrated that a family history of premature coronary heart disease in a first-degree relative: a male parent or sibling before age 55 years or a female parent or sibling before age 65 years is an important independent risk factor for future CVD (Colditz *et al.*,1991). If one's parents developed heart disease later in life, it may be age-related rather than genetic. The association of a positive family history with increased CV risk has been confirmed for men, women, and siblings (Myers *et al.*, 1990; Sesso *et al.*, 2001; Leander *et al.*, 2001).

2.7.4 Race/Ethnicity

Race or ethnicity can both be used to refer to people of similar cultural, religious, tribal, or geographic ancestry (Burchard *et al*., 2003). Health disparities exist along the lines of racial or ethnic groups (Burchard *et al.,* 2003; Tishkoff and Kidd, 2004). Race and ethnicity can have an influence on a person's environment, which includes many factors such as education level, access to healthcare, cultural practices, socioeconomic status, and stress level. Race is often closely related to a person's socioeconomic status or how much money they make. Lower socioeconomic status is associated with an increase of chronic stress, which may lead to heart problems (Sloan *et al.,* 2005). Lower socioeconomic status is also linked to a diet high in saturated fat, cholesterol, and carbohydrates (Gary *et al.*, 2005) as well as to poorer healthcare and health insurance. People of similar geographic ancestry share similar mutations in their genes (Collins, 2004). Some of these genetic variations have been linked to a higher risk of heart disease (Ackerman *et al.*, 2004; Giger *et al.*, 2005). Death from heart disease or stroke at all ages is highest in African Americans (Mensha *et al.*, 2005). Black women are one third more likely to die from heart disease or stroke than white women (Minino et al., 2002). In 2001, deaths of people younger than 65 years from heart disease were most common in Native American and Alaskan Native (36%) and African Americans (32%). Lowest amongst them was the Whites (15%) (AHA, 2005). In a study of more than 2,600 women, black women had a 52% higher risk of heart disease than white women after ruling out many other possible explanations such as weight, blood pressure, and smoking (Jha *et al.*, 2003).

Hospitalization rates for heart disease vary between Asian people of different geographic ancestry. When compared with white people, Chinese people are less likely to be hospitalized with heart disease likewise Japanese and Filipinos. However South Asians are more likely to be hospitalized with heart disease (Klatsky *et al.,* 1994).

Table 2.2: Race & Heart Disease Deaths per 100,000 People in 2005 for adults 18years and older

Race	Men	Women
White	221	131
African American	251	170
Men & Women Combined		
Overall Population	171	
Native American/Alaskan	124	
Asian/Pacific Islander	116	
Hispanic	139	

Source: American Heart Association, 2004.

CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Research Design and Population

The study was case control in design. Convenience (invitational) sampling was applied in getting the control group. Each target participant (i.e. club member) included in the study was asked to bring a colleague of the same gender and of comparable age who was not a member of a keep fit club to serve as his or her control. The target population for this study was adults aged 18 years and above who were members of the Dansoman Keep Fit Club.

3.2 Research Setting

The Dansoman Keep Fit Club was the site for this study. It is located at Dansoman a suburb of Accra and close to the Liberty Sports Club. It is one of the oldest keep fit clubs in Ghana with a large membership base of both genders. Meetings are held weekly usually on Saturday mornings between 06 00 and 08 00 hours GMT during which various exercises are carried out. Data for the study including anthropometry, blood pressure, blood samples and questionnaires was collected from the members and control group at a research centre which was mounted at the premises of the club.

3.3 Subject recruitment

Prior to the recruitment, the researcher explained the purpose and nature of the study to the members of the Dansoman Keep Fit Club. After informed written consent was explained, participants aged 18 years and above were recruited from the club. On the day of the data collection, participants did not do their regular exercises. Phone calls were made and text messages were sent two days prior to the sample collection as a reminder.

Consented participants came along fasting with a non-keep fit club member of similar age and gender.

3.4 SAMPLE SIZE

Sample size and power were computed based on the expected standardized effect size [ratio of the planned mean difference (δ) to pooled standard deviations (σ) between 'Keep Fit' subjects and controls] of the various parameters being measured in the study. With the level of significance, α=5%, and power of 75% (β = 25%), the results are shown in the table below.

Parameter	Hypothesized effect	A	Power	N
BMI	0.82	0.05	60%	52
HDL	0.75	0.05	70%	60
LDL	0.80	0.05	75%	50
Tc	0.70	0.05	75%	64
TG	0.70	0.05	75%	64

The maximum sample of 64 is obtained for TG and Tc. To allow for 20% non response and non-completion of the study, a sample of 75 members of the 'Keep Fit Club' and 75 controls were recruited into the study.

3.5 SUBJECT SELECTION

3.5.1 Inclusion criteria:

1. Subjects aged 18years and above.
2. Subjects who regularly (at least twice in a month) attend Saturday exercises for not less than six months.

3. Subjects in the control group should not be a member of any fitness club and of comparable age.

3.5.2 Exclusion criteria:

1. Subjects who were not members of the Dansoman Keep fit Club.
2. Members on any special diet.
3. Control subjects who were members of a keep fit club.

3.6 ETHICAL APPROVAL

Ethical approval was obtained from The Ethics and Protocol Review Committee of the School of Allied Health Sciences for the study (Ethical Identification Number: SAHS-ET./10363075/AA/4A/2012-2013).

3.7 PRE-TESTING OF QUESTIONNAIRE

Prior to the main study, the questionnaire was pre-tested among a representative group of the sample size and the data received was reviewed followed by fine-tuning of the questionnaire to suit this study population. Information about previous medical history, family history selected diseases and membership of any other keep fit club were added to the questionnaire.

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3.8 DATA COLLECTION

The data collection was carried out in two phases. The first phase involved administering of the pre-tested questionnaires. Information collected included demographic characteristics, socio-economic status, meal patterns, previous medical history and lifestyle risk factors (Smoking, Alcohol, Physical activity and Dietary intake).

Anthropometric and blood pressure measurements were also taken. In the second phase, consented subjects had their blood samples taken.

3.8.1 DIETARY ASSESSMENT

Food intake was assessed through dietary history interview. This included a repeated three-day (two-week days and one week-end day) 24 hour recall of usual food intake of all meals and snacks, and questions to verify intake included portion sizes. Food models and household measurements were used to aid in portion size estimation.

3.9 PHYSICAL ACTIVITY ASSESSMENT

Physical activity (PA) was assessed using the Global Physical Activity Questionnaire (GPAQ). The questionnaire was designed specifically for adults (18–65 years old) and consisted of four domains: (1) at work, (2) during transportation, (3) recreational (4) sedentary behavior (World Health Organization, 2008b).

3.10 ANTHROPOMETRIC MEASUREMENT

Anthropometric measurements used in this study included height, weight, body mass index (BMI), waist-to-hip ratio using waist and hip circumference, percentage of body fat and visceral fat. The measurements were compared to reference standards to assess risk for various diseases. The BMI was calculated by dividing the body weight (kilograms) by the square of the height (meters). A simple range of values used to classify BMI into categories were based on the World Health Organization criteria (2012) for adults. The range was defined as underweight < 18.5(kg/m2), normal weight 18.5-24.5(kg/m2), overweight 25-29.9 (kg/m2), obese ≥ 30 (kg/m2).

3.10.1 Weight

Weight was measured with the Omron Body Composition Monitor (BF- 506, Omron Healthcare, Inc., Vernon Hills, IL, USA) to the nearest 0.1kg in light clothing with subjects standing erect. Participants were asked to remove shoes, jackets and other heavy objects before standing on the scale.

3.10.2 Height

Height was measured with a portable Seca stadiometer (Hamburg, Germany) to the nearest 0.1 centimetre. Subjects stood upright on a base plate without shoes with their head and back straight, feet together and heels touching the back of the plate. The head plate was lowered to touch the top of the head and height noted.

3.10.3 Waist and Hip Circumference

Waist circumference was measured with a non-stretchable tailors' tape measure to the nearest 0.1cm at the level of the umbilicus and hip circumference was measured at the largest horizontal circumference around the buttocks with a non-stretchable tailors' tape measure to the nearest 0.1cm. Waist to hip ratio (WHR) was calculated by dividing the waist circumference by the hip circumference. All measurements were taken with participants dressed in light clothing.

Men with waist circumference (WC) of < 94 cm were normal, 94 – 101.9 cm and ≥102 cm were considered overweight and obese respectively. Women were also classified as follows: normal WC < 80 cm, overweight 80 - 87.9 cm and obese ≥ 88 cm (NHLBI Obesity Education Initiative , 2000).

Men with WHR < 0.90, 0.90 – 0.99 and ≥ 1 and women with WHR of < 0.80, 0.80 – 0.84 and ≥ 0.85 were classified as normal weight, overweight and obese respectively (NHLBI Obesity Education Initiative, 2000). The Omron Body Composition Monitor (BF- 506, Omron Healthcare, Inc., Vernon Hills, IL, USA) was used to determine body fat composition and visceral fat.

3.11 BLOOD PRESSURE MEASUREMENT

The blood pressure was measured in a quiet area after the subject had rested at least for 5 minutes and/or passed urine (a full bladder affects readings). Three measurements were taken at one minute's intervals in the right arm with participants sitting upright using the Omron HEM-907XL. The arm of a participant was relaxed on a hold-up at a height approximately at the heart level and subjects were asked to sit quietly. These precautions were observed to minimize measurement errors and to reduce bias of a single measurement. The average of the last 2 readings was used for the analysis.

3.12 BIOCHEMICAL MEASUREMENTS

3.12.1 Blood Collection and Handling

After 8-12 hours overnight fast, 10ml blood sample was taken from the antecubital vein aliquotted into Fluoride oxalate tubes (5ml) for fasting glucose and into gel separator tubes (5ml) for total cholesterol, HDL, LDL and TG. Blood samples were taken from participants before 9:00 hours in the morning. Subjects without prior diabetes were additionally given a glucose drink containing 75g (anhydrous) glucose in 250ml of water (over 5 minutes); subsequently 2ml blood sample was taken 2-hours after the start of the glucose drink into fluoride oxalate tubes. Fluoridated blood samples were kept on ice prior to centrifugation within 15 minutes of blood draw. Samples were centrifuged for 15minutes at 2500 rpm, both plasma and serum aliquots were pipetted into plastic Eppendorf tubes. Fluoride oxalate samples was kept on ice and transported to the laboratory. Samples were stored at 4ºC until the time of analysis.

3.12.2 Fasting Plasma Glucose assay

Plasma glucose was measured by the glucose oxidase method using Glucose 'GOD FS' kits (Diagnostic System, GmbH, Germany) and following the manufacturer's instructions.

3.12.3 Oral Glucose Tolerance Test

An amount of 75g of anhydrous glucose was dissolved in 300 mL of water, sterilized by boiling and refrigerated overnight at 8ºC in a well presented bottle. Dye and flavour was added to make it easier for the subjects to ingest. The subjects drank all the glucose within 5 minutes and sat on a bench in a waiting room for 2 hours, after which another 2 mL of blood was taken from the antecubital area into fluoridated tubes for post glucose-load plasma glucose assay.

3.12.4 Lipid Profile (Triglycerides, HDL, LDL and total cholesterol)

Plasma cholesterol was determined by enzymatic photometric method using the "CHOP-PAD" kits (Diagnostic System International). Cholesterol was determined after enzymatic hydrolysis and oxidation and the colorimetric indicator generated was read at absorbance of 450 nm. Triglycerides were determined by colorimetric enzymatic test using glycerol-3-phosphate oxidase (GPO) after enzymatic splitting with lipoprotein lipase. The colorimetric indicator was use to assay the amount of triglyceride at a wavelength of 500 nm. HDL was determined according to the manufacturer's instructions by the 'CHOP-PAD' photometric method (Diagnostic System International). LDL cholesterol (LDLc) levels were calculated from measurements of the levels of total cholesterol, triglycerides, and HDLc using the Friedewald equation (Friedewald *et al.*, 1972).

3.13 DATA PROCESSING AND ANALYSIS

The data was cleaned and analysed using Statistical Package for Social Sciences (SPSS) version 20.0. Means and standard deviation of continuous variables were determined. Categorical data was summarised as frequency and percentages. Nutrient analysis was done using Esha F-Pro software and independent t-test was used to determine statistical significance. P values ≤ 0.05 were considered significant. Graphical representations of data in the form of bar charts were created where appropriate.

CHAPTER FOUR

4.0 RESULTS

A total of 89 subjects were recruited into the study of which 57 were KFC members and 32 were NKFC members. Out of the 89 participants recruited into the study, a total of 78 were able to complete all the different phases of the study giving a response rate of 87.6%. A total of 84 (94.3%) subjects however completed only the questionnaire. In the 2-hour post prandial phase, only 70 (78.7%) participants took part; others (10.3%) with prior diabetes were exempted from the 2-hour glucose test.

Table 4.1: NUMBER OF PARTICIPANTS THAT COMPLETED THE DIFFERENT PHASES OF THE STUDY

Participants / Assessment tool	KFC	NKFC	TOTAL
Questionnaire	**55**	**29**	**84**
Anthropometry	**55**	**29**	**84**
Biochemistry	**52**	**26**	**78**
OGTT	**47**	**23**	**70**
All	**52**	**26**	**78**

4.1 DEMOGRAPHIC AND SOCIO-ECONOMIC STATUS OF STUDY PARTICIPANTS

The age for the study was 18 and older. The mean age was 47(11) and 45(13) years for case and control respectively. The demographic and socioeconomic characteristics of the study participants are shown in table 4.2 and 4.3, respectively. Of the 84 participants who completed the questionnaire part of the study, 55 were KFC members and 29 NKFC members. There were no significant differences in gender, age, tribe and marital status with respect to KFC membership. A greater proportion of the total participants were females. A greater number of the subjects, however, were in the 40-49 years range followed by the 50-59 years. Majority of the study participants were Akans followed by Ga-Adangbes and Ewes. The majority of study participants were married.

The level of education varied among the study participants. However, the majority of subjects had tertiary education of between 1 to 3 years. This was followed by Senior High School and those who were not working. The majority of the study participants took salaries that were more than GHC 500 but less than GHC 1000, which was followed by those taking salaries of more than GHC100 but less than GHC300. Those without any income at all included the retired and/or those not working.

Table 4.2: DEMOGRAPHIC CHARACTERISTICS OF KFC MEMBERS AND NON KFC MEMBERS

	KFC MEMBERS	NON KFC MEMBERS	ALL	*p*
	n (%)	n(%)	n(%)	
Gender				
Male	27(49.1)	11(37.9)	38(45.2)	
Female	28(50.9)	18(62.1)	46(54.8)	
All	55(100)	29(100)	84(100)	0.331
Age group(yrs.)				
< 40	13(23.6)	8(27.6)	21(25)	
40 - 49	19(34.5)	8(27.6)	27(32.1)	
50 – 59	14(25.5)	10(34.5)	24(28.6)	
> 60	9(16.4)	3(10.3)	12(14.5)	
All	55(100)	29(100)	84(100)	0.764
Tribe				
Akan	28(50.9)	14(48.3)	42(50)	
Ewe	4(7.3)	6(20.7)	10(11.9)	
Ga-Adangbe	23(41.8)	9(31.0)	32(38.1)	
Others				
All	55(100)	29(100)	84(100)	0.705
Marital status				
Married	29(52.7)	19(65.5)	48(57.1)	
Separated	5(9.1)	1(3.4)	6(7.1)	
Divorced	7(12.7)	1(3.4)	8(9.5)	
Never married	8(14.5)	6(20.7)	14(16.7)	
Widowed	6(10.9)	2(6.9)	8(9.5)	
All	55(100)	29(100)	84(100)	0.521

TABLE 4.3: SOCIO-ECONOMIC STATUS OF STUDY PARTICIPANTS

	KFC MEMBERS	NON KFC MEMBERS	ALL	
	n (%)	*n (%)*	*n (%)*	*p*
Educational level				
Never attended school or only kindergarten	0(0)	1(3.4)	1(1.2)	
Elementary	5(9.1)	1(3.4)	6(7.1)	
Junior high school	5(9.1)	6(20.7)	11(13.1)	
Senior high school	16(29.1)	6(20.7)	22(26.2)	
Tertiary 1-3yrs,(Diploma, Certificate, Professional)	17(30.9)	8(27.6)	25(29.8)	
Tertiary ≥ 4yrs(Degree ,Postgraduate, Professional)	12(21.8)	7(24.1)	19(22.6)	
All	55(100)	29(100)	84(100)	0.744
Monthly salary/ GHC				
< 60	0(0)	1(3.4)	1(1.2)	
More than 100 but less 300	11(21.2)	5(17.2)	16(19.8)	
More than 300 but less than 500	8(15.4)	5(17.2)	13(16.0)	
More than 500 but less than 1000	15(28.8)	7(24.1)	22(27.2)	
More than 1000 but less than 1500	7(13.5)	2(6.9)	9(11.1)	
More than 1500 but less than 2000	2(3.8)	3(10.3)	5(6.2)	
≥2000	7(13.5)	2(6.9)	9(11.1)	
Others(retired and/or not earning salary)	5(3.8)	4(14)	9(7.4)	
All	55(100)	29(100)	84(100)	0.674
Type of job				
Unskilled/watchman/ laborer	0(0)	1(3.6)	1(1.2)	
Technician/Driver/Artisan/Tradesperson/Security	30(55)	12(42.9)	42(51.3)	
Clerical/Audit/Accounts/Messenger/Office worker	7(13)	5(17.9)	12(14.6)	
Dietitian/Nurse/Technologist/Secretary/Transport or Estates/ Officer/Senior Security Officers	5(9.1)	5(17.9)	10(12.2)	
Doctor/Dentist/Administrator/Certified Accountant/Engineer	4(7.3)	2(7.1)	6(7.3)	
Retired	8(14.5)	3(10.6)	11(12.2)	
Others(not working)	1(1.8)	1(3.6)	2(2.3)	
All	55(100)	29(100)	84(100)	

4.2 BLOOD PRESSURE AND ANTHROPOMETRIC MEASUREMENTS

Table 4.4 shows blood pressure and anthropometric measurements of the study subjects. There was no significant difference between the mean SBP, DBP, pulse rate and all other anthropometric measurements of the KFC and NKFC members.

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TABLE 4.4 MEAN (±SD) CLINICAL CHARACTERISTICS OF STUDY PARTICIPANTS

	KFC MEMBERS *n*=55	NON KFC MEMBERS *n*=29	ALL *n*=84	*p*
Age(years)	47±11.92	45±13.93	46±12.44	
SBP[a](mmHg)	128±20.59	122±15.77	127±18.49	*0.258*
DBP[b](mmHg)	77±11.69	74±11.22	76±11.61	*0.184*
Pulse rate	73±11.25	75±11.31	74±11.23	*0.626*
BMI[c](kg/m^2)	28.9±4.76	28.7±5.50	28.8±5.0	*0.731*
Visceral Fat	10.3±4.16	9.6±4.43	10.2±4.24	*0.578*

	KFC Males(*n*=27)	NKFC Males(*n*=11)	*p*	KFC Females(*n*=28)	NKFC Females(*n*=18)	*p*	All(*n*=84)	*p*
% Body fat	26.9±6.86	23.2±8.69	*0.272*	42.1±6.97	41.8±7.09	*0.901*	34.7±10.80	*0.384*
WC[d](cm)	96.4±12.42	94.3±13.24	*0.466*	95.4±9.5	96.8±14.02	*0.719*	95.9±11.82	*0.139*
WHR[e]	0.91±0.06	0.90±0.69	*0.841*	0.86±0.06	0.85±0.06	*0.596*	0.88±0.07	*0.554*
Visceral fat	11.6±5.16	10.5±4.65	*0.728*	9.3±2.49	9.1±4.33	*0.864*	10.2±4.24	*0.772*

[a] Systolic Blood Pressure [b] Diastolic Blood Pressure [c] Body Mass Index [d] Waist Circumference [e] Waist to Hip Ratio

Figure 4.1 shows the proportion of KFC and NKFC members in the various BMI categories. A greater proportion of the study participants were overweight. This is closely followed by obese (BMI ≥30 kg/m2) participants. A smaller percentage of both KFC and NKFC members were classified as having a normal BMI (18.5 – 24.9kg/m2). None of the study participants was underweight for both KFC and NKFC members.

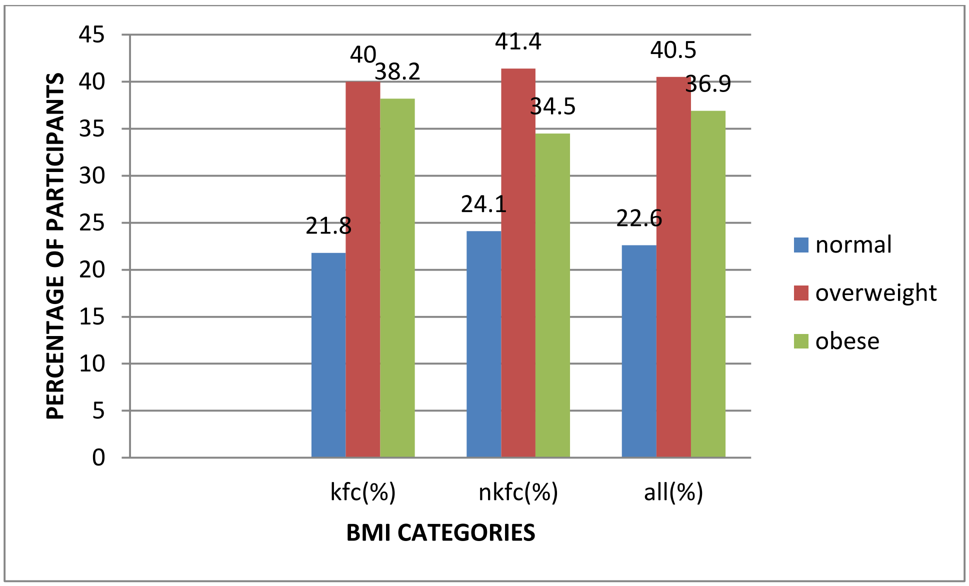

Figure 4.1: Distribution of study participants by obesity classes: KFC=Keep Fit Club members; NKFC=Non Keep Fit Club members.

4.3 MEAL PATTERNS OF STUDY PARTICIPANTS

The meal patterns of the study subjects are shown in Table 4.5. Differences between cases and controls were reported where significant differences were found. Breakfast, lunch and supper were considered as main meals. The majority of the participants on average consumed two main meals a day. No significant differences were observed in the number of meals eaten in a day between the KFC and NKFC members. However, a significantly higher proportion of NKFC members reported that they bought breakfast from outside. Majority of the study participants from both groups reported that they ate snacks. Comparison among the groups showed that a significantly higher proportion of NKFC members ate snacks once a day.

TABLE 4.5: MEAL PATTERNS OF STUDY PARTICIPANTS

	KFC MEMBERS	NON KFC MEMBERS	ALL	
	n (%)	*n* (%)	*n* (%)	*p*
No. of meals a day				
1	1(1.8)	0	1(1.2)	
2	31(56.4)	14(48.3)	45(53.6)	
3	23(41.8)	14(48.3)	37(44)	
More than 3	0(0)	1(3.4)	1(1.2)	
All	55(100)	29(100)	84(100)	0.227
Type of meals bought from outside				
Breakfast	11(20.8)	14(50)	24(28.6)	0.007
Lunch	24(45.3)	16*(57.1)	40(47.6)*	0.313
Supper	7(13.2)	2(7.1)	9(10.7)	0.412
None	13(14.7)	0(0)	13(15.5)	
All	55(100)	32*(114.2)	86*(102.4)	
Snacking in between meals				
Yes	45(81.8)	22(75.9)	67(79.8)	
No	10(18.2)	7(24.1)	17(20.2)	
All	55(100)	29(100)	84(100)	0.105
No. of snacks eaten daily				
1	25(55.6)	19(86.4)	44(65.6)	
2	17(37.8)	3(13.6)	20(29.9)	
3	2(4.4)	0(0)	2(3.0)	
More than 3	1(2.2)	0(0)	1(1.5)	
All	45(100)	22(100)	67(100)	0.034
Average no. of times food is bought from outside weekly				
0	13(23.6)	5(17.2)	18(21.4)	
1	7(12.7)	2(6.9)	9(10.7)	
2	5(9.1)	3(10.3)	8(9.5)	
3	8(14.5)	6(20.7)	14(16.7)	
4	3(5.5)	1(3.4)	4(4.8)	
5	13(23.6)	9(31.0)	22(26.2)	
6	5(9.1)	1(3.5)	6(7.1)	
7	1(1.8)	2(6.9)	3(3.6)	
All	55(100)	29(100)	84(100)	0.412

***Four NKFC members buy both breakfast and lunch from outside**

TABLE 4.6: LIFESTYLE CHARACTERISTICS OF STUDY SUBJECTS (ALCOHOL, SMOKING STATUS AND PHYSICAL ACTIVITY)

	KFC MEMBERS *n (%)*	NON KFC MEMBERS *n (%)*	ALL *n (%)*	*p*
Ever consumed alcohol				
Yes	47(85.5)	22(75.9)	69(82.1)	
No	8(14.5)	7(24.1)	15(17.9)	
All	55(100)	29(100)	84(100)	0.278
Taken alcohol in the last 12 months				
Yes	42(85.7)	19(67.9)	61(80.3)	
No	7(14.3)	9(32.1)	16(19.7)	
All	49(100)	28(100)	77(100)	0.136
Ever smoked				
Yes	7(12.7)	6(20.7)	13(15.5)	
No	48(87.3)	23(79.3)	71(84.5)	
All	55(100)	29(100)	84(100)	0.359
Physical activity/met E				
Physical activity(mean±SD)	3655±5077	3372±5080	3557±5049	0.809

4.4 LIFESTYLE PARAMETERS

Table 4.6 shows the lifestyle characteristics (smoking, alcohol and physical activity) among KFC and NKFC members. The majority of both case and control answered yes to ever drinking alcohol but there was no significant difference between groups. In the last 12months, a greater percentage of both KFC and NKFC members who answered yes to ever taken alcohol had consumed alcohol. There was however no significant difference between the case and control. Overall, a greater number of the study participants reported they had never smoked and none of them were current smokers. No significant difference was found between the smoking status of the KFC members and NKFC members.

Significant difference was observed for alcohol intake after exercise. A significantly high proportion of participants did not take in alcohol after exercise (69.6% vs. 30.4%, p=0.001). More importantly, it was a lower proportion of KFC members that took alcohol after exercise.

4.5 NUTRIENT INTAKE

4.5.1 Energy and Macronutrients

Table 4.7 shows the average amounts of energy and macronutrients consumed by KFC members or NKFC members. No significant differences were observed in the mean intake of energy and all other macronutrients.

4.5.2 Micronutrient Intake

Table 4.8 shows the average amounts of micronutrients consumed by the study participants. Among micronutrients, mean intakes of sodium, calcium and potassium were not significantly different among groups. Phosphorus and iron intakes were significantly higher in NKFC members whilst magnesium was significantly lower in NKFC members.

TABLE 4.7: MEAN DAILY INTAKE OF MACRO NUTRIENT AMONG KFC AND NKFC MEMBERS

	KFC MEMBERS	NON KFC MEMBERS	ALL	
	(n=55)	(n=27)	(n=82)	*p*
Energy(kcal)	1716±549	1813±632	1741±584	0.583
Protein(g)	68.5±35	78.74±43	72.7±38	0.168
% Energy intake	15.9	15.8	16.7	
Total fat(g)	49.9±26	53.1±23	50.4±26	0.840
% Energy intake	26.2	27.3	26.1	
MUFA[a]	11.9±42	5.3±6	9.8±35	0.420
PUFA[b]	11.2±42	2.4±2	8.3±34	0.290
Cholesterol	98.4±81	94.8±124	97.2±97	0.878
SFA[c]	7.5±11	5.1±6	6.7±10	0.322
%SFA	14.9	10.4	13.3	
CHO[d](g)	239.0±82	241.4±84	241.4±84	0.716
%Energy Intake	55.72	50.78	55.45	
Dietary Fibre(g)	47.3±125.47	24.7±20.62	40.1±104.27	0.366

[a]Mono unsaturated fatty acids [b]Poly unsaturated fatty acids [c]Saturated Fatty Acids [d]Carbohydrates

TABLE 4.8: MEAN DAILY INTAKE OF MICRO NUTRIENT AMONG KFC AND NKFC MEMBERS

	KFC MEMBERS	NON KFC MEMBERS	ALL	
	(n=55)	(n=27)	(n=82)	*p*
Sodium(mg)	627.9±501	614.1±557	653.5±517	0.632
Calcium(mg)	482.0±235	573.7±287	512.6±256	0.131
Potassium(mg)	768.4±527	619.7±543	719.0±534	0.238
Phosphorus(mg)	813.9±447	1136.4±503	920.1±487	0.019
Magnesium(mg)	183.4±262.	80.2±67	149.4±222	0.048
Iron(mg)	19.7±12	23.5±13	20.9±13	0.043

TABLE 4.9: BIOCHEMICAL PARAMETERS OF KFC AND NKFC MEMBERS

	KFC	n	NKFC	n	ALL	n	*p*
Fasting plasma glucose (mmol/l)	5.14±1.67	52	4.79±0.68	26	5.02±1.42	78	0.012
2H[a] plasma glucose(mmol/l)	7.18±2.96	47	6.66±2.44	23	7.01±2.79	70	0.351
Total cholesterol (mmol/l)	4.62±1.13	52	5.22±1.18	26	4.82±1.17	78	0.034
HDL[b] cholesterol (mmol/l)	0.93±0.45	52	0.84±0.49	26	0.90±0.46	78	0.476
LDL[c] cholesterol (mmol/l)	3.26±1.18	52	3.95±1.23	26	3.49±1.23	78	0.019
Triglycerides (mmol/l)	1.00±0.54	52	0.92±0.45	26	0.98±0.5	78	0.223

[a]2-Hour Post Prandial [b]High Density Lipoproteins [c]Low Density Lipoproteins

4.6 BIOCHEMICAL ANALYSIS

Mean fasting plasma glucose (FPG), 2-hour post prandial plasma glucose (2H PG), total cholesterol (Tc), triglyceride (TG), HDL- and LDL-cholesterol of the study subjects are shown in table 4.9. There were no statistical significant differences between KFC and NKFC members with regards to 2-HPG, TG and HDL cholesterol. Although, the mean fasting blood glucose of the participants was within the normal reference values (3.5 – 6.0 mmol/L), KFC members had significantly higher concentrations than NKFC members.

Total cholesterol and LDL cholesterol levels were significantly lower in KFC members compared to NKFC .members.

4.7 MEDICAL HISTORY OF STUDY PARTICIPANTS

Figure 4.2 shows the self reported history of diabetes, hypertension and hyperlipidemia among the study participants. Apart from hyperlipidemia which showed a higher prevalence in the NKFC members, diabetes and hypertension prevalence was higher in the KFC members.

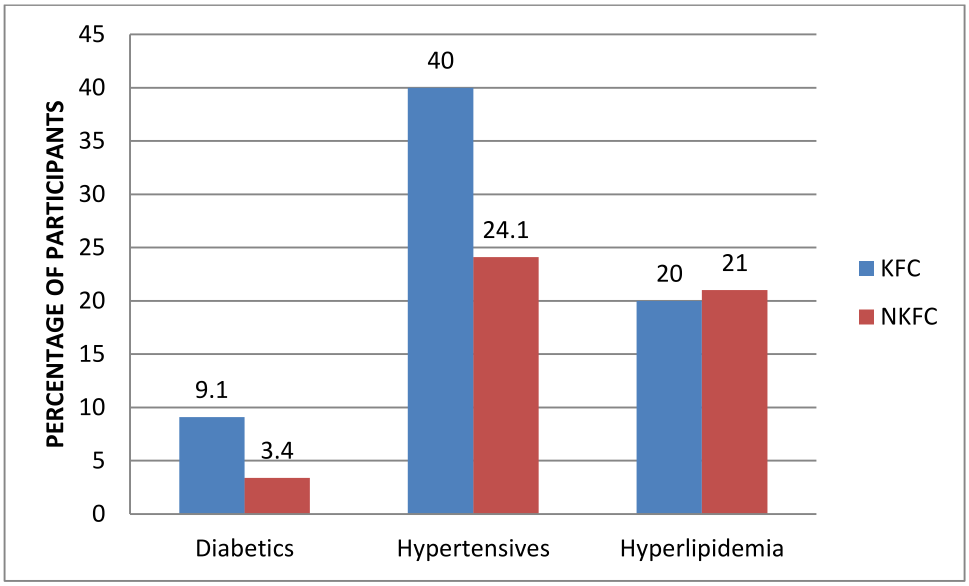

FIGURE 4.2 Distribution of Previous Medical Condition among study participants

4.8 PREVALENCE OF CARDIOVASCULAR RISK FACTORS

4.8.1 OVERWEIGHT AND OBESITY

With reference to Figure 4.1, there was no significant difference in BMI with respect to keep fit club membership (p=0.731). Both groups however showed high prevalence of overweight and obesity.

4.8.2 PHYSICAL ACTIVITY LEVEL

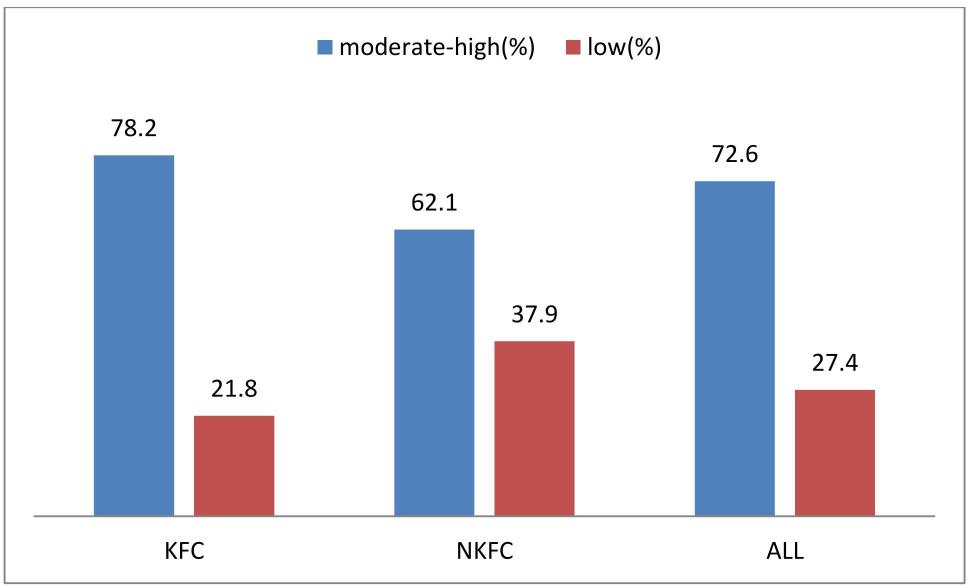

Figure 4.3: Percentage of participants with moderate-high and low physical activity

No significant difference was found in the prevalence of physical activity between KFC members and NKFC members (p=0.118)

4.8.3 HYPERTENSION

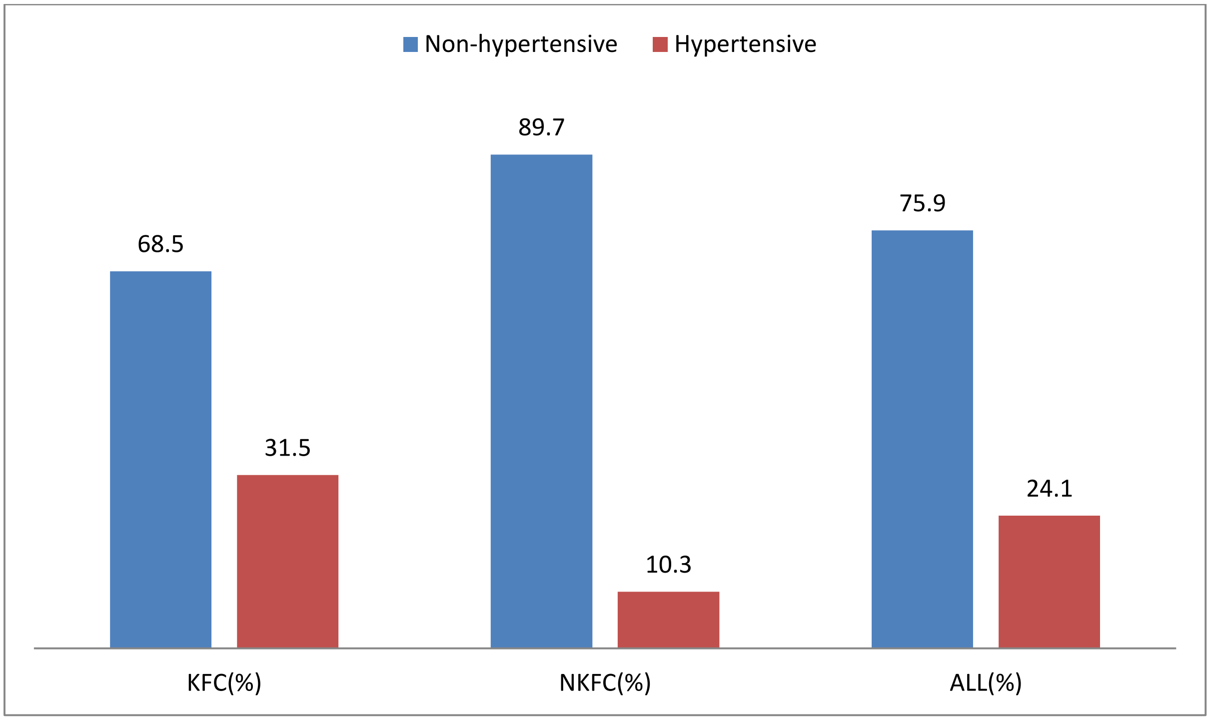

Figure 4.4: Prevalence of hypertension among KFC and NKFC members

A significant difference was found in the prevalence of hypertension between the KFC and NKFC members (*p*= 0.033). The results showed that a significantly higher percentage of the NKFC members were non hypertensive.

4.8.4 DIABETES

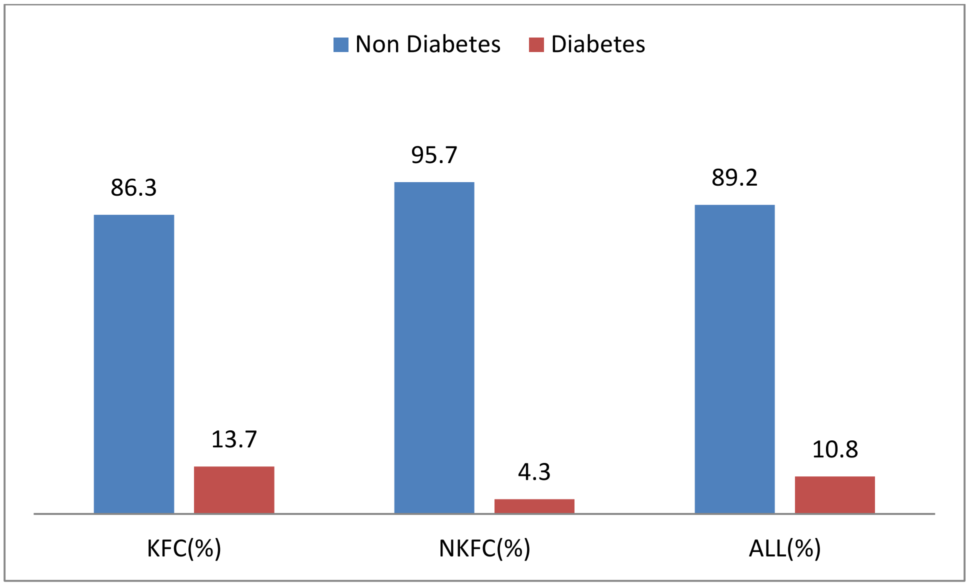

Figure 4.5: Prevalence of Diabetes among KFC and NKFC members

There was no significant difference in diabetes status of KFC and NKFC members (*p*=0.232). The prevalence was relatively higher in the KFC members.

4.8.5 LIPID PROFILE

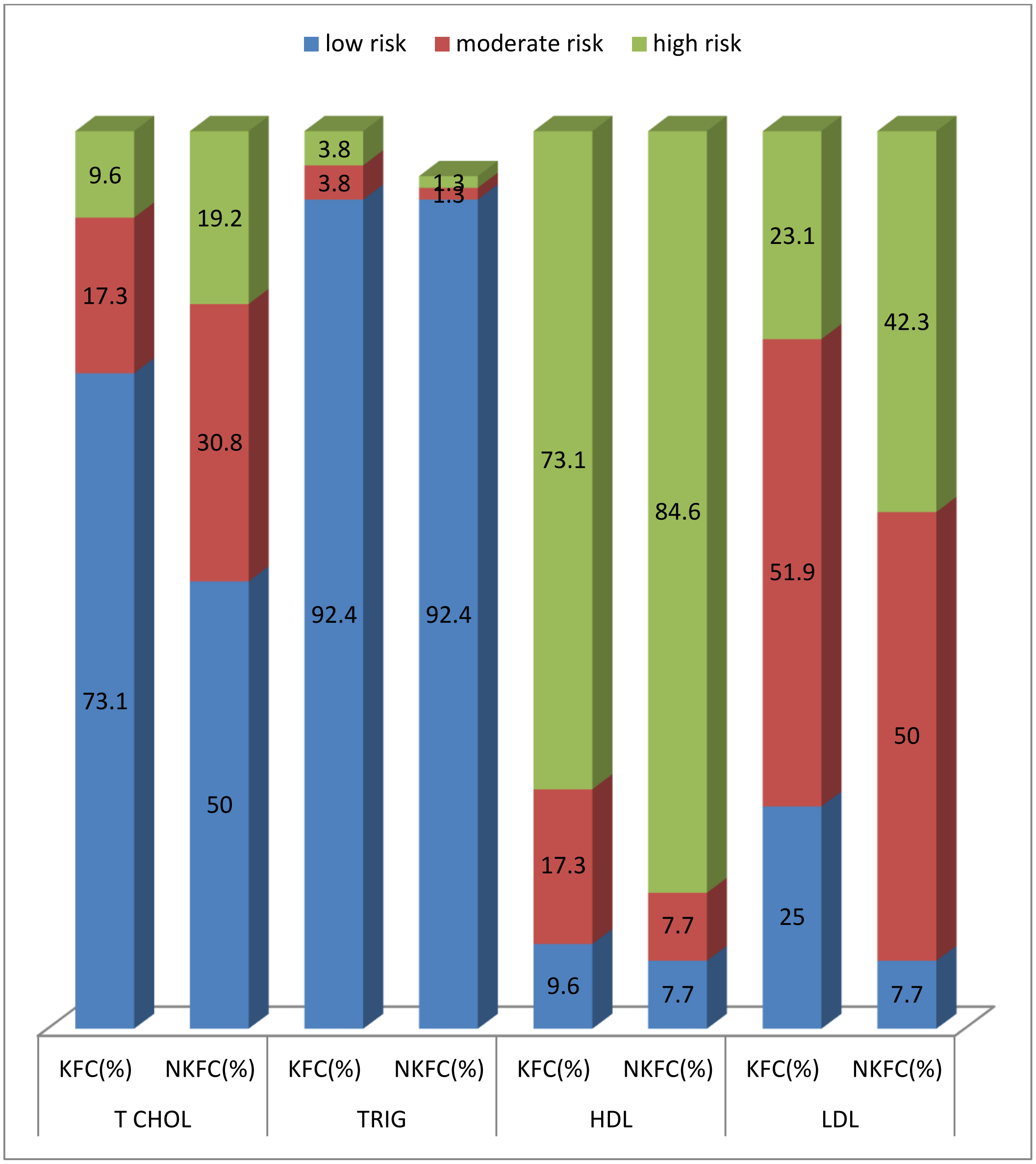

Figure 4.6: Lipid Profile Distribution among KFC and NKFC members.

The prevalence of high risk Tc (p=0.047) and LDL-cholesterol (p=0.029) was significantly higher in the NKFC members.

CHAPTER FIVE

5.0 DISCUSSION

Mortality and disability adjusted life years due to cardiovascular diseases (CVD) is increasing in the country (World Health Organization, 2011). Despite the enormous lifestyle changes experienced by the Ghanaian society during recent decades (Adjei-Mensah and De-graft, 2010), few studies have simultaneously been conducted on the physical activity and dietary habits in the adult population. There is high incidence of sedentary behaviour and diet shifting towards the Western diet due to economic transitions and urbanization. Preventive interventions rather than therapeutic intervention is the most useful means to reduce the occurrence of CVD. Efforts are being made in the area of diet to encourage the intake of low fat and whole grain foods. However, not much is been done about making physical activity part of one’s lifestyle compared to structured exercises. Keep fit clubs are gradually springing up in the country offering an avenue for structured leisure time exercises. However, the effectiveness of this venture is not known. The present study was carried out to investigate the dietary habits and risk of CVD among the Dansoman Keep Fit Club members and an aged and gender matched control group.

5.1 ANTHROPOMETRY AND BLOOD PRESSURE

Hypertension remains the most important risk factor for CVD (World Heart Federation, 2011).Regular physical activity has also been shown to be effective in reducing the relative risk of developing hypertension by 19 to 30 per cent. Mean SBP, DBP and pulse rate were statistically not significant between the KFC and NKFC members. It was observed that the majority of the NKFC members were tradespersons whose daily work schedule involved appreciable amounts of physical activity compared to the cases that mostly had sedentary jobs. As such, most of the NKFC members had physical activity as part of their daily routine. Hence they could be said to be involved in lifestyle physical activity; which has been defined as the daily accumulation of at least 30 min of self-selected activities. This includes all leisure, occupational, or household activities that are at least moderate to vigorous in their intensity that is part of a person's daily routine.

A six months physical activity intervention study on CVD risk factors among healthy, sedentary, middle-aged men and women by Dunn *et al.,* (1997) showed that lifestyle physical activity is as effective as structured exercise programmes in improving CVD risk factors. Similar to this present study, the mean SBP between the two groups did not show any statistical difference. Lifestyle physical activities may be considered even more effective in lowering blood pressure than structured exercise considering that the adherence to lifestyle activities may be higher than for structured exercises (Dunn *et al.,* 1998). However, in terms of clinical significance, lifestyle physical activity appears to be as effective in lowering blood pressure as structured exercises (Padilla *et al.,* 2005). This was confirmed in a study by Dunn *et al.,(*1999) who reported a reduction in SBP and DBP for adults who engaged in either lifestyle physical activity (3.63/ 5.38 mm Hg) or structured exercise (3.26/5.14 mmHg) for 24 months. Some studies have suggested that, higher educational level is associated with lower SBP (Brummett *et al.*, 2011). Lower socioeconomic status (SES) has been associated with higher systolic blood pressure (SBP) (Metcalf *et al.*, 2008; Manuck *et al.*, 2010; Chaix *et al.*, 2010). Focus is usually on the SBP because it has been shown to be more important than diastolic blood pressure with respect to health risk (Izzo *et al.*, 2000; Strandberg and Pitkala, 2003; Beevers 2004) and also possibly to be more responsive than DPB to changes in modifiable risk factors.

In this study, we found no significant differences between the level of education and socio-economic status of the KFC members and their NKFC counterparts. A greater percentage of both case and control received the same amount of money more than GHC500 but less than GHC1000) monthly which may explain the reason why there was no significance differences in their SBP. Brummett *et al.*, (2011) reported that marital status may affect SBP. In their study, the authors found that it was significantly related to lower SBP. In this present study, there was no statistical difference in the marital status of the cases and control. Majority of both the KFC (52.7%) and NKFC (65.5%) members were married. This could be a further reason why no statistical differences were observed between the cases and control with respect to SBP.

Kusuma *et al.*, (2002) carried out a study on blood pressure levels among cross-cultural population of Visakhapatnam District, Andhra Pradesh, India and reported age to vary directly and significantly with SBP. Rohrscheib *et al.*, (2008) also noted an increase in SBP with age in a general population. In this study, no significant difference was observed in the mean age of the KFC and their NKFC counterparts. The mean SBP recorded for both groups was within the normal range. The mean SBP recorded for both groups was favourable. The majority of participants were in the 40-49years age range similar to the age range of participants in a study conducted by Jervase *et al.*, (2009) on sex differences and relationship between blood pressure and age among the Ibos of

Nigeria. Participants in the Nigerian study had similar SBP (125mmHg) as participants in this present study (127mmHg).

Comparison between groups showed that the prevalence of hypertension was significantly higher among the KFC members (31.5%) than non- KFC members (10.3%). (31.5% vs. 10.3%). This could be due to a higher number of known subjects with hypertension who are members of the keep fit club. Their membership could be a clinical advice to help reduce their blood pressure. Surprisingly the KFC group had a higher CVD risk from the relatively higher rate of hypertension

BMI and visceral fat among the cases and controls were not significantly different. The mean BMI of both the KFC and NKFC members were in the overweight range according to WHO (1995). The higher proportion of overweight persons in the KFC group concurs with a cross-sectional study conducted by Sharma *et al.,* (2008) on a United States university marching band, dance team and cheer squad members in which 45% of the participants were overweight and obese in spite of their physical activity level. Majority of the KFC members may be overweight because they joined the club as a means to lose weight. The BMI of participants being in the overweight range could also be associated with the increase in body weight and BMI with age as has been reported by Kapoor and Tyagi (2002) and Tandon (2008). There is increase in body weight till middle age which can be attributed to the accumulation of fat with age (Silver *et al*., 1993). The majority of the study subjects both case and control were between 40-49years and may explain the high overweight proportion recorded in spite of their physical activity level. This agrees with Mungreiphy *et al.,* (2011) who conducted a cross sectional study and also observed a significant association between age and BMI. In contrast to these findings, Davy *et al*.,

(1996) suggested that age-related increases in total body fat may be a result of reduced chronic physical activity levels with age rather than an inevitable consequence of the aging process.

Mean visceral fat for both case and controls were greater than normal and this puts both of them at an equal high risk of CVD. Even though, the KFC members undertook some form of vigorous intensity exercise, according to Ohkawara *et al.*, (2007) a minimum dose of physical activity is required to achieve a higher reduction in visceral fat. Epidemiological observations support the idea that physically active people have relatively low fat mass, and intervention studies tend to show that exercise training reduces fat mass and hence body fat percentage (Wareham, 2005;Wareham ,2007). However, in spite of some large studies, the results are not entirely consistent, and the reported relationships tend to be only modest (Koh-Banerjee *et al.,* 2003). In contrast to our findings, percentage body fat in both genders for case and controls were very high. Studies show that the distribution of the body fat is more important in relation to health outcomes than the fat percentage itself (Wilmore *et al.,* 1986). The body fat ranges for optimal health (18%-30% for women and 10%-25% for men) are based on several epidemiological studies of the general population. Looking at the WHR, which is considered as a measure of the health of a person, as far as obesity and developing serious health conditions are concerned (Price *et al.*, 2006), between gender, both case and controls were at the upper limit of the normal range according to WHO classification. Research shows that people with "apple-shaped" bodies (with more weight around the waist) face more health risks than those with "pear-shaped" bodies who carry more weight around the hips. Again WHR has been shown to be a better predictor of CVD than waist circumference and BMI (Yusuf *et al.*, 2005).

The distribution of both case and control into obesity classes by WHO classification did not show any statistical significance. Both groups showed high prevalence of overweight. This puts both at greater obesity risk and hence CVD.

5.2 MEAL PATTERNS

Analysis of food habits and meal patterns revealed that majority of both KFC and their NKFC counterparts on average ate two meals per day. This suggests that, they rarely ate three square meals a day. This habit is not healthy and could lead to overeating which if not checked could lead to obesity, placing both groups at high risk of CVD. Some studies have shown that consuming large, infrequent meals appears to raise blood LDL cholesterol and promote insulin resistance (Liljeberg and Bjorck, 2000). Larger meals increase postprandial plasma TG concentration. Higher postprandial TG levels have been associated with an increased risk of coronary heart disease (BPatsch *et al.*, 1992). Again about the same proportion of both case and controls took snacks in between their meals explaining why they take just two meals in a day. A significantly higher proportion of the NKFC took one snack daily whilst about 37.8% of KFC members took two snacks daily. The sedentary nature of the jobs of the KFC members may have increased their tendency of snacking more because of busy work schedules. Even though the magnitude of the association between snacking and overall diet quality has been found to be modest (Zizza and Xu, 2012), snacking is associated with a more nutrient-dense diet. Charreire *et al.,* 2011 examined the associations between dietary pattern, physical activity (leisure-time and occupational) and television viewing in middle-aged French adults and reported that leisure-time and occupational physical activities were differentially associated with dietary patterns. Out of the three main meals, lunch was usually bought from outside by both case and control. Majority of the participants reported buying food from outside five days in the week. It is reported that foods people choose when they eat away from home tend to be higher in total and saturated fat and lower in dietary fibre, calcium, and iron than food prepared at home (Guthrie *et al.,* 2002). As a result, some studies suggest that buying food from outside is one cause of poor diet quality and obesity (Binkley, 2008; Binkley *et al.,* 2000). For the average consumer, eating one meal away from home each week translates to roughly one extra kilogram in a year (Todd *et al.,* 2010). Thus on average if majority of the study participants eat five meals away from home in a week, they will likely add about five kilogram each year. This will increase their risk of becoming obese and hence CVD. People choose less healthful foods when eating away from home. Findings also suggest that individuals do not compensate for their less nutritious food-away-from-home choices by making healthier food choices at home (Todd *et al.,* 2010). Consumers may simply have strong preferences for less healthful food when eating away from home. If carefully selected, however, foods away from home may be part of a healthy and affordable diet (You *et al.,* 2009).

5.3 LIFESTYLE PARAMETERS AND PHYSICAL ACTIVITY

Moderate alcohol intake, abstaining from smoking and daily physical activity is known to have a great impact on general health. Research to date has found that alcohol is the most dangerous substance in today's society (Nutt *et al.,* 2010).An insignificant majority of both KFC and NKFC members reported ever taking alcohol and also taking alcohol within the last 12 months. A positive relationship exists between income and the likelihood of consuming alcohol, thus higher income earners are more likely to consume alcohol than lower income earners. (Manrique and Jensen, 2004). Numerous studies stressed that higher educated individuals are more likely to consume alcohol compared to lower educated individuals (Marques-Vidal and Dias, 2005). No statistical difference was found between the case and control as far as income and level of education is concerned. This may explain why majority of both groups indulged in drinking alcohol. In contrast to current findings which suggest that married individuals are less likely to consume alcohol (Jonas, 2000), our data suggest that, even though, a greater proportion of the study subjects were married, alcohol consumption was still high. A cross-sectional primary survey by Cheah (2013) found that physically inactive individuals were less likely to consume alcohol than physically active individuals. The plausible explanation is that individuals who engage in physical activity frequently may have the perspective that their health is at the very healthy stage, which allows them to indulge in unhealthy behaviour such as alcohol drinking and smoking (Cheah, 2013).

It was however worrying to find that some KFC members consumed alcohol just after their exercises though they formed the smaller proportion. This is because the effects of post exercise drinking is not favourable (Gonzáles-Alonso *et al.,* 1992). Alcohol cannot be stored as energy in the muscles and since it is not a nutrient is stored as fat instead (Hellerstein et al., 1999). This fat is usually around the belly and definitely leads to abdominal obesity. This could explain the higher waist circumference and WHR measurements of the KFC members. It is well known that the body needs to rehydrate after exercise and the best way to do it is with water. Alcohol acts as a diuretic which causes water to be lost from the body (Shirreffs *et al.*, 1996). So instead of replacing lost fluids and electrolytes after exercises, drinking alcohol further dehydrates the body. This prolongs muscle recovery (due to decreased blood flow in the muscles) which over time can damage muscle tissue.

Data from this study showed a relatively low smoking habit among both case and controls. About 15.5% of total participants reported ever smoking with none of them currently smoking. This finding is in agreement to a study conducted by Dabo *et al.*, (2009) in the Ashanti region of Ghana. In the study, about 9.7% of total participants had ever smoked before. Charilaou *et al.*, (2009) stated that physically active individuals smoked fewer cigarettes and were more likely to be non-smokers or occasional smokers.

As members of the KFC, where structured exercises are carried out three times in the week, it was expected that members would attain moderate to high intensity physical activity weekly and have higher levels of physical activity than the NKFC members. The mean physical activity level for the KFC members was 3655 MET-min/week which indicates that they were moderate to highly physically active. Their NKFC counterparts had a mean physical activity level of 3372 MET-min/week putting them also at a moderate to high physical activity level. From the International Physical activity Questionnaire scoring protocol, most of the NKFC members obtained their metabolic equivalents from walking most days of the week as well as doing moderate physical activities at their work places. Even though the strong association between physical inactivity and ill health is well documented (Dunn *et al.*, 1999), a large population is inadequately active or completely inactive. Traditional methods of prescribing exercise have not proven effective for increasing and maintaining a programme of regular physical activity (Dunn *et al.*, 1999). A 24-month intervention programme to compare structured and lifestyle physical activity showed that both were effective in improving physical activity, cardiorespiratory fitness, and blood pressure significantly. Both groups showed significantly reduced SBP, DBP and percentage body fat (Dunn *et al.*, 1999). In another study comparing the effectiveness of structured physical activity to lifestyle physical activity after 6 months, the structured programme caused increase in cardiorespiratory fitness nearly 3-fold more than the lifestyle programme. However, between 6 and 24 months, participants in the structured programme lost some of their initial fitness gain (Williams, 1999). This confirms our finding that making physical activity a part of one's daily routine is as effective as joining a KFC in other to protect against CVD. Observations from another intervention programme involving obese women on diet plus structured exercise and diet plus lifestyle physical activity revealed that both interventions resulted in weight loss, reduction in lipid levels and SBP (Andersen, 1999).

The KFC members in spite of their scheduled exercises showed some members with low physical activity (21.8%) and this can be attributed to adherence to meeting times. The prevalence of physical inactivity was higher in the NKFC members (37.9%). This puts them at a higher CVD risk.

5.4 NUTRIENT INTAKE

5.4.1 Energy and Macronutrient intake

There was no significant difference in energy intake between both KFC and NKFC members. According to WHO/FAO (2003) nutrient goals to prevent risk of diet related chronic diseases fat, protein and carbohydrate should contribute 15-30%, 10-15% and 55-

75% of caloric energy respectively. This is ideal because high intakes of carbohydrate are positively associated with serum triglycerides and negatively associated with serum HDL-cholesterol according to NHANES III study. Poor nutritional balance of meals can also expose the study participant's to chronic diseases such as CVD. The mean energy requirement from carbohydrate for the NKFC members of 50% was below the daily requirement. Low-carbohydrate diets are believed to be associated with significant changes in lipid metabolism favouring decreased storage and increased breakdown and oxidation of fat (Volek *et al.*, 2008). This could explain why the NKFC members had relatively lower body fat percentage and WHR. The mean daily intake of fat for the study subject's was at the upper limits. Diet is one of the most important environmental variables that shape lipid profiles. As such, excessive intake of fat may contribute to increased total and LDL-cholesterol.

High intake of SFA can increase the risk of CVD due to its hypercholesterolemia effects (WHO/FAO expert consultation, 2003). The percentage of saturated fat in the diet of both KFC and NKFC was higher than the recommended mean daily intake of less than 7% and it was higher in KFC members than their controls. This needs to be checked since SFA can increase both total and LDL-cholesterol (Hu *et al.*, 1999) which are risk factors of CVD. Though a greater proportion of NKFC members bought food from outside, it is possible they made healthier options and hence their relatively lower SFA percentage intake. Mean intake of cholesterol for both case and control were within the recommended daily intake of less than 300mg per day (AHA, 2006).

5.4.2 Dietary fibre

Generally, the mean intake of dietary fibre was higher than the recommended daily intake (25-30g daily) for the KFC members but at the lower limit for their NKFC counterparts. This observation can place the KFC members at a lesser risk of CVD compared with the NKFC. High intake of dietary fibre especially the soluble fibre has been consistently associated with decreased CVD risk (King, 2005). The soluble fibre may lower cholesterol by preventing the reabsorption of bile acids. In a meta-analysis of 67 controlled trials, it was found that some soluble fibres lower the total cholesterol and LDL cholesterol without affecting the good HDL cholesterol (Brown, 1999). High intake of dietary fibre has also been associated with low blood pressure, low BMI and low waist to hip ratio (Lairon *et al.*, 2005). This association was however not observed in this study. Despite high intakes of fibre by the KFC members they had relatively high blood pressure, high BMI and high WHR. It can also help in lowering serum total and LDL-cholesterol and increasing HDL-cholesterol (Erkkila and Lichtenstein, 2006) which was observed in this study.

5.4.3 Micronutrients

Micronutrients are considered to be a mediating factor in the development and complications of chronic diseases (Owusu *et al.*, 2010). Ensuring sufficient and regular micronutrient intake is essential for the prevention of CVD. The mean intakes of sodium, calcium and iron were below the daily recommendations. A higher intake of dietary sodium has been associated with pathogenesis of high blood pressure (Gibbs *et al*., 2000). Trials on sodium reduction have also shown positive effects on both non-hypertensives and hypertensives (He and MacGregor, 2002, 2004). The low sodium intakes of the study participants which was below the recommended intake of 2.4g a day (USDHHS, 2005), may not be the true reflection of their sodium intake since dietary assessment methods of estimating sodium intake can be associated with misreporting. Urinary sodium excretion test is normally recommended for assessing dietary sodium (El-Bokl *et al.*, 2009) but it was not possible to do this test in this study. In vitro and in vivo laboratory studies have shown that calcium may affect the risk of developing CVD through multiple mechanisms including blood cholesterol, insulin secretion and sensitivity, vasodilation, inflammatory profile, thrombosis, obesity, and vascular calcification(Wang *et al.*, 2012). As a result the lower mean calcium intakes by both groups may increase their CVD risk. High levels of phosphate intake have been shown to directly correlate with atherosclerosis in humans whereas low levels increases insulin resistance and fat accumulation in the liver and lipid storage areas which predisposes one to a CVD (Tonelli *et al*.,2005; Foley *et al*., 2009). According to the Institute of Medicine (USA), adults need about 700mg of phosphorus a day for normal body functioning. The NKFC members had a significantly higher mean phosphorus intake than their KFC counterparts. This puts the KFC members at a lesser risk of getting a CVD. Modern diet tends to produce sodium overload leading to potassium depletion (hypokalaemia). Hypokalaemia is a serious condition that has been implicated in many aspects of cardiovascular disease including atrial fibrillation, stroke, heart attack, hypertension, and sudden cardiac death (SCD). Our data suggests both groups taking in relatively lower levels of potassium compared to the recommendation of 4.7g daily. A low magnesium level (hypomagnesaemia) increases potassium excretion as such the low levels of magnesium >350mg observed in this study correlates with the low potassium intake. The KFC members recorded a significantly higher mean daily magnesium intake levels than the NKFC members though both were below the daily requirements.

5.5 BIOCHEMICAL PARAMETERS

5.5.1 Plasma Glucose

Exercise is an insulin-independent stimulus for increased glucose uptake by the working muscle cells via the GLUT-4 transporter (Shepherd and Kahn, 1999). Fasting plasma glucose (FPG) and 2-hour postprandial plasma glucose (2HPG) differ from each other in their respective physiological determinants (Abdul-Ghani *et al*., 2006) and in the risks that they carry (Unwin *et al*., 2002), and so both of them were used to evaluate the glucose levels of the study participants. There was a significant difference between the case and control with respect to the FPG which was relatively lower in the NKFC members. However, both groups had the mean FPG within the normal range (3.5mmol/l – 6.0 mmol/l). The principal finding of a study by Boulé *et al.*, (2003) about structured regular exercise was its beneficial effects on insulin sensitivity. This is in line with the findings of this study with KFC members having a mean FPG and mean 2HPG of 5.14mmol/l and 7.18mmol/l respectively. Hu *et al.*, (2003) found that moderate to high occupational or leisure-time physical activity independently and significantly reduce risk of type 2 diabetes among the middle-aged general population. This also agrees with our findings that the appreciable level of physical activity among the NKFC members had a good effect on their plasma glucose levels. This observation can be interpreted as structured physical activity having equal benefits with respect to plasma glucose as occupational or lifestyle physical activity.

The KFC members showed a higher prevalence of high plasma glucose. This could be due to a higher number of known subjects with diabetes who are members of the keep fit club. Their membership could be a clinical advice to help keep their blood sugars in the normal range. Therefore surprisingly the KFC group had a higher CVD risk from the relatively higher rate of high plasma glucose.

5.5.2 Lipid Profile

Physical activity has favourable effects on lipid profile (Teixeira de Lemos *et al.*, 2009; Berg *et al.*, 1994), and is now viewed as one of the best non-pharmacological strategies for the prevention or lessening dyslipidaemia. It has been shown that, physical activity stimulates lipolytic activity which decreases plasma triglycerides, promotes the use of free fatty acids as an energy source and increases HDL-cholesterol concentration (Goldhamme *et al.*, 2007). Overall, the KFC members exhibited better lipid profile compared to their NKFC counterparts. The mean total and LDL-cholesterol were significantly lower in the cases compared to the controls. However, it is worthy to note that the KFC members too had their mean LDL-cholesterol higher than recommended normal values (LDL-C ≤2.6mmol/L). LDL-cholesterols may be high in both groups because a higher percentage of them who buy food from outside and this may be associated with their significantly high intake of dietary fat and saturated fatty acids. Mean TG was within the normal range, with mean HDL-cholesterol quite low for both cases and controls. The response of the lipid profile to an exercise session is different and depends on the type of exercise, intensity and frequency, duration per session, and the time spent in such a programme (Durstine and Haskell, 1999). Aerobic, structured and moderate to high intensity with consistent frequency like what the KFC members undertook is shown to improve lipid levels compared to occupational physical activity (Mayer-Davis *et al.*, 1999). A prospective study by Hu *et al.*, (2005) comparing the effects of the two types of physical activity on lipid profile found a stronger inverse association to leisure time physical activity and a weaker inverse association to occupational physical activity. These findings concur with the results of this study and could explain why the NKFC members had high total and LDL-cholesterols compared to the KFC members.

The lipid profile distribution for the study subjects puts the NKFC members at a higher CVD risk. They showed a higher prevalence of hyperlipidemia considering the percentage that had high total cholesterol and LDL-cholesterol levels.

5.6 CONCLUSION

KFC and NKFC members had similar CVD risk. KFC members did not have higher physical activity despite their membership as the NKFC members engaged more in occupational physical activity. Majority of both case and control met the recommended weekly physical activity requirement in metabolic equivalence. The study thus confirms the hypothesis that there is no difference in cardiovascular risk factors among KFC and NKFC members.

Poor dietary practices such as high intake of saturated fat, taking two meals a day and eating meals away from home most days of the week was high among the participants. These practices if prolonged can have effect on the body weight (BMI) and lipid profiles which are important risk factors of CVD.

The improvement of these dietary habits coupled with their moderate to high level of physical activity will offer better protection against CVD.

5.7 RECOMMENDATIONS

It is recommended that the study be conducted at different Keep Fit Clubs to see if results will differ or concur to this study.

A prospective study at the same Keep Fit Club could be done with a larger sample size which will give more power to the study.

Dietary intervention can be given to the Keep Fit Club members and a prospective analysis carried out and compared to the control without prior dietary intervention.

5.8 LIMITATIONS

Several limitations were observed in this study which are important to be noted. The time frame for the study was relatively short. As such the required number of both cases and controls could not be recruited into the study. Again, sampling could only be done on Saturday mornings which posed a sample size challenge because of a number of social events which are usually done on Saturdays. All this can lower the power of the study.

Dietary assessment methods used in the study may be associated with both under estimation and over estimation of meals. It is also possible that the eating habits as reported by the participants were modified to impress the investigator. In addition the Esha F-Pro software used did not have nutrient composition of certain local foods hence similar foods were chosen to compensate for it. All these factors can have effects on the final results.

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APPENDIX 1

QUESTIONNAIRE

PARTICIPANTS CODE………… NAME OF PARTICIPANT………………………

SECTION 1: SOCIODEMOGRAPHICS

1.1 Gender? [1] Male [2] Female ☐

1.2 How old were you at your last birthday? ____________

1.3 Which one of these groups would you say best represents your tribe? ☐

[1] Akan [4] Upper West (Lobi/Wale/Dagaari/Sissala etc.)

[2] Ewe [5] Upper East (Frafra/Mamprusi/Kusasi etc.)

[3] Ga/Dangbe [6] Northern (Dagomba/Gonja/Kokomba/Nanumba etc.)

[7] Other [specify] _____________

1.4 Marital status ☐

[1] Married [2] Separated [3] Divorced [4] Never married [5] Widowed

1.5 Number of Children ....

1.6 What is the highest grade or year of school you completed? ☐

[1] Never attended school or only attended kindergarten [2] Elementary

[3] Junior High School [4] Senior High School

[5] Tertiary 1 year to 3 years (Diploma/Certificate/Professional)

[6] Tertiary 4 years or more (Degree/Postgraduate/Professional)

[7] Other [Specify] _____________

1.7 Monthly income (Ghana Cedis)

[1] Less than ¢60 [2] > ¢60 Less than ¢100 [3] ¢100 to less than ¢ 300

[4] ¢300 to less than ¢500 [5] ¢500 to less than ¢1000 [6] ¢1000 to less than ¢1500 [7] ¢1500 to less than ¢2000 [8] ¢ 2000 or more [9] No income

1.8a. In what kind of business or industry do (did) you work?

[1] Unskilled labourer/watchman

[2] Technician/Driver/Artisan/Tradesperson/Security

[3] Clerical/Audit/Accounts/Messenger/Office worker

[4] Dietitian/Nurse/Technologist/Secretary/Transport or Estates/ Officer/Senior Security Officers

[5] Doctor/Dentist/Administrator/Certified Accountant/Engineer

[6] Retired

[7] Other, specify ________________

1.8b. If retired, please specify

[1] Retired but working [2] Retired but not working

1.9 Are you a member of Dansoman Keep Fit Club**?** Yes [ ] No [ ]

1.9.1 If yes, how long have you been a member? ………….years………..months

1.9.2. If yes, how many times in the month do you go to the Keep Fit Club (KFC)? ______________

1.9.3 Are you an active member of any other Keep Fit Club? Yes [ ] No [ ]

1.9.4 If yes, how many times in the month do you attend the Keep Fit? ______________

1.9.5 What is the usual intensity of the exercises performed?

[1] Vigorous intensity [2] Moderate intensity [3] Light intensity

[4] Other, specify

1.9.6 What is the average duration? _______ hrs _____ mins

1.9.7 Apart from the activity at the KFC, do you undertake any form of exercise? [1]Yes [1]No

1.9.8. If yes how many times in a week? ______________

1.9.9. What is the usual intensity of the exercises performed?

[1] Vigorous intensity [2] Moderate intensity [3] Light intensity

[4] Other, specify

SECTION 2: FOOD HABITS

2.1 MEAL PATTERN

2.1.1. How many main meals do you usually eat a day?

2.1.2 Do you eat snacks between meals? [1] Yes [2] No

2.1.3. If yes, how many snacks do you usually eat each day? [ ]

2.1.4. Which of these meals do you usually buy outside? Pls indicate 1=Yes, 2=No

[1] Breakfast [ ]   [2] Lunch [ ]

[3] Supper [ ]   [4] Snacks [ ]

2.1.5. How often do you buy food from outside when you are at work? ________________

2.1.6. Where do you usually buy it? You can choose more than one ans

[1] Fast food spot [ ]

[2] Restaurant [ ]

[3] Local shop bar [ ]

[4] School canteen/ cafeteria [ ]

[5] Street vendors [ ]

[6] Other (specify)…………………………………..

If you answered **1or 2** to question **2.1.6.**, please answer question **2.1.7.(You can choose more than one ans)**

2.1.7. Why do you often eat from restaurants or fast food?

[1] Cost [ ]

[2] Location/ Proximity [ ]

[3] Convenience [ ]

[3] Comfort [ ]

[4] Type of service rendered [ ]

[5] Other (specify)...

Please you will now answer some questions about various health behaviours. Such as **smoking, alcohol intake, physical activity and other health conditions**. The information provided will be held in strict confidentiality.

2.2 ALCOHOL INTAKE

2.2.1 Have you ever consumed alcohol? [1] Yes [2] No ☐ If No, please go to **SECTION 2.3**

2.2.2. How old were you when you first started drinking? ________ years

2.2.3 Have you ever consumed alcohol (such as beer, wine, spirits, fermented cider, akpeteshie, pito, palm wine or bitters) within the last 12 months? [1] Yes [2] No ☐

2.2.4. How often do you take alcoholic drinks (at least 1 bottle/day or 1 tot/day)? ☐

[1] Everyday

[2] 5-6 times a week

[3] 3-4 times a week

[4] Once or twice a week

[5] Once or twice a month

[6] Rarely

[7] Other (specify)………………

2.2.5. Which type do you commonly drink?

[1] Beer ☐ [2] Guinness ☐

[3] Wine ☐ [4] Spirits ☐ [5] Other (specify)……………………..

2.2.6. How many of the following do you drink at a time on an average in a day?

[1] Bottles ………………………..

[2] Cans…………………………

[3] Jugs………………………..

[4] Wine glasses…………………..

[5] Tot glasses…………………

[6] Other (specify)…………………………..

2.2.7 Do you usually take alcohol after exercising? [1] Yes [2] No ☐

2.2.8 If yes, what kind of drink do you usually take?

[1] Beer ☐ [2] Guinness ☐

[3] Wine ☐ [4] Spirits ☐ [5] Other (specify)……………………..

2.2.9 On a typical day after exercising, how many of the following do you drink at a time? **(1 small beer/Guinness bottle=1 unit, 1 big bottle=2 units, 1 tot=1 unit, 1 wine glass=1 unit)**

[1] Bottles ……………………….. [6] Other (specify)…………………………..

[2] Cans…………………………

[3] Jugs………………………..

[4] Wine glasses…………………..

[5] Tot glasses…………………

2.3 SMOKING STATUS

2.3.1 Smoking status

[1] Never smoked [2] Stopped smoking [3] Still smokes

2.3.2. Do you currently smoke any tobacco products such as cigarettes, cigar or pipes?

[1] Yes [2] No **if No go to Qxn 2.3.7**

2.3.3. Do you currently smoke tobacco every day? [1] Yes [2] No

2.3.4. On average, how many sticks/packet do you smoke each day? ………………………..

2.3.5. How old were you when you first started smoking daily? ………………………………..

2.3.6. How old were you when you stopped smoking? ....

2.3.7. Do you currently use any smokeless tobacco such as snuff, chewing tobacco, betel

[1] Yes [2] No

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

2.4 PHYSICAL ACTIVITY

2.4.1 Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like

(lifting or carrying heavy loads, digging, or construction work) for at least 10 minutes continuously?

[ ] Yes [ ] No **if No, go to question 2.4.4**

2.4.2 In a typical week, on how many days do you do vigorous-intensity activities as part of your work?

Number of days…………………….

2.4.3 How much time do you spend doing vigorous-intensity activities at work on a typical day?

Hours…………….. Mins …………………

2.4.4 Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking for at least 10 minutes continuously?

[ ] Yes [ ] No **if No, go to question 2.4.7**

2.4.5 In a typical week, on how many days do you do moderate-intensity activities as part of your work?

Number of days…………………….

2.4.6 How much time do you spend doing moderate-intensity activities at work on a typical day?

Hours…………….. Mins …………………

TRAVEL TO AND FROM PLACES:

2.4.7 Do you walk or use a bicycle for at least 10 minutes continuously to get to and from places?

[ ] Yes [ ] No **if No, go to question 2.4.10**

2.4.8 In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?

Number of days…………………….

2.4.9 How much time do you spend walking or bicycling for travel on a typical day?

Hours…………….. Mins …………………

RECREATIONAL ACTIVITIES:

2.4.10 Do you do any vigorous-intensity sports, fitness or recreational activities that cause large increases in breathing or heart rate like running, football, and aerobics for at least 10 minutes continuously?

[ ] Yes [ ] No [ ] **if No, go to question 2.4.13**

2.4.11 In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational activities?

Number of Days..........................

2.4.12 How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?

Hours…………….. Mins …………………

2.4.13 Do you do any involve moderate-intensity sports, fitness or recreational activities that cause large increases in breathing or heart rate like cycling, swimming for at least 10 minutes continuously?

[ ] Yes [ ] No [ ] **if No, go to question 2.4.16**

2.4.14 In a typical week, on how many days do you do moderate--intensity sports, fitness or recreational activities?

Number of Days..........................

2.4.15 How much time do you spend doing moderate--intensity sports, fitness or recreational activities on a typical day?

Hours…………….. Mins …………………

SEDENTARY BEHAVIOUR :□

2.4.16 How much time do you usually spend sitting or reclining on a typical day? For example time spent at work sitting, in an office, reading, watching television, using a computer, knitting or resting.

Hours…………….. Mins …………………

2.5 OTHERS(HEALTH STATUS AND FAMILY HISTORY)

2.5.1. Has any doctor ever told you, you have diabetes(sugar disease) Yes [1] No[2] [ ]

2.5.2. If yes, how long ago ________________

2.5.3. Do you currently take any medication for this condition Yes [1] No[2] ☐

2.5.4. If yes, what do you take? ☐

[1] Oral tablets [3] Both insulin and oral medication

[2] Insulin injection [4] Others (Specify) ___________________

2.5.5. Has any doctor ever told you, you are hypertensive? Yes [1] No[2] ☐

2.5.6. If yes, how long ago __________years ______ months

2.5.7. Do you currently take any medication for this condition? Yes [1] No[2] ☐

2.5.8. Has any doctor ever told you, you have abnormal blood fat? Yes [1] No[2] ☐

2.5.9. If yes, how long ago ___________ years _______ months

2.5.10. Do you currently take any medication for this condition? Yes [1] No[2] ☐

2.5.11 Have you ever been counseled by a dietitian before? Yes [1] No[2] ☐

2.5.12 Has a close relative (father, mother, sister, brother. Child) had any of the following?

(Use code 1=Yes, 2=No, 3= don't know)

Hypertension ☐ Diabetes ☐ Stroke ☐

Heart Attack ☐ Heart Failure ☐ Kidney Failure ☐

2.5.13 Has any other family member (direct aunt, uncle, grandmother, grandfather) had any of the following? (Use code 1=Yes, 2=No, 3= Don't know)

Hypertension	☐	Diabetes	☐	Stroke	☐
Heart Attack	☐	Heart Failure	☐	Kidney Failure	☐

THANK YOU FOR PARTICIPATING

APPENDIX II

24 HOUR FOOD RECALL

WEEKDAY 1

Menu	Food	Handy Measure	Weight (g)
Breakfast	1. 2. 3. 4.		
Mid-morning snack	1. 2. 3.		
Lunch	1. 2. 3.		
Mid-afternoon snack	1. 2. 3.		
Supper	1. 2. 3.		
Bedtime snack	1. 2. 3.		

WEEKDAY 2

Menu	Food	Handy Measure	Weight (g)
Breakfast	1. 2. 3. 4.		
Mid-morning snack	1. 2. 3.		
Lunch	1. 2. 3. 4.		
Mid-afternoon snack	1. 2. 3.		
Supper	1. 2. 3. 4.		
Bedtime snack	1. 2. 3.		

WEEKEND

Menu	Food	Handy Measure	Weight (g)
Breakfast	1. 2. 3. 4.		
Mid-morning snack	1. 2. 3.		
Lunch	1. 2. 3. 4.		
Mid-afternoon snack	1. 2. 3.		
Supper	1. 2. 3. 4.		
Bedtime snack	1. 2. 3.		

APPENDIX III

ANTHROPOMETRY

Weight ……………… (kg) Height……………… (m) BMI ………………… (Kg/m2)

Waist Circumference……… (cm) Hip Circum………… (cm) WHR ………………

Percentage Body fat........................% Visceral fat………………

BLOOD PRESSURE

Ask participants to please go and pass urine if he/she has not done so in the last two hours. Ask if participants have smoked or drank alcohol in the past 30 minutes. If so delay the BP measurement for 30 min.

- Use right arm
- The participant is to rest in a quiet place for at least 5 minutes before the BP is measured.
- Patient must be relaxed and not talking;do not engage the patient in conversation
- The feet are to be flat on the floor
- The back is to be supported
- The arm held is to be held at heart level
- Use a BP cuff of appropriate size to the arm

ARM SELECTED: Use right arm unless right arm is abnormal or absent

Readings	**First**	**Second**	**Third**
Systolic BP			
Diastolic BP			
Pulse rate			

APPENDIX IV

INFORMED CONSENT FORM

PARTICIPANT'S NAME: ________________________________

STUDY TITLE: DIETARY HABITS AND RISK OF CARDIOVASCULAR DISEASES AMONG KEEP FIT CLUB MEMBERS IN DANSOMAN.

Heart disease is one of the leading cause of death, in Ghana. Unhealthy dietary habits and reduced physical activity can negatively impact one's heart health. This study seeks to investigate the effect of physical activity in reducing the risk of having a heart disease.

Your participation in the research is entirely voluntary. You may decide to take part or withdraw from the research at any time without anyone objecting. We are going to ask you to provide information about yourself. Blood samples (1 teaspoon) will be taken by a trained laboratory technician to test for blood sugar and cholesterol tests. This may cause bruising at the site of the needle insertion but steps will be taken by the technician to decrease chances of these discomforts.

All information that will be collected during the project will be kept confidential. The forms will not bear the participants' personal identities but rather numbers or codes will be assigned to each of the files, questionnaires and documents that will be used during the study.

Results from the blood analysis will be made known to you on request or otherwise will be held confidential. Your participation in this study will help us determine the effect of physical activity. The data obtained from the study will be useful for the formulation of interventions to reduce and prevent CVD in Ghanaians. It may also provide the evidence to permit the development of interventions to reduce CVD risk in the middle-aged adult population in Accra and possibly the rest of Ghana.

For further enquiries you can contact the address below:

Prof. A. G. B. Amoah (University of Ghana Medical School. P. O. Box 4236, Accra. Tel: 020-2012224) Supervisor of the study, or Belinda Osei Onwona (School of Allied Health Sciences, P. O. Box KB 143, Korle-Bu. Tel: 0243364176).

CONSENT

I have fully explained to ___________________________ the nature and purpose of the above described research, its procedures, risks and benefits. I have allowed the subject to ask questions and have answered and will answer to the best of my ability, all questions relating to the study.

I ___________________________ have read (or have had read to me in a language that I fully understand) and understood the nature of the proposed study I am aware of the fact that I can withdraw from the study at any point in time without receiving any objection. My signature or thumbprint below indicates that I have given my consent to participate in this study.

___________________________	___________________	___________
Name of Researcher (0243364176)	Signature	Date
___________________________	___________________	___________
Name of Participant	Signature/Thumbprint	Date

APPENDIX V-ETHICAL CLEARANCE

SCHOOL OF ALLIED HEALTH SCIENCES
COLLEGE OF HEALTH SCIENCES
UNIVERSITY OF GHANA
ACADEMIC AFFAIRS

Phone: +233-0302-687974/5
Fax: +233-0302-688291

My Ref. No. SAHS/ 10363075
Your Ref. No.

P. O .Box KB 143
Korle Bu
Accra
Ghana

26th March, 2013.

Ms. Belinda Osei Onwona,
Dept. of Dietetics,
SAHS,
Korle Bu.

Dear Ms. Onwona,

<u>ETHICS CLEARANCE</u>

Ethics Identification Number: SAHS – ET. /10363075/AA/4A/2012-2013.

Following a meeting of the Ethics and Protocol Review Committee of the School of Allied Health Sciences held on Friday 1st February, 2013, I write on behalf of the Committee to approve your research proposal as follows:

TITLE OF RESEARCH PROPOSAL: **"Dietary habits and risk of cardiovascular diseases among Keep Fit Club members in Dansoman."**

This approval requires that you submit six-monthly review reports of the protocol to the Committee and a final full review to the Committee on completion of the research. The Committee may observe the procedures and records of the research during and after implementation.

Please note that any significant modification of the research must be submitted to the Committee for review and approval before its implementation.

You are required to report all serious adverse events related to this research to the Committee within seven (7) days verbally and fourteen (14) days in writing.

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As part of the review process, it is the Committee's duty to review the ethical aspects of any manuscript that may be produced from this research. You will therefore, be required to furnish the Committee with any manuscript for publication.

Please always quote the ethical identification number in all future correspondence in relation to this protocol.

Thank you.

Yours sincerely,

Dr. (Maj. Rtd.) George Asare
(Chairman, Ethics and Protocol Review Committee)

cc Dean
Co-ordinator, Dept. of Dietetics
Senior Assistant Registrar

APPENDIX VI-ETHICS MODIFICATION APPROVAL

SCHOOL OF ALLIED HEALTH SCIENCES
COLLEGE OF HEALTH SCIENCES
UNIVERSITY OF GHANA
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Phone: +233-0302-687974/5
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P. O .Box KB 143
Korle Bu
Accra
Ghana

My Ref. No. SAHS/ 10363075
Your Ref. No.

11th April, 2013.

Ms. Belinda Osei Onwona,
Dept. of Dietetics,
SAHS,
Korle Bu.

Dear Ms. Onwona,

RE: MODIFICATION REQUEST

Ethics Identification Number: SAHS – ET. /10363075/AA/4A/2012-2013.

I write on behalf of the Committee to acknowledge receipt of your letter dated 7th April, 2013 on the above subject.

TITLE OF RESEARCH PROPOSAL: **"Dietary habits and risk of cardiovascular diseases among Keep Fit Club members in Dansoman."**

The modifications made in compliance with our letter dated 26th March, 2013, have been examined. The Committee is satisfied with the changes made and the modified protocol will replace the previous protocol in our custody.

You are therefore permitted to implement the said modifications. All other rules and regulations associated with your work as specified in the previous clearance letter still hold.

Thank you.

Yours sincerely,

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Dr. (Maj. Rtd.) George Asare
(Chairman, Ethics and Protocol Review Committee)

cc Dean
Co-ordinator, Dept. of Dietetics
Senior Assistant Registrar