EVALUATION OF A WEIGHT MANAGEMENT STRATEGY IN A PRIVATE HOSPITAL IN ACCRA

BY

ANNIE ANYAKU UWADIA

(10361516)

THIS DISSERTATION IS SUBMITTED TO THE UNIVERSITY OF GHANA IN PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF MASTER OF SCIENCE IN DIETETICS

JULY 2013

DECLARATION

I, Annie Anyaku Uwadia, author of this dissertation, do hereby declare that it was done by me under the supervision of Mrs. Laurene Boateng and Dr. Matilda Asante. All references cited in this work have been duly acknowledged.

Sign…… Date……

Annie Anyaku Uwadia

(Student)

Sign…… Date……..

Mrs. Laurene Boateng

(Supervisor)

Sign…… Date…….

Dr. Matilda Asante

(Supervisor)

ABSTRACT

Background: The high prevalence of overweight and obesity is reported to be a major contribution to the increased level of Non-Communicable Diseases (NCDs) in Ghana. It has been reported that 80% of premature deaths from NCDs can be prevented through known dietary and life style interventions. A recent survey indicates that 18% of Ghanaians have been diagnosed with at least one NCD, with 45% of this number receiving dietary and life style interventions. The effectiveness of these interventions needs to be studied.

Aim: The aim of this study is to investigate the effectiveness of diet and lifestyle interventions prescribed to weight loss patients who attend the diet therapy department in a private hospital in Accra. The specific objective is to evaluate the strategy adopted by the dietitian and to determine the adherence levels of participants.

Methods: A partly retrospective and prospective study design was employed. Interviewer administered questionnaires were given to 70 clinically stable consenting male (15) and female (55) patients, aged 18 years and above, enrolled in weight management in a private hospital in Accra. Anthropometric data was obtained retrospectively from participant's records at the diet therapy unit while data on adherence level was collected prospectively with the use of questionnaires.

Results: Participants recorded significant changes in weight and BMI (p <0.05) at 6 months post intervention following a low calorie, low fat, low carbohydrate, high fibre diet with exercise regimen. Significant changes in body fat (p <0.05) were recorded in

participants who strictly adhered to exercise and in participants who visited the dietitian weekly to fortnightly.

Conclusion: Dietary management of patients with a low calorie, low carbohydrate, low fat, high fibre diet with exercise regimen is effective in achieving significant weight changes at 6 months post intervention. Significant changes in weight can be achieved with diet alone but significant reduction in body fat is achieved with diet and exercise. Higher levels of adherence to lifestyle modifications are better achieved with frequent visits to the dietitian.

DEDICATION

I dedicate this work to my husband and my kids for their love and support. To my mum and dad for their love and sacrifice.

ACKNOWLEDGEMENT

To God almighty for the sufficient grace and strength he gave me through this project.

To my supervisors; Mrs. Laurene Boateng and Dr. Matilda Asante for their counsel and guidance through this research work.

To my sister and friend, Belinda Damali, for her love and support through this programme.

To Mr. David Adjei for his help and guidance through this research work.

Special thanks to my clinical tutors; Mr. Wise Letsa, Mr. Chame, Mrs. Ivy Frimpong, Ms. Priscilla Donkor and Ms. Charity Ashie for their support and encouragements, and to the staff and members of Trust Specialist Hospital.

TABLE OF CONTENTS

CHAPTER TWO

LITERATURE REVIEW

CHAPTER THREE

CHAPTER FOUR

CHAPTER FIVE

LIST OF FIGURES

LIST OF TABLES

LIST OF ABREVIATIONS

BMI – Body Mass Index

NCD – Non-Communicable Disease

CVD – Cardiovascular Disease

SSA – Sub-Saharan Africa

SFA – Saturated Fatty Acid

PUFA – Poly Unsaturated Fatty Acid

MUFA – Mono- Unsaturated Fatty Acid

LDL – Low Density Lipoprotein

HDL – High Density Lipoprotein

DPP – Diabetes Prevention Programme

IGT – Impaired Glucose Tolerance

CHAPTER ONE

INTRODUCTION

1.1 Background

Overweight (BMI ≥ 25 ≤ 30kg/m^2) and obesity (BMI ≥ 30kg/m^2) described as abnormal or excessive fat accumulation (World Health Organization, 2013) is associated with increased risk for cardiovascular disorders, type 2 diabetes, dyslipidemia, endocrine disorders, stroke, osteoarthritis, some cancers and gallbladder disease (Cappuccio *et al*., 2008). Worldwide, it is known as a "global epidemic," (World Health Organization., 2000). The leading causes of mortality in developed countries are non-communicable diseases (NCDs) such as type 2 diabetes, cardiovascular diseases (CVDs) and cancer which account for approximately two-thirds of all deaths (World Health Organization, 2003). Urbanization, globalization and nutrition transition are major drivers of unhealthy lifestyle behaviours in developing countries (Candib, 2007). It brings about increased access to energy-dense foods and less strenuous jobs resulting in many people having a positive energy balance and hence becoming overweight or obese (Sodjinou., 2008). Fast paced economic transition has also resulted in reduced physical activity levels, decreased hours of rest and increasing levels of stress (Popkin., 2004). Small daily excess intake over expenditure can lead to a large accumulation of fat (Kumar & Clark., 2009). Weight stability requires a balance between calories consumed and calories expended. Several lifestyle behaviours may influence whether or not a person can maintain energy balance over the long term. Obesity, which was once viewed as the result of lack of will power, or a lifestyle "choice" – the choice to over eat and under

exercise, is now being considered more appropriately by the modern world as a chronic disease, which requires effective strategies for its management (Sriniva., 2004). Its recognition as a complex disorder with a multitude of factors contributing to its development has made its management challenging both for the patient and the practitioner (Dietitian's in Obesity Management, 2007), hence more attention should be given to its management.

1.2 Statement of the Problem

The World Health Organization (2003) report on Diet, Nutrition and the Prevention of Chronic Diseases placed obesity at the top of the public health agenda as the major avoidable risk factor for a wide range of NCDs. The ensuing Global Strategy on Diet, Physical Activity and Health noted that already 66% of deaths from NCDs occur in low-income countries and this figure is projected to rise. Health reports from Ghana show that the prevalence of lifestyle diseases (NCDs) are on the increase and are ranked among the top ten in-patient cause of death (Bosu., 2007). The many chronic and acute health disorders associated with excess body weight burden a society by negatively affecting the health-related quality of life of its people and by incurring substantial costs to the individuals affected and to the society, from increased health-care costs and loss of productivity. The progressive increase in the burden of chronic NCDs has been attributed to risky lifestyle behaviours (Daar., 2007). The increasing trend of obesity in Ghana provides a sufficiently strong basis for diet and lifestyle intervention in primary care units. There is therefore the need to evaluate the effectiveness of its management in health care facilities.

1.3 Hypothesis

The weight management strategy adopted by the dietitian is not effective in achieving weight loss.

1.4 The Aim of the Study

The aim of this study is to investigate the effectiveness of dietary and lifestyle interventions prescribed to weight loss patients who attend the diet therapy department in a private hospital in Accra.

1.5 Specific Objectives

- To determine the strategy adopted by the dietitian in weight management.
- To evaluate anthropometric changes of weight loss patients
- To evaluate the level of adherence to diet by weight loss patients
- To determine the impact of dietary and lifestyle intervention on their weight change
- To establish reasons for non-adherence to dietary and life style interventions.

1.6 Justification

Obesity is one of the leading causes of the global increase in non communicable diseases (NCDs). NCDs are associated with ill-health, disability and premature death; they are also implicated in increasing health care cost to both individuals and the country in general. Addressing risk factors such as unhealthy diet, physical inactivity and harmful use of alcohol can prevent obesity. Lifestyle modifications in food intake

and exercise remain the hallmarks of effective treatment of overweight and obesity. The dietitian can play a pivotal role in modifying weight status by helping to formulate reasonable goals which can be met and sustained with a healthy eating approach as outlined in the dietary guidelines of the Ghanaian healthy food steps. There is little or no data to show the efficacy of weight management strategies adopted by dietitians in Accra and the sustainability of this weight loss in a long term.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The world Health Organization (2010) has projected that nearly one in three people worldwide will be overweight, and one in ten will be obese by 2015. The proximate cause of weight gain is energy imbalance, with food energy intake exceeding total energy expenditure; however the societal causes of the global obesity pandemic remain a focus of debate (Swinburn *et al*, 2011). The rising incidence of obesity is thought to result from the current Western lifestyle, in which activity levels and diet deviate substantially from the conditions under which our species' metabolic physiology evolved (Popkin, 2005; Stanhope, 2008).

Modern conveniences and mechanization lead to decreased physical activity and lower energy expenditure in industrialized societies (WHO, 2010). Others hypothesize that changes in diet and energy intake have contributed to obesity, citing the relatively recent increase in energy dense foods, particularly processed foods high in fructose and other simple sugars that can depress energy expenditure and increase appetite and adiposity (Prentice, 2003; Swinburn *et al*, 2011).

Some studies (Jenkins *et al*., 1994; Keim *et al*., 1997; Yunsheng *et al*., 2003) reported that several characteristics of dietary behavior such as eating frequency, the temporal distribution of eating events across the day, breakfast skipping, and the frequency of meals eaten away from home, together referred to as "eating patterns," may influence

body weight. A cross sectional study conducted in Saudi Arabia on 357 male college students aged 18 to 24 years, reported high levels of over weight and obesity among the students. Irregular and infrequent meals together with low vegetables and fruits intake were the most common unhealthy eating habits of the participants (Abdallah *et al*., 2010).

Obesity is a disorder that spans all ages, ethnicity and affect both gender (Thomas, 2004). It is known worldwide as a "global epidemic," (WHO, 2010), and also described as the "new world syndrome" (Srinivas *et al.*, 2004). Weight loss has been associated with significant health benefits, including improved glycemic control and reduced blood pressure (Fabricatore *et al*, 2003) in obese patients with comorbidity.

2.2 Global Prevalence of Obesity

Rates of severe obesity have increased during the past 3 decades (Sturm., 2007). Its prevalence is increasing in all age groups in many of the developed countries in the world. Currently, 500 million adults are obese worldwide, of which an estimated 115 million reside in developing countries (Raja *et al*., 2012). For the first time in history, more of the world's population is obese and overweight than underweight, a pattern the World Health Organization refers to as "globesity".

The prevalence of obesity in Europe ranged from 4.0% to 28.3% in men and from 6.2% to 36.5% in women (Berghöfer *et al*., 2008). The highest prevalence (i.e. greater than 25%) were found in regions of Italy and Spain in both gender (Cuppuano, 2003), as well as in Portugal, Poland, the Czech Republic, Romania, and Albania in women (Santos., 2003; Dennis., 2000; Shapo., 2003). Eastern Europe and the Mediterranean

countries showed higher prevalence of obesity than countries in Western and Northern Europe. Data from the Centers for Disease Control (CDC) and Prevention show that 68% of American adults are either overweight or obese, and 34% are obese (Flegal., 2010).

Ogden (2012) reported that more than 35% of U.S. men and women were obese in 2009–2010, there was no significant difference in prevalence between men and women at any age. Overall, adults aged 60 and over were more likely to be obese than younger adults; there was no significant difference in obesity prevalence with age among men. However, among women, 42.3% of those aged 60 and over were obese compared with 31.9% of women aged 20–39 (Ogden., 2012).

2.3 Obesity in Sub-Saharan Africa

Sub-Saharan Africa (SSA), made up of low and middle-income countries, is undergoing a health transition causing these countries to experience a double burden of disease. The nutrition transition appears to be accelerating in SSA from the receding famine stage to the nutrition related non-communicable disease stage (Zulfa *et al*., 2011). As a result, an increasing number of households are experiencing the dual burden of underweight and obesity occurring simultaneously (Popkin., 2001; Doak *et al*., 2005). At the same time high rates of NCDs, like diabetes, cardiovascular disease and cancer are occurring together with infectious diseases such as HIV/AIDS, tuberculosis and malaria (Maher *et al*., 2010).

In Nigeria, a 2008 WHO report puts the prevalence of overweight and obesity at 26.8% and 6.5% respectively (WHO., 2010). Hermanus *et al*, (2012) reported that underweight

and stunting coexist with overweight and obesity. Garrett and Ruel (2003), using demographic and health survey (DHS) data from several developing countries, found the relationship between stunted children and overweight or obese mothers. In SSA, the percentage of stunted children with overweight mothers ranged from 0.6% in Mozambique to 8.2% in Namibia.

2.4 Prevalence of Obesity in Ghana

Overweight and obesity are common among Ghanaians, particularly among females, the elderly, and urban dwellers (Amoah.,2003). The overall crude prevalence of overweight and obesity was 23.4 and 14.1% respectively among adults aged 25 years and above (Amoah., 2003).

The rates were higher in females (7.9%) than in males (2.8%), (Biritwum *et al*., 2005). There were more overweight and obese persons in the urban high-class residents compared with the low class residents and in urban than in rural subjects (Amoah.,2003). Obesity was highest in Greater Accra (16.1%) and virtually not present in Upper East or Upper West regions. It was highest among the Ga population (14.6%), followed by Ewes (6.6%) and the Akans (6.0%).

It is was more common among the married than unmarried and highest among the employed compared to self-employed (Biritwum., 2005). Obesity increased with age up until the age of 64 (Amoah, 2003; Biritwum *et al*, 2005). Obesity was highest among the employed compared to the self-employed (Biritwum *et al*, 2005), especially among subjects whose jobs were of a sedentary nature (Amoah., 2003).

2.5 Perception of Obesity among Ghanaians

The West African social desirability for overweight women is frequently cited as cause for the continued direct relationship between obesity and socio-economic status in the region (Jackson *et al*, 2005; Agyemang *et al*, 2008; Fezeu *et al*, 2008). According to Benkeser *et al*, (2012), the recent increase in overweight and obesity in West Africa may not be a consequence of changes in the environment but rather the result of society-wide intentional weight gain enabled by the increased availability of food concurrent with decreased need for physical exertion Duda *et al*, (2007) used culturally specific silhouettes and surveyed urban Ghanaian women on whether improved health outcomes would incentivize women to change their current body image.

Out of the 305 participants, 214 (86%) overweight or obese women stated they would be willing to decrease their body weight if it meant leading a healthier life. Women over the age of 50, however, were significantly less willing to decrease their body weight (Duda *et al*., 2007).

In another study conducted in Ghana, out of 2,814 women interviewed, 30.4% reported a desire to be heavier, 6.3% had tried to increase weight by eating more food or calorie dense food and 41.8% desired to have normal weight. Only 17.7% had tried to decrease weight by eating less food or food with fewer calories, 12.6% tried to decrease weight by exercising, and 2.6% tried to decrease weight by taking diet pills. Women in this study also reported an awareness of the health risk associated with overweight and obesity and a desire to change body size to lead a healthier life (Benkeser *et al*., 2007).

2.6 Health Implications of Obesity

Worldwide, at least 2.8 million people die each year as a result of being overweight or obese, and an estimated 35.8 million (2.3%) of global DALYs are caused by overweight or obesity (WHO, 2003). According to Renehan *et al*, (2008), every additional 5 kg/m² in BMI increases a man's risk of oesophageal cancer by 52% and for colon cancer by 24%, and in women, endometrial cancer by 59%, gall bladder cancer by 59%, and postmenopausal breast cancer by 12%.

The global burden of disease, (2010) reported that infectious diseases, maternal and child illness, and malnutrition now cause fewer deaths and less illness than they did twenty years ago, as a result, fewer children are dying every year, but more young and middle-aged adults are dying and suffering from disease and injury, as non-communicable diseases.

Overweight and obesity lead to adverse metabolic effects on blood pressure, cholesterol, triglycerides and insulin resistance (Cappuccio *et al*., 2008). Risks of coronary heart disease, ischemic stroke and type 2 diabetes mellitus increase steadily with increasing body mass index (WHO., 2003).

Levy *et al* (2009) examined the impact of obesity on health status, Out of 43 % of people that were obese, 35.7% suffered hypercholesterolemia, 25.4% had hypertension, 19.3% displayed frequent behavioural problems and 7.1% had diabetes mellitus. Similar findings were reported in a quantitative study by Albertini *et al* (2008) to establish the effect of obesity on coronary heart disease. The leading causes of mortality in developed countries were non-communicable diseases (NCDs) such as type 2 diabetes,

cardiovascular disease (CVD) and cancer which account for approximately two-thirds of all deaths (WHO., 2003).

These diseases account for one-third of deaths in the developing world, where infectious diseases and malnutrition, particularly in infants, account for up to 43% of deaths (WHO, 2003). It is estimated that of the projected 64 million deaths worldwide in 2015, 41million (64%) will result from chronic diseases – unless urgent action is taken (WHO, 2005).

2.7 Weight Loss Management

Obesity is a multifactorial condition involving genetic, environmental and behavioural factors (Jardine, 2010) to optimize health. The Academy of Nutrition and Dietetics states that successful weight management requires "a lifelong commitment to healthful lifestyle behaviours, emphasizing sustainable and enjoyable eating practices and daily physical activity" (Cummings *et al*, 2002).

Weight loss is achieved by reducing energy input and increasing energy output. It is also achieved with energy restriction (Zora *et al*, 2002), but there are indications that weight loss can also be achieved with low-fat diets and that low-fat diets are important for weight maintenance (Schrauwen *et al*., 2000; Astrup *et al*., 2000). The importance of reducing dietary fat in a weight loss strategy, however, has been debated extensively in the literature (Bray *et al*., 1998). Successful weight loss programmes can be measured by the extent of weight loss achieved and continued participation in the dietary intervention programme (Packianathan *et al*., 2005).

2.7.1 Body Fat Assessment

The body mass index (BMI) is a simple and commonly used parameter for classifying various degrees of adiposity. It is derived from the weight of the individual in kilograms divided by the square of the height in meters (kg/m^2). By the current World Health Organization, (2013) criteria, a BMI <18.5kg/m2 is considered underweight, 18.5-24.9 kg/m^2, ideal weight and 25-29.9kg/m^2 overweight. The obese category is sub-divided into obese class I (30-34.9kg/m^2), obese class II (35-39.9kg/m^2) and obese class III (>40kg/m^2).

The measurement of fat around the waist is used to identify abdominal obesity. Abdominal obesity is defined as waist hip ratio > 0.90cm for men and > 0.85cm for women (WHO., 2008). The waist circumference is measured at the midpoint between the lower border of the rib cage and the iliac crest (Han *et al*, 1997), the waist to hip ratio (WHR) provide useful indices of abdominal fat accumulation and a better correlation with an increased risk of ill health and mortality than BMI alone (Kissebah *et al*., 1994). An abdominal girth in excess of 108 cm (40 inches) for men and 98 cm (35 inches) for women or a WHR>1.0 and 0.85 in men and women, respectively, are the accepted indicators of excessive abdominal fat accumulation which correlate with a substantially increased risk of metabolic complications (WHO., 2000; Han *et al*., 1997).

Direct and accurate measurement of adiposity relies on complex technologies such as dual energy X-ray absorptiometry (DEXA), but this results in relatively high cost, hence, anthropometric indices (BMI and WHR) remain the commonly used to assess fat mass because they are relatively straightforward and cheap to obtain (Taylor *et al*.,

2000; Lindsay *et al*., 2001; Janssen *et al*., 2002). Skinfold-based equations are also widely used to evaluate body fat (BF), but over-/underestimation is often reported (Garcia *et al*., 2006).

2.8 Life Style Modification

Behaviour modification is the cornerstone of lifestyle intervention (Mahan *et al*., 2012). It focuses on restructuring a patient's environment, nutritional intake and physical activity by using goal setting, stimulus control, problem solving, cognitive restructuring, self-monitoring and relapse prevention (Berkel *et al*., 2005).

The first report of a behavioral therapy for obesity was in 1967 (Bray, 2013), since this initial report, the length and aggressiveness of treatment techniques have been extended and intensified. The NHLBI/NAASO algorithm (Bethesda, 2000) recommends that individuals with a BMI $\geq$30 kg/m^2, as well as those with a BMI of 25.0–29.9 kg/m^2 plus two or more disease risk factors, should attempt to lose weight by adhering to a programme of diet, exercise, and behaviour therapy. These three components are frequently referred to as lifestyle modification and are the cornerstone of obesity treatment (Fabricatore and Waden., 2003).

Physical exercise and activity are important for maintaining long-term weight loss and can be beneficial in preserving lean body mass while dieting. A dose-response relationship has been demonstrated in overweight adult women between the amount of exercise and long-term weight loss maintenance (Jakicic., 2008). The rate of weight loss is directly related to the difference between the subject's energy intake and energy expenditure (Bray., 1998). Reducing caloric intake below expenditure results in a

predictable initial rate of weight loss that is related to the energy deficit (Heymsfield *et al*., 2007).

However, prediction of weight loss for an individual can be difficult because of marked variability in initial body composition, adherence, and energy expenditure (Heymsfield *et al*, 2007; Hall *et al*, 2011). A longitudinal study by Simin, (2010), investigated changes in anthropometric measurements including weight, body mass index (BMI), and waist circumference (WC) of participants. Data used for this study was collected from the community-based Nambour Skin Cancer Study, a cohort study comprising a sample of unselected adults aged 25-75 years at baseline. Anthropometric indicators were measured at study clinics in 1992, 1996, and 2007 dietary behaviours and lifestyle characteristics were reported in self-completed questionnaires at the same time points.

Women gained on average more weight, BMI and WC than men. Substantial gain in weight and BMI occurred particularly in those who aged from young-to-mid adulthood while gain in WC continued into older age groups. Heavy smoking was associated with loss in weight and BMI in both sexes and with WC gain in men. Male heavy alcohol drinkers were also more likely to gain WC but not weight or BMI.

Among dietary behaviours, consumption of visible fat on meat was associated with higher gain in anthropometric measures in both sexes. In men, more frequent consumption of fried foods was associated with weight and WC increase, and use of lard for frying/roasting with weight increase. In women, attempting to lose weight was associated with higher gain in weight, BMI, and WC.

Further analysis showed that low socioeconomic status and unhealthy dietary and lifestyle behaviours clustered together in participants who developed obesity over time.

Younger age in men and women, higher occupation and low physical activity in men, were independently associated with greater improvement in diet quality over time. Men with better diet quality gained less BMI during follow-up. The study provided evidence that younger to middle age men and women are more likely to gain weight or BMI but they tend to gain WC throughout adulthood into older age. Furthermore, this study indicates that unhealthy dietary behaviours are associated with long-term gain in weight, BMI and WC and demonstrates that unhealthy behaviours cluster together and can play an important role in obesity development over time.

2.8.1 Dietary Intervention

Dietary intervention consists of individualized dietary plan tailored to suit the individual in order to achieve weight loss. There are different types of diet in which the dietitian can prescribe to the patients, independently or in combination of the other.

Low Calorie Diet

Weight gain is the result of higher energy intake than energy expenditure. This is also known as a positive energy balance. The total amount of energy (expressed in units of kilocalories) ingested by food and drinks come from four major nutrients (macronutrients).

Table 2.8 Caloric Contents of Macronutrients

Macronutrients	Kcal/g
Fat	9
Alcohol	7
Carbohydrate	4
Protein	4

As shown in the table above, fat contains more energy per gram than carbohydrates and protein. Energy intake in the form of one macronutrient is more likely to lead to a positive energy balance than energy intake from other macronutrients, this provides the basis to emphasize the reduction of the intake of the former macronutrient in recommendations for prevention of weight gain or for achieving weight loss in overweight persons (Dam and Seidell., 2007).

The findings of Frank *et al*, (2009) randomly assigned 811 overweight adults to one of four diets; the targeted percentages of energy derived from fat, protein, and carbohydrates in the four diets were 20, 15, and 65%; 20, 25, and 55%; 40, 15, and 45%; and 40, 25, and 35%. The diets consisted of similar foods and met guidelines for cardiovascular health. The participants were offered group and individual instructional sessions for 2 years. The primary outcome was the change in body weight after 2 years in two by two factorial comparisons of low fat versus high fat and average protein versus high protein and in the comparison of highest and lowest carbohydrate content.

At six months post intervention, participants assigned to each diet had lost an average of 6 kg, which represented 7% of their initial weight, but began to regain weight after 12 months. By 2 years, weight loss remained similar in those who were assigned to a diet with 15% protein and those assigned to a diet with 25% protein, in those assigned to a diet with 20% fat and those assigned to a diet with 40% fat, and in those assigned to a diet with 65% carbohydrates and those assigned to a diet with 35% carbohydrates.

Among the 80% of participants who completed the trial, the average weight loss was 4 kg, 14 to 15% of the participants had a reduction of at least 10% of their initial body weight. Satiety, hunger, satisfaction with the diet, and attendance at group sessions were similar for all diets. Attendance was strongly associated with weight loss (0.2 kg per session attended).

Findings from this study (Sacks *et al*, 2009) show that reduced calorie diets result in clinically meaningful weight loss regardless of which macronutrients they emphasize. A balanced restricted-energy diet is the most widely prescribed method of weight reduction (Mahan., 2012). It is designed to create an energy deficit of 500–1,000 kcal/day and induce a weight loss of 0.5–1 kg/week. (Bethesda., 2000).

A low-calorie diet is reported to induce weight loss - approximately 6 to 10% of body weight after six months (Moghaddasi and Kashani., 2012). A person's ability to adhere to the macronutrient composition of a diet is likely to be associated with a person's ability to control total energy intake (Dam and Seidell., 2007).

A systemic review of the efficacy and safety of the low carbohydrate diets conducted by Bravata *et al*, (2003) in Stanford, reviewed articles describing adult, outpatient recipients of low-carbohydrate diets of 4 days or more in duration and 500 kcal/day or

more, and which reported both carbohydrate content and total calories consumed. Literature searches identified 2609 potentially relevant articles of low-carbohydrate diets. These included 107 articles describing 94 dietary interventions reporting data for 3268 participants; 663 participants received diets of 60 g/day or less of carbohydrates, of whom only 71 received 20 g/day or less of carbohydrates. The study reported insufficient evidence to make recommendations for or against the use of low-carbohydrate diets, particularly among participants older than age 50 years, for use longer than 90 days, and for diets of 20 g/day or less of carbohydrates.

Among the published studies, participant's weight loss while using low-carbohydrate diets was principally associated with decreased caloric intake and increased diet duration but not with reduced carbohydrate content.

Low Carbohydrate and High Fibre Diet

Low carbohydrate diets or carbohydrate-restricted diets are dietary programs that restrict carbohydrate consumption, often for the treatment of obesity. Foods high in easily digestible carbohydrates (e.g., sugar, bread, pasta) are limited or replaced with foods containing a more complex carbohydrates (e.g., vegetables, whole grains) and moderate protein (e.g., meat, poultry, fish, eggs, nuts and seeds).

Nordmann *et al*, (2006), confirm that there is a spontaneous reduction in caloric intake when carbohydrate intake only is restricted to 5–10% of caloric intake. Hunger levels of low carbohydrate diets have also been reported to be similar with those of a low fat diet (Borden *et al*., 2005). Another study used the Eating Inventory, a validated questionnaire assessing hunger and cognitive restraint, and found that hunger was reduced by 50% when measured after 1 week of a low carbohydrate diet (Nickols-

Richardson.,2005). Another study examining a 20g carbohydrate diet found that fasting serum leptin was reduced by 50% and fasting serum neuropeptide Y was reduced by 15% (Miller *et al*., 2003).

The amount of carbohydrate allowed varies with different low carbohydrate diets. Carbohydrate provides less energy per gram than fat and is thus less energy dense than fat. (Drewnowski *et al*., 2004). The carbohydrate content of diets tends to have a modest inverse association with the energy density of diets (Stookey, 2001; Drewnowski *et al*., 2004). The association lies in the proportion of carbohydrates and the ability to control energy intake for lower weight gain (Dam and Seidell., 2007). A study by Frederick *et al*, (2003), carried out in Philadelphia on obese participants with a mean BMI of 43, reported that participants placed on a low-carbohydrate diet lost more weight during the six-month study than participants placed on low-fat and low calorie diet. However, the difference in weight loss between the groups remained significant at 95% confidence interval.

Findings from some studies also reported weight loss was greater after six- months for low-carbohydrate diets as compared with low-fat diets, although these differences greatly reduced after longer follow-up (Nordmann *et al.*, 2006; Gardner *et al.*, 2007). Long-term dietary and lifestyle interventions show that consumption of a relatively high carbohydrate diet (55% of energy) that includes high amounts of fibre-rich foods can be compatible with clinically relevant weight loss (Tuomilehto *et al*., 2001; Knowler *et al*., 2002; Esposito *et al*., 2004; Mayer-Davis *et al*., 2004).

The efficacy of low carbohydrate diets for weight loss was established in 6 out patient randomized controlled trials (Meckling *et al*, 2004; Sondike *et al*, 2003; Foster *et al*, 2003; Samaha *et al*, 2003; Stern *et al*, 2004; Yancy *et al*., 2004), these trials used the most widely recommended diet at that time (a 30% fat, reduced calorie diet) as the comparison diet. There were differences in the intensity of the interventions in these outpatient studies. For example, the amount of behavioral support ranged from simply providing a popular diet book along with minimal education to providing biweekly group sessions with extensive handouts and close monitoring (Foster *et al*., 2003; Yancy *et al*., 2004).

Across these studies, there appeared to be better intensity of the intervention increased. Some of these studies collected detailed outpatient nutritional intake information (Meckling *et al*, 2004). Whereas instruction in a low carbohydrate diet does not mention calories, the restriction of dietary carbohydrate leads to a reduction in calorie.

The ad libitum intake can vary from person to person, but, in many cases, the protein and fat intakes, in absolute terms, are not much higher than those of a typical American diet, because the total caloric intake is lower. As such, the low carbohydrate diet is not necessarily a high-protein diet or a high-fat diet (Westman *et al*., 2007).

A two year randomized trial was carried out on 307 participants with body mass index of 30 – 40 kg/m^2. Participants were assigned to either a low carbohydrate or a low fat diet. Those in the low carbohydrate group were instructed to eat no more than 20 grams of carbohydrate per day for 3 months. After this period, the carbohydrate intake was increased by 5 grams per day each week until they achieved their desired weight. The

low fat diet group were given instructions to decrease calorie intake from 1200 to 1800 kcal per day with no more than 30% of calories from fat.

All patients also participated in an education programme on changing physical activity and other lifestyle factors. Participants on this programme met weekly for 20 weeks, then every other week for another 20 weeks, and then monthly for the rest of the study.

The researchers collected information on weight at the start of the diet and after 3, 6, 12, and 24 months. Information on cholesterol levels, blood pressure, bone density, and side effects was also collected at the end of the 2year study in both groups. Patients in both groups lost an average of 7 kg or 7% of body weight, no differences were found between the 2 groups (low carbohydrate and low fat) (Foster *et al*., 2010).

Data from several randomized trials over the past years have demonstrated that low carbohydrate diets produced greater short term (6 months) weight loss than low fat, calorie restricted diets (Foster *et al*, 2003; Samaha *et al*, 2003; Yancy *et al*., 2004; Gardner *et al*., 2007). Some studies found greater weight loss with low carbohydrate diets than with low fat diets (Gardner *et al*, 2007; Shai *et al*, 2008), whereas others found no difference (Shai *et al*., 2008; Yancy *et al*., 2010). However, weight loss with either diet was usually minimal (Nordmann *et al*, 2006; Malik *et al*, 2007), presumably because of the modest dose of behavioral treatment provided in these studies (Foster *et al*, 2003; Samaha *et al*, 2003; Stern *et al*, 2004; Yancy *et al*., 2004; Gardner *et al*., 2007; Shai *et al*., 2008).

Low Fat Diet

Fat is a major source of energy containing about 9 calories per gram of fat (Stern, 2008). It is 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).

The Academy of Nutrition and Dietetics, (2010) recommends daily consumption of less than 7 percent of calories from saturated fatty acids (SFA). It is also recommended that SFA should be replaced with poly-unsaturated fatty acids (PUFA) and mono-unsaturated fatty acids (MUFA) in the diets. Daily cholesterol intake should be limited to <300mg/day and <200mg/day for individuals with or at high risk for CVD and Type 2 diabetes, and also avoid the consumption of trans-fats from industrial sources and limit natural sources to <0.5% of total caloric intake.

Fat is also associated with a higher energy density (Stookey, 2001; Drewnowski *et al*., 2004). In a 2-year randomized trial of 322 moderately obese participants with mean age of 52 years, mean body mass index of 31kg/m^2 and predominantly male (86%), participants were placed on one of three diets: low-fat, restricted-calorie; Mediterranean, restricted-calorie; or low-carbohydrate, non–restricted-calorie.

The rate of adherence to the study diet was 95.4% at 1 year and 84.6% at 2 years. The Mediterranean-diet group consumed the largest amounts of dietary fiber and had the highest ratio of monounsaturated to saturated fat ($P<0.05$) for all comparisons among treatment groups. The low-carbohydrate group consumed the smallest amount of

carbohydrates and the largest amounts of fat, protein, and cholesterol and had the highest percentage of participants with detectable urinary ketones ($P<0.05$) for all comparisons among treatment groups. The mean weight loss was 2.9 kg for the low-fat group, 4.4 kg for the Mediterranean-diet group, and 4.7 kg for the low-carbohydrate group ($P<0.001$) for the interaction between diet group and time.

The relative reduction in the ratio of total cholesterol to high-density lipoprotein cholesterol was 20% in the low-carbohydrate group and 12% in the low-fat group ($P=0.01$). Among the 36 subjects with diabetes, changes in fasting plasma glucose and insulin levels were more favorable among those assigned to the Mediterranean diet than among those assigned to the low-fat diet ($P<0.001$) for the interaction among diabetes and Mediterranean diet and time with respect to fasting glucose levels. At the end of this 2-year dietary intervention study, the researchers (Iris *et al*, 2008) reported that the Mediterranean and low-carbohydrate diets are effective alternatives to the low-fat diet for weight loss and appear to be just as safe as the low-fat diet.

In addition to producing weight loss in this moderately obese group of participants, the low-carbohydrate and Mediterranean diets had some beneficial metabolic effects, a result suggesting that these dietary strategies might be considered in clinical practice and that diets might be individualized according to personal preferences and metabolic needs. The similar caloric deficit achieved in all diet groups suggests that a low-carbohydrate, non–restricted calorie diet may be optimal for those who will not follow a restricted calorie dietary regimen.

In a randomized trial of 241 Dutch non-obese individuals with no intention to lose weight, free access was provided to 45 different foods either in reduced fat or full fat, covering between 30 and 40% of energy intake. The group that consumed the reduced-fat products had decrease in body fat over 6 months as compared with those that consumed the full-fat products (Westerterp *et al*., 1996; Weststrate *et al*., 1998). Another study by Saris *et al*, (2000) also reported weight loss of participants at 6 months post intervention following a low fat diet as compared with a higher fat control diet.

Zora *et al*, (2002) examined the effects of dietary counseling strategies for fat and/or energy restriction on anthropometric measures in 86 pre-menopausal women, with average BMI of 28 kg/m^2, who participated in a 12-week intervention trial called the Women's Diet Study. The dietary goals were 15% of energy from fat and/or 25% reduction in energy intake (from the normal daily recommendations of 55-65%). Participants placed on the combination of low-fat/low-energy diet resulted in the most weight loss. The decreases in BMI, percent body fat (BF) and waist circumference (WC) after 12 weeks were statistically equivalent with the low fat, low-energy or combination of low-fat/low-energy diets. However, the relatively greater decreases in percent body fat (BF) and waist circumference (WC) with the combination diet versus the low-fat or low-energy diets were not statistically significant.

In a longitudinal study conducted in Baltimore, 459 healthy men and women placed on a low fat, high fibre diet recorded smaller gains in BMI in women and smaller gains in waist circumference in both women and men (Newby *et al*., 2004).

Atkins's Diet

The Atkins diet is named after Robert C. Atkins, M.D., the diet's founder. Dr. Atkins, a cardiologist, introduced his Diet Revolution in 1972. He developed the diet because of the increasing rates of obesity and chronic diseases such as diabetes. He observed that overweight people eat too many carbohydrates, and suggested that limiting intake of carbohydrates (sugars and starches) would improve health and aid in weight control (Wells and Odle., 2005).

The diet is based on restrictions of carbohydrates and focuses on eating mostly protein and fat, along with the use of vitamin and mineral supplements. Eight glasses of water is also recommended daily to avoid dehydration and constipation. It is also known as a ketogenic diet - a high protein, high fat, and very low carbohydrate regimen resulting in ketosis (Wells and Odle., 2005).

The human body burns both fat and carbohydrates for energy, but carbohydrates are used first. By drastically reducing carbohydrates and increasing more protein and fat in the diet, the body will naturally burn stored fat more efficiently resulting in weight loss. This drastic restriction of carbohydrate causes the body to go into a state of ketosis (Verni., 2000)

When the body is in ketosis, participants feel less hungry, and thus more likely to eat less. However, ketosis can also cause a variety of unpleasant effects (such as unusual breath odour and constipation) in a small number of people.

The Atkins diet has its pros and cons:

As benefits, refined carbohydrates are eliminated from the diet; and increased weight loss occurs, especially in the first 6 months, despite the diet's high fat content.

The disadvantage of this diet is the insufficient energy it provides in the form of carbohydrate. As a result of this, the body is forced to go into ketosis, which causes additional burden on the kidneys. This has a long-term effect on the heart. It is deficient in vital nutrients supplied by fruits, vegetables, and whole grains leading to vitamin deficiencies, such as, thiamine, folic acid, vitamin c, iron and magnesium (Gardner *et al*., 2007; Gardner *et al*., 2010). Low-carbohydrate diets such as Atkins can adversely affect calcium levels in the body (Shalini *et al*, 2002) and most Atkins dieters experience constipation, halitosis, and sometimes, dehydration (Dansinger *et al*., 2005).

2.8.2 Exercise

Physical activity is the second component of lifestyle modification. The benefits of physical activity include inducing negative energy balance (by increasing calorie expenditure), sparing fat-free mass during weight loss, and improving cardiovascular fitness and producing minimal weight loss in the absence of caloric restriction (Fabricatore., 2003). It plays a critical role in improving cardiovascular health in both average-weight and obese individuals (Haskell *et al*, 2007; Blair *et al*, 2002; Mora, 2007). In the absence of significant weight loss, regular bouts of aerobic activity have been found to reduce blood pressure (Whelton *et al*, 2002) and lipids (Kraus *et al*, 2002) as well as visceral fat (Ross *et al*, 2000; Ross *et al*, 2004) the latter which is associated with improved glucose tolerance and insulin sensitivity (in non-diabetic individuals) and glycemic control (in patients with type 2 diabetes)(Hayes *et al*., 2008).

Leskinen *et al*, 2009 examined 16 twin pairs with discordant levels of physical activity and found that inactive twins had greater amounts of high-risk fat, including visceral,

liver, and intramuscular. In sum, physical activity, independent of weight loss, appears to be associated with improvements in body composition and metabolic conditions.

Physical activity alone is of limited benefit in inducing weight loss, as reported in an article of the American College of Sports Medicine (Donnelly *et al*, 2009), most individuals cannot find the time or motivation to engage in high volume of activity (e.g., 35 miles of walking a week) that is required to lose even 0.45 kg/wk. Participants restricting their food intake by 500 kcal/day more easily achieve this rate of weight loss. A study by Slentz *et al*, (2004) underscored the minimal benefit of exercise alone for weight loss. Individuals who jogged/ran the equivalent of 20 miles a week (but were not instructed to restrict their food intake) lost only 3.5 kg at the end of 8 months of training. On the other hand, individuals who walked 12 miles a week at a moderate intensity (the equivalent of 6 one-half hour bouts of walking a week) lost only 1.1 kg. The addition of regular exercise to caloric restriction increases short-term weight loss, although it does spare the loss of fat-free mass (Shaw *et al*., 2006). These findings suggest that obese individuals should be encouraged to add exercise to dietary regimen to improve weight loss.

2.9 Adherence to Diet and Exercise

Adherence has been defined as the "active, voluntary, and collaborative involvement of the patient in a mutually acceptable course of behaviour to produce a therapeutic result (Alan., 2006). Adherence to dietary guidelines is associated with significantly better health outcomes (Martin *et al*., 2005). Overweight and obese adults are less likely to comply with dietary recommendations (Drewnowski and Specter., 2004).

The initial six-month reduction in weight is the main predictor of both long-term retention and success in weight loss (Greenberg., 2009). Poor dietary adherence has been implicated in the lack of success of popular and traditional dieting strategies. For example, in a recent review on low-calorie diets, the authors stated that the lack of success of such diets was likely due to difficulties with participants adherence (Heymsfield., 2007).

Greenberg (2009) reported that physically active participants on a weight loss program are more likely to report that exercise was followed by less eating than by more eating, this suggests that exercise could help many dieters lose and maintain weight.

There have been perceived barriers or challenges to the adherence to diet and exercise. An explorative study conducted by Sabinsky *et al*, (2007) reported that the most frequently mentioned barrier was the lack of motivation, followed by their perception of the type of diet prescribed and busy schedule (not having enough time for cooking, exercising, etc.), King *et al*, (2009) also identified a variety of factors that prevent patients from exercising, including a lack of one or more of the following: motivation, time, access to facilities or equipment, energy, workout partner, and self-efficacy. However, process goals such as adherence rates are important to evaluate because even the best-designed exercise program will not improve participants' fitness and health status if adherence rates are low (Linke., 2011). For lifestyle strategies to be effective, they must be feasible and acceptable. It is desirable to strive for guidelines or advice that are positively perceived (Brekke *et al*., 2003).

2.10 Readiness to Change

Change interventions are especially useful in addressing lifestyle modification for disease prevention, long-term disease management and addictions. And the concepts of "patient noncompliance" and motivation often focus on patient failure (Zimmerman *et al*., 2000).

Understanding patient readiness to make change, appreciating barriers to change and helping patients anticipate relapse can improve patient satisfaction and lower physician frustration during the change process (Zimmerman *et al*., 2000).

During the past decade, behavior change has come to be understood as a process of identifiable stages through which patients pass (Zimmerman *et al*., 2000). The Stages of Change model (Prochaska, 1992) shows that, for most persons, a change in behavior occurs gradually, with the patient moving from being uninterested, unaware or unwilling to make a change (precontemplation), to considering a change (contemplation), to deciding and preparing to make a change. During the precontemplation stage, patients do not even consider changing, at the contemplation stage, patients are ambivalent about changing, patients prepare to make a specific change at the preparation stage, while the action stage is where patients make the change.

2.11 Benefits of Weight Loss

Diet is one of the main determinants of health (WHO., 2002) and food consumption patterns are a major modifiable risk factor for cardiovascular disease, diabetes, and some cancers (Smith *et al.*, 2010). Weight loss is an important goal for overweight or obese persons (Samuel *et al*., 2004). It improves glycemic control in people with diabetes (Franz *et al*., 2003). Moderate weight loss (5% of body weight) can improve insulin action, decrease fasting blood glucose concentrations, and reduce the need for diabetes medications (Torgerson *et al*., 2004). Weight loss is also known to improve other risk factors for cardiovascular disease (Togerson *et al*, 2004) by decreasing blood pressure (Stevens *et al*, 2001; Mertens *et al*, 2000), improving serum lipid concentrations (decrease in serum triglycerides, total cholesterol, and LDL cholesterol and increase in serum HDL cholesterol concentrations) (Metz *et al*., 2000), and reducing serum markers of inflammation (Tchernof *et al*, 2002; Ziccardi *et al*, 2002). Moderate weight loss and increased physical activity can prevent or delay the development of type 2 diabetes in high risk groups, such as those with impaired glucose tolerance (Knowler., 2002). For example, data from the Diabetes Prevention Programme (DPP) demonstrated that weight loss (7% of weight loss in the first year) and increased physical activity (150 min of brisk walking per week) reduced the 4-year incidence of type 2 diabetes by 58% in men and women with impaired glucose tolerance (Ziccardi., 2002). Lifestyle changes were nearly twice as effective as metformin therapy (31% reduction in incidence of diabetes) in preventing type 2 diabetes (Ziccardi., 2002).

Results of the Diabetes Prevention Programme (DPP, 2002) have provided a definitive evidence of the health benefits of modest weight loss. More than 3,200 overweight individuals with impaired glucose tolerance (IGT) were randomly assigned to one of three conditions: 1) placebo; 2) metformin (Glucophage, 850 mg/day); or 3) a lifestyle intervention designed to induce a loss of 7% of initial weight and to increase physical activity to ≥150 minutes per week. Participants were treated for up to 4 years. The maximum weight loss in lifestyle-treated patients was ~7 kg (at 6 months), which declined to ~4 kg (at year 4). Participation in the lifestyle intervention reduced the risk of developing type 2 diabetes by 58% compared with placebo and by 39% compared with metformin.

The preventive effect of lifestyle intervention was held for members of both sexes and all racial and ethnic groups. Significant clinical health benefits are obtained with modest weight loss ranging from as little as 5% to 10% of initial body weight (Yanovski., 2002). The increasing improvement in levels of some biomarkers over time in a weight loss intervention following a Mediterranean calorie restricted or low carbohydrate, calorie restricted or low fat, calorie restricted diet, despite the achievement of maximum weight loss by 6 months, suggests that a diet with a healthful composition has benefits beyond weight reduction (Iris., 2008).

In a study by Liu *et al*, (2013), predictors of weight loss was investigated in 1566 overweight and obese adults who attended Wharton Medical Clinic Weight Management Centre for at least six months. Overall 42.7% (n=669) of the entire sample achieved weight loss that was greater than 5%. The study reported that older patients are more likely to achieve greater weight loss in comparison with younger patients.

White patients with diabetes lost as much weight as Asian patients with diabetes. There were no significant differences in weight loss between patients who had comorbidities and those without comorbidities. However, there were significant differences in patients who discontinued the dietary and lifestyle treatments.

In a one year study by Martins *et al*, (2010), morbid obese participants (BMI > 40kg/m^2) with comorbidity were sampled and grouped into for weight loss treatment groups; (A) bariatric surgery or to one of three conservative treatments; (B) residential intermittent program; (C) commercial weight loss camp and (D) hospital outpatient program. Body weight, risk factors and comorbidities were assessed at baseline and 1 year. All treatments resulted in significant weight loss, but bariatric surgery led to the largest weight loss. There were no differences in weight loss between residential intermittent programme and commercial weight loss camp. There were no differences in changes in total or LDL cholesterol, triacylglycerol or glucose between groups; however, the increase in HDL cholesterol was significantly larger in groups A and C. There were no differences in comorbidities resolution between groups A and B, C and D combined (except hypertension, which was better in group A).

CHAPTER THREE

METHODOLOGY

3.1 Study Design

This study was carried out in two parts: retrospective and prospective. Evaluation of anthropometric changes of participants was carried out retrospectively while the strategy adopted by the dietitian and level of adherence of participants was evaluated prospectively.

3.2 Study Site

Study was conducted at the diet therapy unit of the Trust Specialist Hospital in Accra. It is a private primary health care center located in Osu, in the Greater Accra region where obesity is reported to be highest (Biritwum *et al*., 2005).

3.3 Study Population

Males and females aged 18 and above, with or without co-morbidity were recruited into the study. Convenience sampling was used in selecting subjects for this study over a period of three (3) successive months. Patients that were eligible to participate were identified from routine follow-up consultations and invited to participate. Those who were willing to participate were given detailed information about the study and asked to give a written consent.

3.4 Inclusion and Exclusion Criteria

3.4.1 Inclusion Criteria

Participants recruited for this study were patients on a weight loss regime who were already undergoing dietary and lifestyle modification for more than 6 months.

3.4.2 Exclusion Criteria

Weight loss patients who have been undergoing dietary and life style modification for less than 6 months were excluded from this study.

3.5 Sample Size Determination

The study size was chosen to obtain 80% power to detect at least 4 percentile drop in mean BMI between baseline and outcome measurement of the BMI class of the diet therapy centre, keeping the overall rate of type I errors below 5%. From this the minimum sample size required for the study was 58 patients.

3.6 Ethical Approval

Ethical approval for the study was obtained from the Research Ethics and Protocol Review Committee of the School of Allied Health Sciences (Ethical Identification Number: SAHS-ET./10361516/AA/10A/2012/2013).

3.7 Methods of Data Collection

At six (6) months post dietary and exercise intervention, anthropometric data (weight, BMI, WHR, BF and VF) was collected from participant's records at the diet therapy

unit while data on the dietitian's strategy and participant's level of adherence were collected prospectively with the use of questionnaires.

3.8 Pre-testing of Study Protocol

Prior to the main study, the study questionnaire was pre-tested among a representative group who met the study criteria at the Trust Specialist Hospital, to validate, clarify, eliminate possible errors and fine tune to fit the study populace.

3.9 Data Analysis

The data obtained was cleaned and analyzed with Statistical Package for Social Scientists (SPSS version 19.0). Categorical data was summarized as frequencies and percentages while continuous data was summarized as mean± standard deviation. Analysis of variance (ANOVA) was used to analyze mean change in anthropometric variables of subjects at baseline, 3rd and 6th months post interventions, adherence to exercise and number of visits. After testing for normality, Post-Hoc analysis using Bonferroni test was conducted afterwards. The independent t-test was used to compare mean levels of anthropometric variables for co morbidity. *P*-value less than 0.05 were interpreted as significant.

CHAPTER FOUR

RESULTS

4.1 Socio - Demographic Characteristics of Participants

The study sampled 55 females and 15 males representing 78.6% and 21.4% of the sample size respectively. Most of the participants (44.3%) were in age group 51-60, 22.9% were above 60 years. Twenty percent (20.0%) were in age group 41-50, while the least (4.3%) were in age group 18-30 years. Most of the participants (42.9%) were Akans, followed by Gas (30%). Majority of the participants (78.6%) were married, 8.6% were widowed while 5.7% were divorced. Most participants (47.1%) had tertiary education, 27.1% senior high education, 11.4% had postgraduate education while the least (5.7%) had vocational training education. Almost half (47.1%) of the respondents were employed, 18.6% were pensioners and 15.7% were self-employed. A few (7.1%) were unemployed.

Table 4.1 Demographic Characteristics of Participants

	Frequency (n=70)	Percent (n=100)
Gender		
Female	55	78.6
Male	15	21.4
Age groups		
18-30	3	4.3
31-40	6	8.6
41-50	14	20.0
51-60	31	44.3
> 60	16	22.9
Ethnic groups		
Akan	30	42.9
Ewe	9	12.9
Ga	21	30.0
Others	10	14.3
Marital status		
Divorced	4	5.7
Married	55	78.6
Never married	5	7.1
Widowed	6	8.6
Education		
Junior high School	6	8.6
Senior high School	19	27.1
Tertiary School	33	47.1
Vocational Training School	4	5.7
Post graduate	8	11.4
Employment		
Employed	33	47.1
House wife	8	11.4
Pensioner	13	18.6
Self Employed	11	15.7
Unemployed	5	7.1

4.2 The Dietitian's Strategy for Weight Loss

The Dietitian's strategy for weight loss was assessed with the use of a self-administered questionnaire. The dietitian approaches weight management by changing or modifying the patient's diet and recommending an exercise regimen. A low calorie, low carbohydrate, low fat and high fibre diet was prescribed for patients. The low calorie diet is a diet that is 500 or 1000kcal deficit of the patient's recommended caloric intake. This was achieved by a guided portion size calculated to achieve a prescribed calorie. The low carbohydrate diet, high fibre diet is a diet that is low in simple and refined carbohydrates and high in complex carbohydrate. This diet included adequate intake of fruit and vegetables. The low fat diet is a diet that is low in saturated fats and devoid of trans-fat. This was achieved by reducing intake of animal fats, controlling the amount of oil used in cooking and restricting consumption of pastries and fried foods. Advice on cooking methods designed to achieve low fat and oils in meals were also given to patients. Patients were also advised to eat more frequently from home rather than restaurants, as eating outside their homes will pose a great challenge in controlling their fat and oil intake.

A mild exercise regimen such as walking, brisk walking, jogging or cycling is recommended alongside the dietary regimen. The exercise is to be carried out for 30 minutes every day. Patients who wanted to engage in more vigorous or aggressive forms of exercise, particularly those with challenging or compromising health conditions were advised to consult their physicians or physiotherapists for advice

Prior to dietary intervention, the patient's readiness to change dietary habits was assessed by the dietitian. An individualized, guided dietary plan was planned for those who were ready to change. For those who were not ready to change or contemplating, general guidelines on diet were recommended with a follow up appointment a week after. In follow up sessions, the dietitian encouraged patients to understand the need for lifestyle interventions until they accepted to go on the weight loss programme. The dietitian invited caregivers or relatives who could influence the patient's willingness or readiness to change dietary habits to these interviews.

As part of the nutrition assessment, the dietitian investigates the patient's weight loss expectations. The dietitian dissuades the patient of any unrealistic weight loss expectations, and then proceeds to educate and counsel the patient on realistic goals and expectations. A well-detailed diet sheet is given to the patient for further guidance at home.

As part of monitoring and evaluation, the patient's level of adherence is determined at every follow-up visit during counseling sessions. Direct or indirect questions are asked on adherence to diet. Patients who were having difficulties were re-counseled and encouraged to follow the dietary and exercise regimen. Frequency of appointments was determined in dialogue by the dietitian and the participant, which resulted in weekly, fortnightly or monthly visits. These follow-up appointments were used to determine compliance to dietary and exercise regimen and to encourage non-compliant participants.

4.3 Anthropometry of Participants

Analysis of variance was used to determine any differences in the mean levels of the five anthropometric variables from baseline to 6 months. There were significant differences in the mean levels of Weight (p=0.046) and BMI (p=0.008) at 6 months. However, no significant differences were observed in the mean levels of WHR, BF, and VF (p> 0.05) (Table 4.3). Post hoc analysis of the Anova using Bonferroni showed significant mean differences at baseline and 6 months (p=0.040) for Weight and BMI (p=0.010). All other pairings were not significant for the anthropometric measurements (Table 4.4). Appendix 5 shows means for the five anthropometric measurements at baseline, 3 months and 6 months.

Table 4.3 Anthropometric measurements and Treatments

Variables		SS	Df	MS	F-value	P-value
Weight	Between Groups	1102.44	2	551.22	3.123	0.046
	Within Groups	36533.54	207	176.49		
	Total	37635.98	209			
BMI	Between Groups	136.07	2	68.03	4.927	0.008
	Within Groups	2858.41	207	13.81		
	Total	2994.48	209			
WHR	Between Groups	0.01	2	0.01	1.165	0.314
	Within Groups	1.20	207	0.01		
	Total	1.21	209			
BF	Between Groups	176.60	2	88.30	1.245	0.290
	Within Groups	14683.23	207	70.93		
	Total	14859.83	209			
VF	Between Groups	42.30	2	21.15	2.445	0.089
	Within Groups	1790.20	207	8.65		
	Total	1832.50	209			

Table 4.4 Post Hoc Analysis (Bonferroni) for the various anthropometric measurements

Dependent Variable	(I)	(J)	Mean Diff (I-J)	SE	P-value	95% C.I.	
Weight	Baseline	3months	3.37	2.25	0.400	-2.051	8.795
	Baseline	6months	5.57143	2.25	0.040	0.153	10.994
	3 months	6months	2.20	2.25	0.990	-3.225	7.623
BMI	Baseline	3months	1.19	0.63	0.180	-0.333	2.702
	Baseline	6months	1.95714	0.63	0.010	0.445	3.473
	3 months	6months	0.77	0.63	0.660	-0.742	2.294
WHR	Baseline	3months	0.01	0.01	0.790	-0.027	0.056
	Baseline	6months	0.02	0.01	0.440	-0.013	0.059
	3 months	6months	0.00	0.01	1.000	-0.035	0.040
BF	Baseline	3months	1.69	1.42	0.710	-1.759	5.121
	Baseline	6months	2.13	1.42	0.410	-1.315	5.565
	3 months	6months	0.44	1.42	1.000	-2.997	3.884
VF	Baseline	3months	0.91	0.50	0.200	-0.292	2.112
	Baseline	6months	0.99	0.50	0.150	-0.211	2.196
	3 months	6months	0.07	0.50	1.000	-1.138	1.279

4.4 Participant's Adherence to Diet

More than half (55.7%) of the participants reported moderate adherence to the diet regimen provided, 20% reported that they adhered strictly while 24.3% were light adherers to diet.

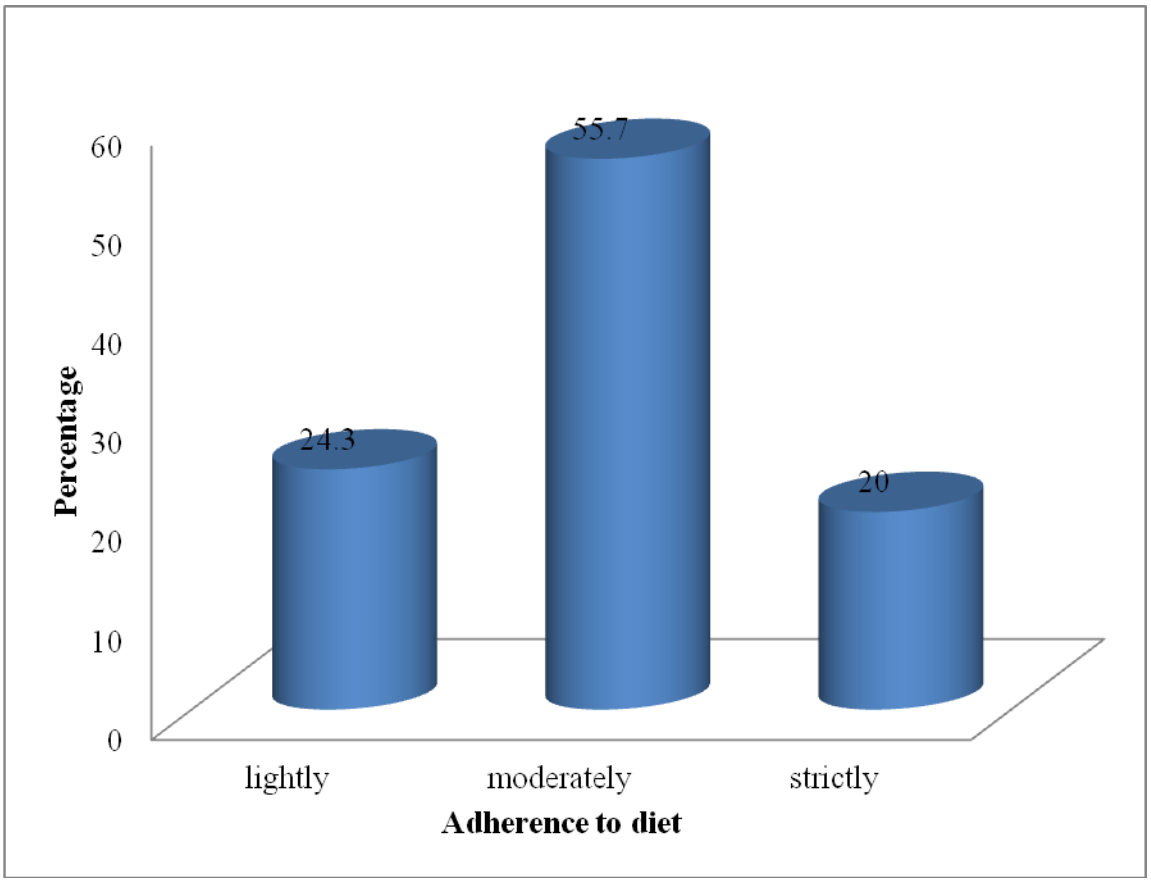

Figure 4.1 Distributions for participant's adherence to diet

4.4.1 Challenges to Adherence to Diet

Respondents reported on a number of challenges preventing them from adhering to the diet regimen. The most frequently reported challenge was busy work schedule (18.6%), followed by eating out (14.3%) and granting self-permission (14.3%), situation at home (11.4%) and lack of understanding (8.6%). More than a quarter (28.6%) of participants reported that they did not have any challenges. A few (2.9%) of participants stated financial constraints as a challenge.

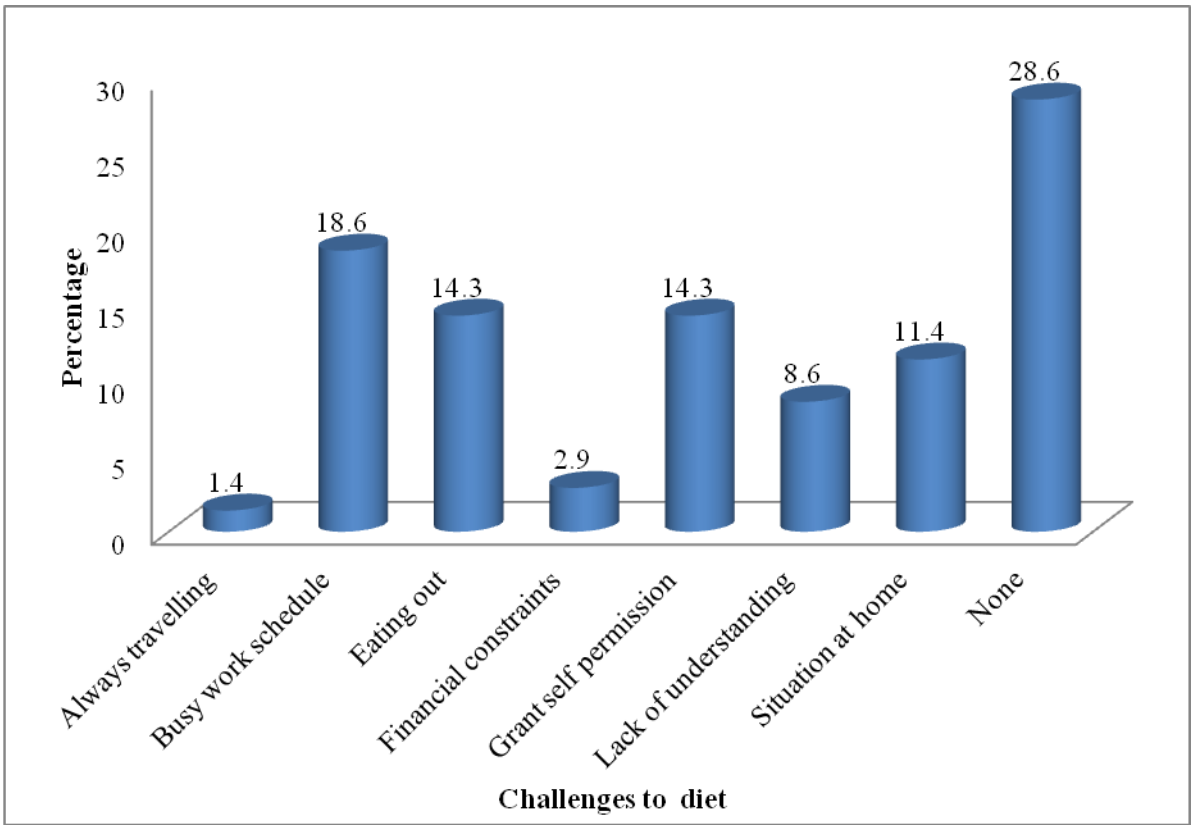

Figure 4.2 Distributions for challenges to adherence to diet

4.5 Participant's Adherence to Exercise and Change in Anthropometric Measurements

There were significant differences in the mean levels of BF (p =0.021) across all levels. However, there were no significant differences in the mean levels of WHR, Weight, and BF (p> 0.05) at all four levels of adherence. (Table 4.5) Post hoc analysis of the Anova using Bonferoni showed significant mean differences between No exercise and Light exercise (p=0.039) and Light and Strict exercise (p=0.036) for BF. All other pairings were not significant for the other anthropometric measurements. (Table 4.6). Appendix 6 shows means of the five main anthropometric measurements at four different levels of adherence to exercise.

Table 4.5 Anthropometric measurements for Adherence to Exercise

		S S	df	M S	F-value	P-value
Weight	Between Groups	541.293	3	180.431	0.974	0.414
	Within Groups	12226.478	66	185.25		
	Total	12767.771	69			
BMI	Between Groups	70.137	3	23.379	1.586	0.201
	Within Groups	973.135	66	14.744		
	Total	1043.271	69			
WHR	Between Groups	0.016	3	0.005	1.032	0.384
	Within Groups	0.337	66	0.005		
	Total	0.353	69			
BF	Between Groups	666.707	3	222.236	3.477	0.021
	Within Groups	4218.565	66	63.918		
	Total	4885.271	69			
VF	Between Groups	32.888	3	10.963	1.374	0.258
	Within Groups	526.555	66	7.978		
	Total	559.443	69			

Table 4.5.1 Post Hoc Analysis (Bonferroni) for the various anthropometric measurements for Exercise

Variable	(I)	(J)	Mean Diff	SE	P-value	95% C.I.	
Weight	None	Light	-9.13	8.33	1.000	-31.797	13.547
	None	Moderate	-7.84	5.38	0.898	-22.478	6.791
	None	Strict	-9.22	5.50	0.591	-24.190	5.747
	Light	Moderate	1.28	7.22	1.000	-18.353	20.915
	Light	Strict	-0.10	7.31	1.000	-19.980	19.788
	Moderate	Strict	-1.38	3.59	1.000	-11.152	8.398
BMI	None	Light	-0.38	2.35	1.000	-6.771	6.021
	None	Moderate	-1.94	1.52	1.000	-6.066	2.191
	None	Strict	-3.03	1.55	0.332	-7.252	1.194
	Light	Moderate	-1.56	2.04	1.000	-7.102	3.977
	Light	Strict	-2.65	2.06	1.000	-8.264	2.956
	Moderate	Strict	-1.09	1.01	1.000	-3.849	1.666
WHR	None	Light	-0.06	0.04	0.999	-0.180	0.058
	None	Moderate	-0.04	0.03	0.914	-0.118	0.036
	None	Strict	-0.05	0.03	0.66	-0.126	0.032
	Light	Moderate	0.02	0.04	1.000	-0.083	0.124
	Light	Strict	0.01	0.04	1.000	-0.090	0.119
	Moderate	Strict	-0.01	0.02	1.000	-0.057	0.046
BF	None	Light	13.75	4.90	0.039	0.433	27.067
	None	Moderate	4.78	3.16	0.810	-3.815	13.378
	None	Strict	1.58	3.23	1.000	-7.215	10.369
	Light	Moderate	-8.97	4.24	0.229	-20.502	2.564
	Light	Strict	12.17	4.29	0.036	-23.853	-0.493
	Moderate	Strict	-3.20	2.11	0.803	-8.946	2.538
VF	None	Light	-2.13	1.73	1.000	-6.830	2.580
	None	Moderate	-2.03	1.12	0.44	-5.068	1.006
	None	Strict	-1.09	1.14	1.000	-4.193	2.020
	Light	Moderate	0.09	1.50	1.000	-3.981	4.168
	Light	Strict	1.04	1.52	1.000	-3.088	5.165
	Moderate	Strict	0.94	0.75	1.000	-1.084	2.973

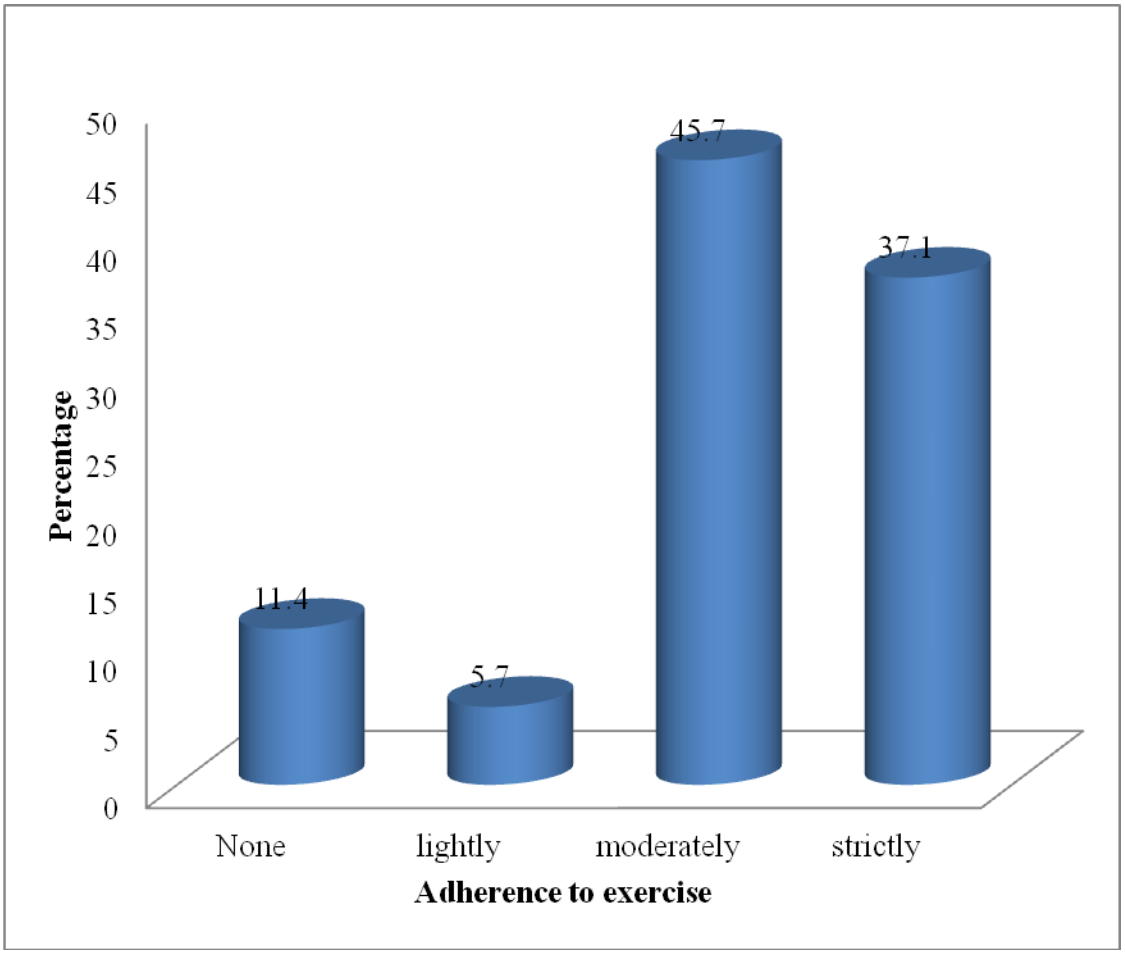

Figure 4.3 Distributions for participant's adherence to exercise

4.5.1 Challenges to Adherence to Exercise

Participants reported on a number of challenges towards adhering to exercise regimen recommended by the dietitian. Nearly a quarter of participants (24.3%) reported busy work schedule, 10% stated lack of exercise partner, and 2.9% stated that they were shy of criticism from friends and passers-by when carrying out the exercise routine. Majority (41.4%) of the participants reported they had no challenges towards adhering to the prescribed exercise regimen.

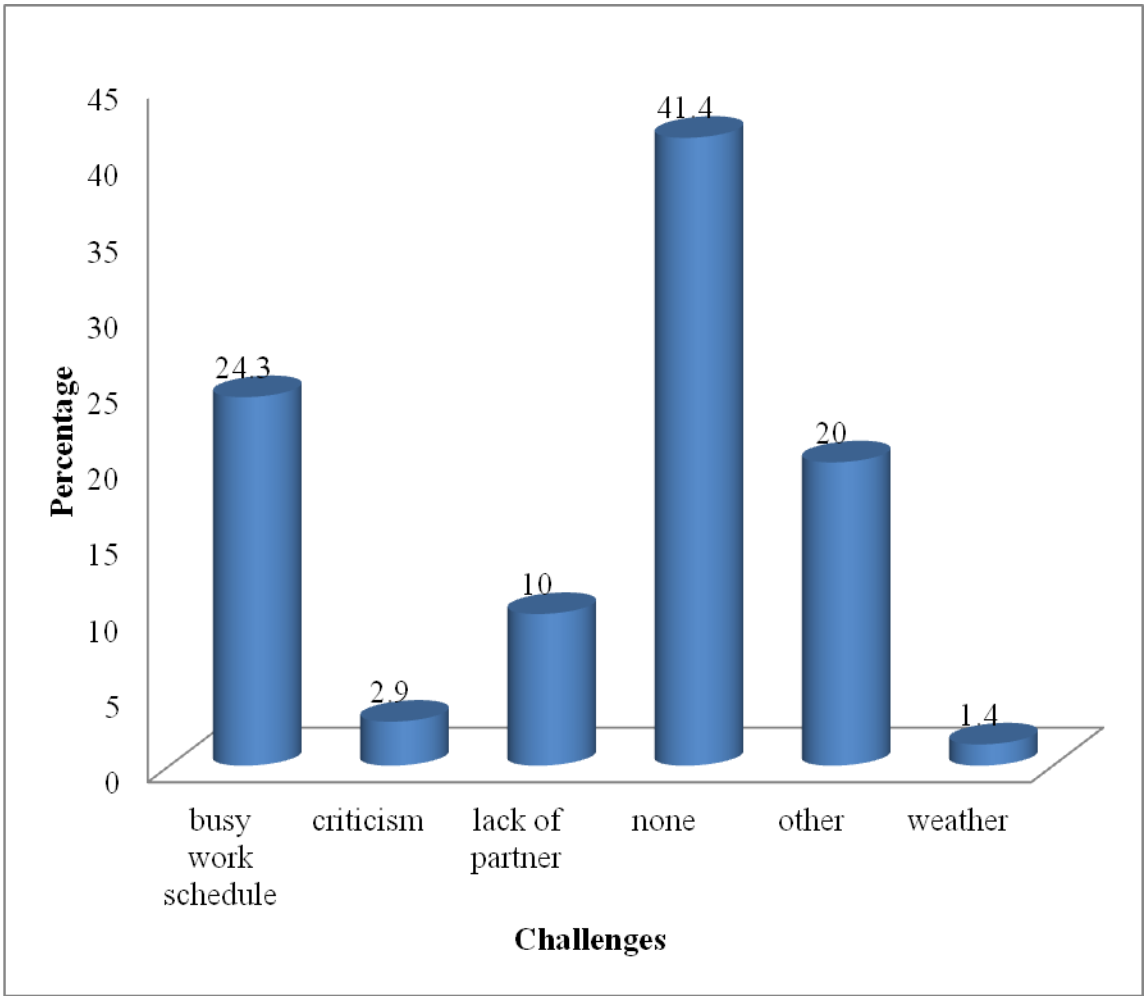

Figure 4.4 Distributions for challenges to adherence to exercise

4.6 Changes in Anthropometric measurements and Adherence to Number of Visits

Mean and standard deviations were computed for the five main anthropometric measurements at weekly, fortnightly and monthly. Overall, four anthropometric measurements (Weight, BMI, BF and WHR) had a steady decrease in their mean levels from monthly to weekly visits. However, the mean level of WHR (0.91) remained unchanged over a week and fortnight. Analysis of variance was used to determine any

statistically significant differences in the mean levels of the five anthropometric variables across the various visiting times. There was significant difference in the mean levels of BF (p=0.007) across the visit times. However, no significant differences were found in the mean levels of WHR, Weight, BMI and VF (p> 0.05) across the visits. (Table4.6). Post hoc analysis of the ANOVA using Bonferroni showed significant mean differences between weekly and fortnight visits for (p=0.015) BF. All other pairings were not significant for the other anthropometric measurements across the visits. (Table 4.7)

Table 4.6 Anthropometric measurements and Adherence to Visits

		Sum of Squares	Df	Mean Square	F-value	P-value
Weight	Between Groups	999.893	2	499.94	2.846	0.065
	Within Groups	11767.878	67	175.64		
	Total	12767.771	69			
BMI	Between Groups	57.221	2	28.61	1.944	0.151
	Within Groups	986.05	67	14.71		
	Total	1043.271	69			
WHR	Between Groups	0.021	2	0.01	2.069	0.134
	Within Groups	0.333	67	0.00		
	Total	0.353	69			
BF	Between Groups	670.254	2	335.12	5.327	0.007
	Within Groups	4215.018	67	62.91		
	Total	4885.271	69			
VF	Between Groups	18.896	2	9.45	1.171	0.316
	Within Groups	540.547	67	8.07		
	Total	559.443	69			

Table 4.7 Post Hoc Analysis (Bonferroni) for the various anthropometric measurements

Bonferroni							
Variable	**(I) code**	**(J) code**	**Mean Diff**	**SE**	**P-value**	**95% C.I.**	
Weight	Weekly	Fortnightly	-2.18	3.68	1.000	-11.216	6.849
	Weekly	Monthly	-9.75	4.11	0.061	-19.842	0.333
	Monthly	Fortnightly	7.57	4.48	0.287	-3.430	18.573
BMI	Weekly	Fortnightly	-1.03	1.06	1.000	-3.643	1.587
	Weekly	Monthly	-2.31	1.19	0.168	-5.234	0.606
	Monthly	Fortnightly	1.29	1.30	0.975	-1.899	4.470
WHR	Weekly	Fortnightly	0.00	0.02	1.000	-0.048	0.048
	Weekly	Monthly	-0.04	0.02	0.183	-0.095	0.012
	Monthly	Fortnightly	0.04	0.02	0.247	-0.017	0.101
BF	Weekly	Fortnightly	-6.40	2.20	0.015	-11.808	-0.996
	Weekly	Monthly	-5.87	2.46	0.059	-11.906	0.169
	Monthly	Fortnightly	-0.53	2.68	1.000	-7.118	6.051
VF	Weekly	Fortnightly	0.96	0.79	0.686	-0.978	2.894
	Weekly	Weekly	-0.40	0.88	1.000	-2.566	1.758
	Monthly	Fortnightly	1.36	0.96	0.482	-0.996	3.720

4.7 Anthropometric measurements and comorbidity

Figure 4.6 shows the proportion of participants with various health conditions. The most common comorbidities of participants were dyslipidemia and hypertension. Approximately 29% of the participants on weight loss regime were hypertensive or diabetic. And 27.1% of the participants had dyslipidemia. Weight loss patients with no other health condition were few (5.7%). The Independent t-test was used to determine the existence of significant changes in mean levels of all five anthropometric measurements for those who had comorbidity compared to those who did not have. No

significant differences were observed in the mean levels of all five anthropometric variables (p>0.05) between the two groups.

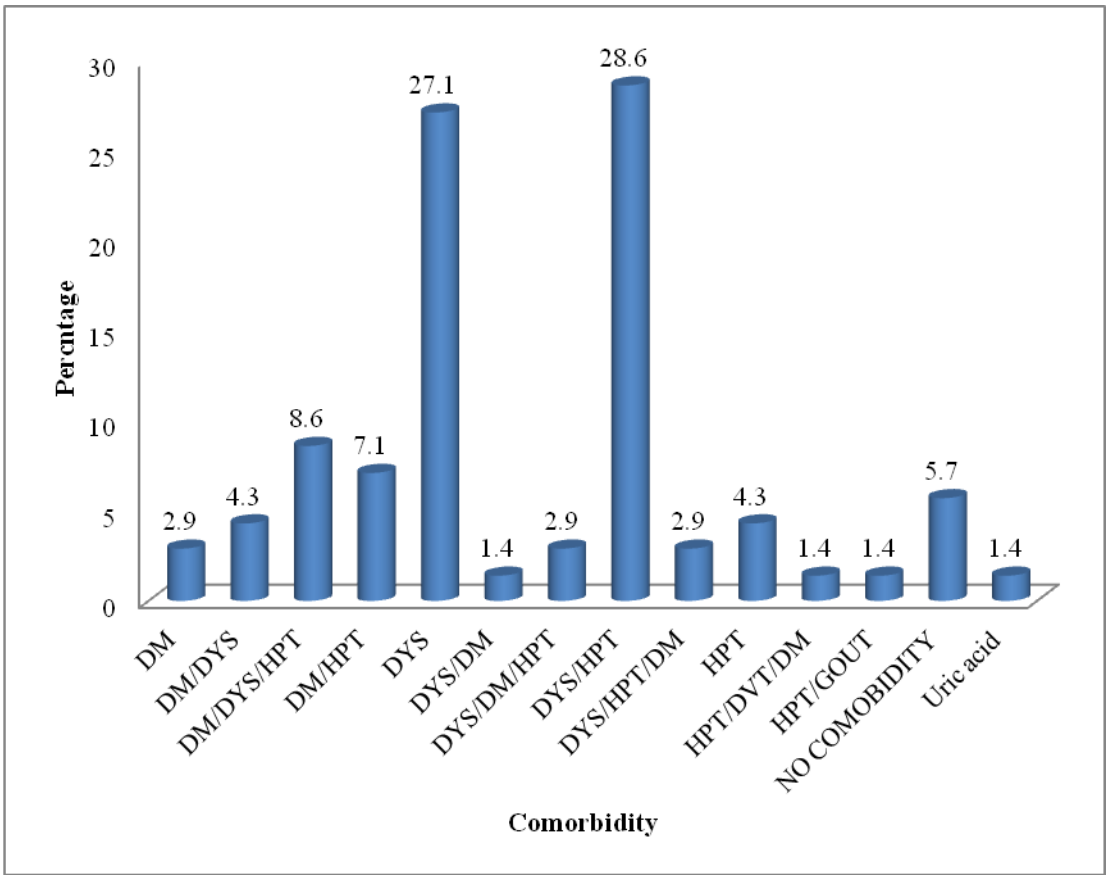

Figure 4.5 Distributions for Comorbidity of Respondents

Table 4.8 anthropometric measurements and comorbidity

		N	Mean	SD	P-value	95% C.I.	
Weight	Comorbidity	66	86.09	13.25			
	None	4	86.00	11.49	0.989	-17.462	17.643
BMI	Comorbidity	66	32.15	3.40			
	None	4	33.00	5.42	0.776	-9.346	7.649
WHR	Comorbidity	66	0.90	0.08			
	None	4	0.88	0.05	0.505	-0.059	0.100
BF	Comorbidity	66	42.00	8.68			
	None	4	47.50	4.93	0.106	-12.809	1.809
VF	Comorbidity	66	11.42	2.90			
	None	4	10.00	3.27	0.452	-3.637	6.486

CHAPTER FIVE

DISCUSSION

5.1 Socio-Demographic Characteristics

The aim of this study was to investigate the effectiveness of dietary and lifestyle intervention prescribed to weight loss patients who attend the diet therapy department in a private hospital in Accra. This study sampled more females than males giving a female to male ratio of 2:1.

This confirms a report by Gibbs (2007) who stated that women are more likely to use general health services than men. Biritiwum (2005) also reported that obesity was higher in females than males in Ghana and this may account for the higher proportion of females in this study.

Findings of the study by Amoah (2003) reported that obesity increased with age up to 64 years, and was highest among the Akan and Ga tribes and relatively low among Ewes. Findings from this present study agree with Amoah's findings on the prevalence of obesity in ethnic groups in Ghana.

Participants with tertiary education had the highest prevalence of obesity compared with the other literate (junior high school, senior high school and post graduate school) and illiterate (vocational training) groups. This finding also correlates with the findings of Amoah (2003).

5.2 The Dietitian's Strategy

One of the objectives of this study was to determine the strategy adopted by the dietitian in achieving weight loss and to evaluate the effectiveness of this strategy. Findings from this study reported that the dietitian adopted the low calorie, low fat, low carbohydrate and high fibre diet with an exercise regimen.

The dietitian recorded significant weight loss of participants at six months post intervention. Other anthropometric measurements such as body mass index (BMI), visceral fat (VF) and body fat (BF) were also evaluated. There were significant changes in the body mass index (BMI) of participants at six months post intervention, but the changes recorded for the visceral fat (VF) and body fat (BF) were not significant at six months post intervention.

Findings from this present study match the findings of Gary *et al* (2010) on 307 obese participants with mean body mass index of 36.1kg/m^2. Who reported that the low calorie, low carbohydrate, low fat diet is effective at achieving significant weight loss at 6 months to 2 years post intervention.

Another study conducted in Philadelphia by Frederick *et al* (2003), randomly assigned severely obese participants (including 77 blacks and 23 women) with a mean body mass index of 43 kg/m^2 to a low calorie, low carbohydrate, low fat diet, and observed significant weight loss at six months post intervention. These findings also agree with the findings of this present study.

Bravata *et al* (2003) carried out a systemic review on articles describing adult, outpatient recipients on low carbohydrate and low calorie diets. He gathered 107, which

described 94 dietary interventions reporting data for 3268 participants, of which 663 participants received low carbohydrate diets.

The study found insufficient evidence to make recommendations for or against the use of low carbohydrate diets, particularly among participants older than 50 years, for use longer than 90 days. Neither did they find sufficient evidence to prescribe or recommend low carbohydrates.

Among the published studies, participant's weight loss while using low carbohydrate diets was principally associated with decreased caloric intake and increased diet duration but not with reduced carbohydrate content. Hence the study did not see any need to place the patient on a low carbohydrate diet while on the low calorie diet. This report is contrary to the findings of this present study.

5.3 Anthropometry of Participants

This study collected data of anthropometric measurements (weight, BMI, BF, VF) at baseline, 3 months and 6 months post intervention, following the low calorie, low carbohydrate, low fat and high fibre diet. Significant changes were observed in weight and BMI of the participants at six months post intervention. However, there were no significant changes in body fat, waist hip ratio and visceral fat of the participants at six months post intervention. Some studies achieved the same significant weight loss at six months post intervention following the low calorie, low carbohydrate, low fat and high fibre diets either independently or in combination with the other (Zora *et al*., 2002; Newby *et al*., 2004).

The study by Zora *et al* (2002) examined the effects of dietary counseling strategies for low calorie and/or low fat diets on anthropometric measures in 86 pre-menopausal women, with average BMI of 28 kg/m^2, who participated in a trial called the Women's Diet Study.

Participants placed on the combination of low calorie and low fat diets resulted in the most weight loss than participants who were placed on either low fat or low calorie diets. The decreases in weight and body mass index (BMI) were statistically significant, but the percent body fat (BF) and waist circumference (WC) were not statistically significant.

This findings agree with the findings from this present study this study that reported that decreases in percentage body fat (BF) and waist hip ratio (WHR) were not significant following the low carbohydrate, low fat, low calorie and high fibre diet at six months post intervention.

A longitudinal study conducted in Baltimore, sampled 459 healthy men and women, who were on a high fibre and low fat diet. The study observed smaller gains in BMI in women and smaller gains in waist circumference (WC) in both women and men (Newby *et al*., 2004). Findings from this study showed that weight loss can be sustained following a low fat, high fibre diet.

However, Papadaki *et al* (2013) in a large scale, family-based, randomized, controlled dietary intervention carried out in eight European cities (from Northern, Central and Southern Europe) reported significant changes in all anthropometric measurements that were evaluated (weight, BMI, BF, WHR), which is contrary to the findings from this

present study that observed significant changes only in weight and body mass index (BMI) of participants.

5.4 Participants Adherence to Number of Visits and Challenges to Diet

The dietitian scheduled routine follow-up visits for the participants after their initial visit. Follow–up appointments differed for participants and were based on level of adherence and improvement in weight loss.

Findings from this study showed that patients who visited the dietitian weekly and fortnightly had significant changes in their body fat compared to patients who visited the dietitian monthly. This is because participants, who visited weekly-discussed weekly challenges with the dietitian, hence were more likely to adhere to the dietary regimen using weekly guidelines, advice and encouragements from the dietitian.

These findings supports the recommendations of the Academy of Nutrition and Dietetics, (2002), which recommended that successful weight loss require ongoing encouragement and support from the weight management team.

The success of dietary interventions is dependent on participant's level of adherence to the intervention prescribed. Adherence to dietary guidelines is associated with significantly better health outcomes (Martin *et al*., 2005). Drewnowski and Specter, (2004) reported that overweight and obese adults were less likely to comply with dietary recommendations. Contrary to this report, this present study found favourable levels of adherence to diet by the participants. Participants who adhered strictly (20%) and moderately (55%) to the dietary regimen were higher than participants who adhered lightly to the dietary regimen prescribed by the dietitian.

Certain challenges affected strict adherence to the diet and were reported by the participants. The most common challenge was busy work schedule, some participants reported that their work schedule made it difficult for them to make healthy food choices and eat 3 main meals a day. Eating out ranked second among the challenges, participants reported the nature of their jobs made it difficult for them to eat healthy home cooked meals, rather they relied on fast foods and restaurants known to serve unhealthy foods high in saturated and trans fat. Granting self-permission also ranked second among the challenges, this challenge was also very common among the participants. They engaged in self-rewards with unhealthy food choices such as pastries, fried meat, alcohol, after adhering strictly to the prescribed diet for a period of time.

Situation at home ranked among the third challenge reported by the participants, some participants reported cooking and eating from the same pot with the rest of the family a challenge, since they were not all adhering to the same dietary regimen. Participants were tempted with foods they were to avoid because it was cooked in the house. However, some participants reported their challenges to be a lack of understanding of the dietitian's dietary guidelines and recommendations. Dietary adherence has been found to be strongly associated with rates of weight loss and adversely affected by the severity of caloric restriction (Warziski *et al*, 2008; Del *et al*, 2009), and this has been confirmed in this present study.

5.5 Participants Adherence and Challenges to Exercise

Findings from this study showed that, the level of adherence to exercise was higher than the level of adherence to diet. Despite this high level of adherence to exercise, some of

the participants still had challenges adhering to the exercise regimen. However, the proportion (17.1%) of participants who had challenges adhering to exercise regimen were less than the proportion (24.3%) who had challenges adhering to the dietary regimen.

Busy work schedule was the most common challenge that was reported by the participants who had challenges with exercise. Participants who adhered to the exercise regimen had significant differences in their body fat (BF) at 6 months post exercise regimen. Some studies have also reported similar findings (Brian *et al*., 2008; Imayama *et al*., 2013).

Imayama *et al*, (2013) examined the associations of adherence to exercise and physiological improvements with changes in exercise self-efficacy. The study recruited 202 middle-aged adults to 12 months aerobic exercise. Weight, waist circumference (WC), percent body fat (BF) and exercise self-efficacy were assessed at baseline and 12 months. There were significant changes in weight, waist circumference (WC) and percent body fat (BF) at 12 months following a strict adherence to exercise.

In another study by Brain *et al* (2008), twenty-seven middle-aged (42-60 years), obese women (30-40kg/m^2) were sampled to an exercise intervention. This study showed significant reduction in total abdominal fat of participants adhering to the high intensity exercise. There were no significant changes observed in participants who adhered to light intensity exercise. These findings indicate that body composition changes are affected by intensity of exercise training with the high intensity exercise being more effective for reducing total abdominal fat.

Findings from both studies are similar to the present study, which showed that strict adherence to exercise significantly lowered percentage body fat (BF).

5.6 Anthropometric Measurements and Comorbidities

Comorbidity refers to any two or more diseases that occur in one person at the same time. In this study, comorbidity refers to the presence of hypertension (HPT), dyslipidemia (DYS) or diabetes (DM) in combination with one or both of the other diseases.

Anthropometric measurements of participants with comorbidities were evaluated at baseline (first visit to the diet therapy clinic), third month, and sixth month post intervention. Anthropometric changes of participants with comorbidities were compared with that of participants without comorbidities. There were no significant differences in anthropometric changes of participants with comorbidities and those without comorbidities. Both groups recorded a steady decrease in all anthropometric measurements (weight, BMI, BF, WHR, VF).

In a study by Liu *et al* (2013), predictors of weight loss was investigated in 1566 overweight and obese adults who attended Wharton Medical Clinic Weight Management Centre for at least six months. More than half of the participants reported significant weight loss. It also observed that people with diabetes lost as much weight as people without. These findings demonstrate that sufficient weight loss can be achieved in all patients (co-morbidity or no co-morbidity) with clinically effective lifestyle based treatments. Which agrees with the findings of this present study that did not find any

significant difference in the weight loss of co-morbid participants and that of participants without co-morbidity.

In a one year study conducted by Martins *et al* (2010) on morbid obese participants (BMI > 40kg/m^2) with comorbidity, participants were grouped into for weight loss treatment groups; (A) bariatric surgery or to one of three conservative treatments; (B) residential intermittent program; (C) commercial weight loss camp and (D) hospital outpatient program. Body weight, risk factors and comorbidities were assessed at baseline and 1 year.

All treatments resulted in significant weight loss, but bariatric surgery led to the largest weight loss. There were no differences in weight loss between residential intermittent program and commercial weight loss camp. There were no differences in comorbidities resolution between groups A and B, C and D combined. Findings from this study showed that clinically significant weight lost in morbidly obese patients were similar with that of the patients with comorbidities. This also supports the findings from this present study that showed no significant differences in weight loss of obese patients with comorbidities and that of patients without comorbidities.

5.7 Limitations

The data on adherence to dietary and exercise regimen used in this study only relied on self-reports, which is subject to human error of recalling information. Data on anthropometric changes were collected retrospectively; the researcher did not conduct the anthropometric measurements. Hence, data was based on the dietitian's report, which is subject to intervention bias.

5.8 Recommendations

Further studies on the effectiveness of low calorie, low carbohydrate, low fat and high fibre diet with exercise regimen should be carried out by the Ghana Dietetic Association. The study should include a control group, and should be carried out for a longer period to evaluate the effectiveness and maintenance of the weight loss over a long term. The dietitian's strategy should be compared to strategies used by dietitians in public hospitals. The various reasons stated as challenges to adherence to diet and exercise should be considered in dietary and exercise interventions for weight loss. Planned physical activity should be incorporated into the daily work life of participants.

5.9 Conclusion

This study has showed a weight management strategy of incorporating four different diets (low calorie, low carbohydrate, low fat and high fibre diet) into a single diet, and it is effective in achieving weight loss at six months post intervention. Significant and effective weight loss is better achieved when this diet is combined with an exercise regimen. Higher levels of adherence to lifestyle modifications are better achieved with frequent visits to the dietitian. The effectiveness of this weight management strategy seen in this study will promote public health policies on life style modification interventions.

REFERENCES

Abdallah, S.A., Alaa-Eldin, A.F and Naseem, M.A. (2010) Obesity and eating habits among college students in Saudi Arabia: a cross sectional study, *Nutrition Journal*, 9 (39).

Agyemang, C., Owusu-Dabo, E., Jonge, A., Martins, D., Ogedegbe, G. and Stronks, K. (2008) Overweight and obesity among Ghanaian residents in The Netherlands: how do they weigh against their urban and rural counterparts in Ghana? *Public Health Nutrition*, 12 (7), pp. 909-916.

Alan M.D. (2006), Improving Patience Adherence, *Clinical Diabetes*, 24 (2), pp. 71-77.

Albertini, G., Davidson, P.W., Henderson, C.M., Robinson, L.M., Haverman, M. and Janick, M.P. (2008) Overweight status, obesity and risk factors for coronary heart disease in adults with intellectual disability, *Journal of Policy & Practice in Intellectual Disabilities*, 5(3), pp.174-177.

American Dietetic Association (2002) Weight management, *Journal of the American Dietetic Association*, 102 (8).

Amoah, A.G. (2003) Socio-demographic variations in obesity among Ghanaian adults, *Public Health Nutrition*, 6(8), pp. 751-757.

Astrup, A., Grunwald, G., Melanson, E., Saris, W. and Hill, J. (2000) The role of low-fat diets in body weight control: a meta-analysis of ad libitum dietary intervention studies, *Int J Obes Relat Metab Disord*, 24, pp. 1545–1552.

Benkeser, R.M., Biritwum, R. and Hill, A.G. (2012), Prevalence of overweight and obesity, and the perception of healthy and desirable body size in urban Ghanaian women, *Ghanaian medical journal*, l 46 (2).

Bethesda, M. (2000) National Institutes of Health/National Heart Lung and Blood Institute, North American Association for the Study of Obesity: practical guide to the identification, evaluation, and treatment of overweight and obesity in adults, National Institutes of Health.

Biritwum, R., Gyapong, J. and Mensah, G. (2005), The epidemiology of obesity in Ghana, *Ghana Med Journal*, 39(3), pp. 82-85.

Blair, S.N. and Leermakers, E.A. (2002) Exercise and weight management, in: Wadden, T.A. and Stunkard, A.J. (eds.) *Handbook of Obesity Treatment*. New York: Guilford Press. Pp. 283–300.

Boden, G., Sargrad, K., Homko, C., Mozzoli, M. and Stein, T.P. (2005) Effect of a low-carbohydrate diet on appetite, blood glucose levels, and insulin resistance in obese patients with type 2 diabetes, *Ann Intern Med* ,142, pp. 403–411.

Bosu, W.K. (2007), 'Ghana's national NCD programme', on History, prospects and challenges: *Proceedings of the First Annual Workshop British Academy UK Africa Academic Partnership on Chronic Disease in Africa, Noguchi Memorial Institute for Medical Research.*

Bravata, D.M., Sanders, L., Huang, J., Krumholz, H.M., Olkin, I. and Gardner, C.D. (2003) Efficacy and safety of low-carbohydrate diets: a systematic review, *JAMA*, 289(14), pp. 1837-50.

Bray, G.A. and Poplin, B.M. (1998) Dietary fat intake does affect obesity, *Am J Clin Nutr* , 68, pp. 1157–1173.

Brehm, B., Seeley, R., Daniels, S. and D'Alessio, D.(2003) A randomized trial comparing a very low carbohydrate diet and a calorie-restricted low fat diet on body weight and cardiovascular risk factors in healthy women, *J Clin Endocrinol Metab*, 88 (55), pp. 1617–1623.

Brian, A. I., Christopher, K. and Weltman, A. (2008) Effect of exercise training intensity on abdominal visceral fat and body composition, *Med Sci Sports Exerc*., 40(11), pp. 1863–1872.

Candib, M.L. (2007) Obesity and diabetes in vulnerable populations: reflection on proximal and distal causes, *Annals of Family Medicine*, 5(6), pp. 547-556.

Cappuccio, F.P., Kerry, S.M., Adeyemo, A., Luke, A., Amoah, A.G., Bovet, P., Connor, M.D., Forrester, T., Gervasoni, J.P. and Kaki, G.K. (2008) Body size and blood pressure: an analysis of Africans and the African diaspora, *Epidemiology*, 19(1), pp. 38-46.

Carmody, R. and Wrangham, R.W (2009) The energetic significance of cooking, *Journal of Human Evolution*, 57, pp. 379–391.

Cummings, S., Parham, E.S. and Strain, G.W. (2002) Position of the American Dietetic Association: weight management, *Journal of American Dietetic Association*, 102 (8), pp.1145-55.

Daar, A.S., Singer, P.A., Persad, D.L., Pramming, S.K., Matthews, D.R., Beaglehole, R., Bernstein, A., Borysiewicz, L.K., Colagiuri, S., Ganguly, N., Glass, R.I., Finegood, D.T., Koplan, J., Nabel, E.G., Sarna, G., Sarrafzadegan, N., Smith, R., Yach, D. and Bell, J. (2007) Grand challenges in chronic non-communicable diseases, *Nature*, 450(20), pp. 494-496.

Dam, R.M. and Seidell, J.C. (2007) Carbohydrate intake and obesity, *European Journal of Clinical Nutrition*, 61, pp. 75–99.

Dansinger,M.L., Gleason, J.A., Griffith, J.L., Selker, H.P. and Schaefer, E.J. (2005) Comparison of the Atkins, Ornish, Weight Watchers, and Zone diets for weight loss and heart disease risk reduction: a randomized trial. *JAMA*, 293, pp. 43-53.

Delamater, A.M. (2006) Improving Patient Adherence, *Clinical Diabetes*, 24(2), pp.71-77.

Denis, L., Nathalie, A., Sandrine, B., Richard, P., Enora, C., S, Hercberg., and Marie-Christine B.(2005) Dietary fiber intake and risk factors for cardiovascular disease in French adults, *American Journal of Clinical Nutrition*,82 (6), pp. 1185-1194.

Dennis, B.H., Pajak, A., Pardo, B., Davis, C.E., Williams, O.D. and Piotrowski, W. (2000) Weight gain and its correlates in Poland between 1983 and 1993. *International Journal of Obesity and Related Metabolic Disorder*, 24(11), pp 1507-1513.

Doak, C.M., Adair, L.S., Bentley, M., Monteiro, C. and Popkin, B.M. (2005) The dual burden household and the nutrition transition paradox, *International Journal of Obesity (London)*, 29(1), pp. 29-36.

Donnelly, J.E., Blair, S.N., Jakicic, J.M., Manore, M.M., Rankin, J.W. and Smith, B.K. (2009) Appropriate physical activity intervention strategies for weight loss and prevention of weight regain for adults, *American College of Sports Medicine*, pp. 459-471.

Drewnowski, A., Almiron-Roig, E., Marmonier, C. and Lluch, A. (2004). Dietary energy density and body weight: is there a relationship? *Nutr Rev*, 62, pp. 403–413.

Drewnowski, A. and Specter, S.E. (2004) Poverty and obesity: the role of energy density and energy costs *Am J Clin Nutr*, 79 (1), pp. 6-16.

Duda, R., Jumah, N.A., Hill, A.G., Seffah, J. and Biritwum, R. (2007) Assessment of the ideal body image of women in Accra, Ghana, *Tropical Doctor*, 37(4), pp. 241-244.

Eric, C.W, Richard, D. F., John, C. M., Mary, C. V., Jeff, S. V., James, A.W., Yancy, W. and Stephen, D. P.(2007) Low-carbohydrate nutrition and metabolism 1–3, *Am J Clin Nutr*; 86, pp. 276–84.

Esposito, K., Ziccardi, P., Nappo, F., Giugliano, G., Marfella, R., Cioffi, M., D'Andrea, F.,Molinari, A.M. and Giugliano, D. (2002) Reduction of inflammatory cytokine concentrations and improvement of endothelial functions in obese women after weight loss over one year, *Circulation*, 105, pp. 804–809.

Esposito, K., Marfella, R., Ciotola, M., Di Palo, C., Giugliano, F., Giugliano, G. et al (2004) Effect of a mediterranean-style diet on endothelial dysfunction and markers of vascular inflammation in the metabolic syndrome: a randomized trial, *JAMA*, 292, pp.1440–1446.

Fabricatore, A.N. and Wadden, T.A. (2003) Treatment of obesity: an overview: *Clinical Diabetes*, 21 (2), pp. 67-72.

Fezeu, L.K., Assah, F.K., Balkau, B., Mbanya, D.S., Kenge, A., Awah, P.K. and Mbanya, J.N. (2008) Ten-year changes in central obesity and BMI in rural and urban Cameroon. *Obesity*, pp. 1144-1147.

Flegal, K.M., Carroll, M.D., Ogden, C.L. and Curtin, L.R. (2010) Prevalence and trends in obesity among US adults, *JAMA*. 303, pp. 235–241.

Foster, G.D., Wyatt, H.R., Hill, J.O., McGuckin, B.G., Brill, C., Mohammed, B.S., Szapary, P.O., Rader, D.J., Edman, J.S. and Klein, S. (2003) A randomized trial of a low-carbohydrate diet for obesity, *New England Journal of Medicine*, 348, pp. 2082–2090.

Franz, M.J., Bantle, J.P., Beebe, C.A., Brunzell, J.D., Chiasson, J.L., Garg, A., Holzmeister, L.A., Hoogwerf, B., Mayer-Davis, E., Mooradian, A.D., Purnell, J.Q. and Wheeler, M. (2003) Evidence-based nutrition principles and recommendations for the treatment and prevention of diabetes and related complications, *Diabetes Care*, 26 (1), pp. 51–61.

Frederick, F., Samaha, Nayyar, I., Prakash, S., Kathryn, L., Chicano, Denise, A., Joyce, M., Terrence, W., Monica, W., Edward, J.G. and Linda, S. (2003) A low-carbohydrate as compared with a low-fat diet in severe obesity, *New England Journal of Medicine*, 348, pp. 2074-2081.

García, A.L., Wagner, K., Einig, C., Trippo, U., Koebnick, C. and Zunft, H. J. (2006) Evaluation of body fat changes during weight loss by using improved anthropometric predictive equations, *Ann Nutr Metab*,50(3), pp. 297-304.

Gardner, C.D., Kiazand, A., Alhassan, S., Kim, S., Stafford, R.S., Balise, R.R. et al (2007) Comparison of the Atkins, Zone, Ornish, and LEARN diets for change in weight and related risk factors among overweight premenopausal women: the A TO Z weight Loss Study: a randomized trial. *JAMA*, 297, pp. 969–977.

Garrett, J.L. and Ruel, M.T. (2003) *Stunted child-overweight mother pairs: an emerging policy concern*, FCND discussion paper No.148

Gibbs, L. (2007) Identifying work as a barrier to men's access to chronic illness (arthritis) self-management programs, *International Journal of Men's Health*, 6 (2).

Hall, K.D., Sacks, G., Chandramohan, D., Chow, C.C., Wang, Y.C., Gortmaker, S.L. and Swinburn, B.A. (2011) Quantification of the effect of energy imbalance on bodyweight, *The Lancet*. 378(9793), pp. 826-37.

Han, T.S., Seidell, J.C., Currall, J.E., Morrison, C.E., Deurenberg, P. and Lean, M.E. (1997) The influences of height and age on waist circumferences as an index of adiposity in adults. *Int J Obes Re- lat Metab Disord*, 21, pp. 83-89.

Haskell, W.L., Lee, I.M., Pate, R.R., Powell, K.E., Blair, S.N., Franklin, B.A., Macera, C.A., Heath, G.W.,Thompson, P.D. and Bauman, A. (2007) Physical activity and public health: updated recommendation for adults from the American College of Sports Medicine and the American Heart Association, *Med Sci Sports Exerc*., 39, pp. 1423–1434.

Hayes, C. and Kriska, A. (2008) Role of physical activity in diabetes management and prevention, *Journal of American Dietetic Association*, 108, pp. 19– 23.

Hermanus A.R., Catharina C.G., Margaretha, V. (2012) Overweight and obesity in children and adolescents: The South African problem, *South Africa Journal of Science.*, 108(5), pp.7.

Heymsfield, S.B., Harp, J.B., Reitman, M.L., Beetsch, J.W., Schoeller, D.A., Erondu, N. and Pietrobelli, A. (2007) Why do obese patients not lose more weight when treated with low-calorie diets? a mechanistic perspective, *American Journal of Clinical Nutrition*, 85, pp. 346 – 354

Imayama, I., Alfano, C.M., Mason, C.E., Wang, C., Xiao, L., Duggan, C., Campbell, K.L., Foster-Schubert, K.E., Wang, C.Y. and McTiernan, A.(2013) Exercise adherence, cardiopulmonary fitness and anthropometric changes improve exercise self-efficacy and health-related quality of life, *J Phys Act Health*, 10(5), pp. 676-689.

Iris, S., Dan, S. and Yaakov, H. (2008) Weight loss with a low-carbohydrate, Mediterranean, or low-fat diet, *New England Journal of Medicine,* 359, pp. 229-241.

Jardine, G. (2010) Diabetes Education: Obesity and dietary behavioural changes, 15 (2), pp. 88.

Jeffery, R.W., Drewnowski, A., Epstein, L.H., Stunkard, A.J., Wilson, G.T., Wing, R.R. and Hill, D.R. (2000) Long-term maintenance of weight loss: current status, *Health Psychol.*, 19(1), pp. 5.

Jenkins, D.J., Jebkins, A.L., Wolever, T.M. (1994) Low glycemic index: lente carbohydrates and physiological effects of altered food frequency, *Am J Clin Nutr*, 59 (3), pp. 706S–9S.

Keim, N.L., Van, Loan., Horn, W.F. (1997) Weight loss is greater with consumption of large morning meals and fat-free mass is preserved with large evening meals in women on a controlled weight reduction regimen, *J Nutr,* 127, pp.75–82.

Kissebah, A.H. and Krakower, G.R. (1994) Regional adiposity and morbidity, *Physiol Rev* ,74, pp. 761-811.

Knowler, W.C., Barrett-Connor, E., Fowler, S.E., Hamman, R.F., Lachin, J.M., Walker, E.A. and Nathan, D.M. (2002) Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin, *The New England Journal of Medicine,* 346, pp. 393–403.

Krauss, R.M., Eckel, R.H. and Howard, B. *et al.* (2000) AHA dietary guidelines: revision 2000: a statement for healthcare professionals from the Nutrition Committee of the American Heart Association. *Circulation,* 102, pp. 2284-2299.

Kraus, W.E., Houmard, J.A., Duscha, B.D., Knetzger, K.J., Wharton, M.B., McCartney, J.S., Bales, C.W., Henes, S., Samsa, G.P., Otvos, J.D., Kulkami, K.R. and Stentz, C.A. (2002) Effects of the amount and intensity of exercise on plasma lipoproteins, *The New England Journal of Medicine*, 347, pp. 1483– 1492.

Kumar, P. and Clark, M. (2009) Nutrition, in: Kumar and Clark (eds.) Kumar & Clark *Clinical Medicine*. 7th ed.UK: Saunders Elsevier, pp. 228-229.

Leskinen, T., Sipilä, S., Alen, M., Cheng, S., Pietiläinen, K.H., Usenius, J.P., Suominen, H., Kovanen,V., Kainulainen, H., Kaprio, J. and Kujala,U.M.(2009) Leisure-time physical activity and high-risk fat: a longitudinal population-based twin study: Long-term physical activity and high-risk fat, *International Journal of Obesity*, 33, pp. 1211-1218

Levy, J., Rimmerman, A. and Sohler, N. (2009) Factors associated with obesity and coronary heart disease in people with intellectual disabilities, *Social Work in Health Care* ,48 (1), pp.76-89.

Lindsay,R.S., Hanson,R.L., Roumain,J., Ravussin,E., Knowler, W. C. and Tataranni, P.A., (2001) Body mass index as a measure of adiposity in children and adolescents: relationship to adiposity by dual energy x-ray absorptiometry and to cardiovascular risk factors, *The Journal of Clinical Endocrinology & Metabolism*, 86 (9), pp. 4061-4067.

Linke, S.E., Gallo, L.C. and Norman, G.J. (2011) attrition and adherence rates of sustained vs. intermittent exercise interventions, *Annals of behavioural Medicine,* 42(2), pp. 197-209.

Liu, R.H., Wharton, S., Sharma, A.M., Ardern, C.I. and Kuk, J. L. (2013) Difference in weight loss based on ethnicity, age and comorbidity status in a publicly funded adult weight management centre: 1-year results, *Clinical Obesity*, 3(1), pp. 21-31.

Logue, E., Sutton, K., Jarjoura, D. and Smucker, W. (2000) Obesity management in primary care: assessment of readiness to change among 284 family practice patients, *Journal of The American Board of Family Practice* ,13, pp. 164–171.

Mahan,L.K., Escot-stump, S., and Krause (2012) *Food, Nutrition and Diet Therapy*. 13th ed. Philadelphia: W.B. Saunder Co., pp. 473-475.

Maher, D., Ford, N. and Unwin, N. (2012) Priorities for developing countries in the global response to non-communicable diseases, *Globalization and Health* 2012, 8, pp14.

Malik, V.S. and Hu, F.B. (2007) Popular weight-loss diets: from evidence to practice, *Nat Clin Pract Cardiovasc Med,* 4, pp. 34-41.

Martin, L.R., Williams, S.L., Haskard, K.B and DiMatteo,M.R (2005) The challenge of patient adherence, *Ther Clin Risk Manag*, 1(3), pp.189–199.

Martínez-González, M.A., Martínez, J.A., Hu, F.B., Gibney, M.J., Kearney, J. (1999) Physical inactivity, sedentary lifestyle and obesity in the European Union, *lnternational Journal of Obesity and Related Metabolic Disordorder,* 23(11), pp. 1192-1201.

Mayer-Davis, E., Franz, M.J., Bantle, J.P., Beebe, C.A., Brunzell, J.D., Chiasson, J.L., Garg, A., Holzmeister, L.A., Hoogwerf, B., Mooradian, A.D., Purnell, J.Q. and Wheeler, M. (2003) Evidence- based nutrition principles and recommendations for the treatment and prevention of diabetes and related complications, *Diabetes Care*, 26 (1), pp.51–61.

McAuley, K.A., Hopkins, C.M., Smith, K.J., McLay, R.T., Williams, S.M., Taylor, R.W. and Mann, J.I. (2005) Comparison of high-fat and high-protein diets with a high-carbohydrate diet in insulin-resistant obese women, *Diabetologia*, 48(5), pp.1033.

Meckling, K.,O'Sullivan, C. and Saari, D. (2004) Comparison of a low-fat diet to a low-carbohydrate diet on weight loss, body composition, and risk factors for diabetes and cardiovascular disease in free-living, overweight men and women, *J Clin Endocrinol Metab* , 89, pp. 2717–2723.

Mertens, L., van-Gaal, L.F. (2000) Overweight, obesity, and blood pressure: the effects of modest weight reduction, *Obesity Research Journal*, 8 (3), pp. 270–278.

Metz, J.A., Stern, J.S., Kris-Etherton, P., Reusser, M.E., Morris, C.D., Hatton, D.C., Oparil, S., Haynes, R.B., Resnick, L.M., Pi-Sunyer, F.X., Clark, S., Chester, L., McMahon, M., Snyder, G.W. and McCarron, D.A. (2000) A randomized trial of improved weight loss with a prepared meal plan in over- weight and obese patients: impact on cardiovascular risk reduction, *Arch Intern Medicine Journal*, 160, pp. 2150–2158.

Miller, B., Bertino,J., Reed,R. *et al* (2003) An evaluation of the Atkins' diet, *Metabol Syndr Relat Disord* ,1, pp. 299 –309.

Moghaddasi,M.S. and Kashani, H.H.(2012) Effect of tea in the treatment of obesity, *Scientific Research and Essays*, 7(13), pp. 1381-1384.

Mora, S., Cook, N., Buring, J.E., Ridker, P.M. and Lee, I.M. (2007) Physical activity and reduced risk of cardiovascular events: potential mediating mechanisms, *Circulation*, 116, pp. 2110 - 2118.

Newby, P., Muller, D., Hallfrisch, J., Andres, R. and Tucker, K. (2004) Food patterns measured by factor analysis and anthropometric changes in adults 1–3, *Am J Clin Nutr*, 80, pp. 504–513.

Nickols-Richardson, S.M., Coleman, M.M., Volpe, J.M. and Hosig, K.W.(2005) Perceived hunger is lower and weight loss is greater in overweight pre-menopausal women consuming a low-carbohydrate/high-protein vs high-carbohydrate/low-fat diet, *Journal of American Dietetic Association*,105, pp.1433–1437.

Nordmann, A.J., Nordmann A, Briel, M., Keller, U., Yancy, W.S., Brehm, B.J., Bucher, H.C. (2006) Effects of low-carbohydrate vs. low-fat diets on weight loss and cardiovascular risk factors: a meta-analysis of randomized controlled trials. *Arch Intern Med*, 166, pp. 285–293.

Ofei, F. (2005) Obesity: a preventable disease, *Ghana Medical Journal*, 39(3).

Ogden, C.L., Carrol, M.D., Kit, B.K. and Flegal, K.M. (2012) NCHS data brief, 82 (13), pp. 97-101.

Packianathan, I., Sheikh, M., Boniface, D. and Finer, N. (2005) Predictors of programme adherence and weight loss in women in an obesity programme using meal replacements, *Diabetes Obesity and Metabolism*, 7, pp. 439–447.

Papadaki, A., Linardakisa, and M., Pladaa, M. *et al.* (2013) A multicentre weight loss study using a low calorie diet over 8 weeks: regional differences in efficacy across eight European cities, *Swiss Medical Weekly*, 21, pp. 143.

Popkin, B.M. (2005) Using research on the obesity pandemic as a guide to a unified vision of nutrition, *Public Health Nutrition*, 8, pp. 724–729.

Popkin, B.M. and Gordon-Larsen, P. (2004) The nutrition transition: worldwide obesity dynamics and their determinants. *Intl Journal of Obesity*, 28, pp. 2-9.

Prentice, A.M., Jebb, S.A. (2003) Fast foods energy density and obesity: a possible mechanistic link, *Obesity Reviews* ,4, pp. 187–194.

Raja, S., Livingston, I. and Manuel, R. (2012) The Impact of Globalization on the Prevalence of Obesity: Trends and Health Implications in Sub-Saharan Africa, in: *Proceedings of the Global Awareness Society International 21st Annual Conference*, New York City, May 2012.

Renehan, A.G., Tyson, M., Egger, M., Heller, R.F. and Zwahlen, M. (2008) Body-mass index and incidence of cancer: a systematic review and meta-analysis of prospective observational studies, *Lancet*, 371 (9612), pp. 569-578.

Ross, R., Dagnone, D., Jones, P.J., Smith, H., Paddags, A., Hudson, R. and Janssen, I. (2000) Reduction in obesity and related comorbid conditions after diet-induced weight loss or exercise-induced weight loss in men, *Ann Intern Med*, 133, pp. 92– 103.

Ross, R., Janssen, I., Dawson, J., Kungl, A., Kuk, J., Wong, S., Nguyen-Duy, T., Lee, S., Kilpatrick, K. and Hudson, R. (2004) Exercise-induced reduction in obesity and insulin resistance in women: randomized controlled trial. *Obes Res*. 12, pp. 789– 798.

Rubak, S., Sandbæk, A. and Christensen, B. (2005) Motivational interviewing: a systematic review and meta-analysis, *British Journal of General Practice*, 55 (513), pp. 305-312.

Sabinsky, M.S., Toft, U., Raben, A. and Holm, L. (2006) Overweight men's motivations and perceived barriers towards weight loss, *European Journal of Clinical Nutrition*, 61, pp. 526–531.

Samaha, F.F., Iqbal, N., Seshadri, P., Chicano, K.L., Daily, D.A., McGrory, J., Williams, T.,Williams, M., Gracely, E.J. and Stern, L. (2003) A low-carbohydrate as compared with a low-fat diet in severe obesity. *The New England Journal of Medicine*, 324, pp. 2074– 2081.

Samuel, K., Sheard, N.F., Pi-Sunyer, X., Daly, A., Wylie-Rosett, J., Kulkarni, K. and Clark, N.G. (2004) Weight management through lifestyle modification for the prevention and management of type 2 diabetes: rationale and strategies, *Diabetes Care*, 27 (8), pp. 2067-2073.

Santos, A.C., Barros, H.(2003) Prevalence and determinants of obesity in an urban

sample of Portuguese adults, *Public Health*,117(6), pp. 430-437.

Saris, W.H., Astrup, A., Prentice, A.M., Zunft, H.J., Formiguera, X. and Verboeket- van de Venne, W.P et al (2000) Randomized controlled trial of changes in dietary carbohydrate/fat ratio and simple vs complex carbohydrates on body weight and blood lipids: the CARMEN study. *Int J Obes Relat Metab Disord*, 24, pp. 1310–1318.

Schrauwen, P., Westerterp, K.R. (2000) The role of high-fat diets and physical activity in the regulation of body weight, *Brit J Nutr*, 84, pp. 417–427.

Shai, I., Schwarzfuchs, D., Henkin, Y., Shahar, D.R., Witkow, S. and Greenberg ,I. *et al* (2008) Weight loss with a low-carbohydrate, Mediterranean, or low-fat diet, *New England Journal of Med*. 359, pp. 229-241.

Shapo, L., Pomerleau, J., McKee, M., Coker, R. and Ylli, A. (2003) Body weight patterns in a country in transition: a population-based survey in Tirana City, Albania. *Public Health Nutr*., 6(5), pp. 471-477.

Shaw, K.A., Geennat, H.C., O'Rourke, P. and Del-Mar, C. (2009) Exercise for overweight or obesity (review), *The Cochrane Collaboration, Publisher: the Cochrane Library 2009.*

Simin, A. (2010) *Longitudinal change in anthropometric characteristics and diet quality in Australian adults.* PhD Thesis, School of Population Health, The University of Queensland.

Slentz, C.A., Duscha, B.D., Johnson, J.L., Ketchum, K., Aiken, L.B., Samsa, G.P., Houmard, J.A., Bales, C.W. and Kraus, W.E. (2004) Effects of the amount of exercise

on body weight, body composition, and measures of central obesity: STRRIDE- a randomized controlled study, *Arch Intern Med.,* 164(1), pp. 31-39.

Smith, R.D., Lock, K., Dangour, A.D.,Keogh-Brown, M., Pigatto, G. and Hawkes, C. et al. (2010) Health, agricultural, and economic effects of adoption of healthy diet recommendations, *The Lancet*, 376 (9753), pp. 1699–1709.

Sodjinou,R., Agueh, V., Fayomi, B. and Delisle, H., (2008) Obesity and cardio metabolic risk factors in urban adults of Benin: relationship with socio-economic status, urbanization, and lifestyle patterns, *BMC Public Health*, 8, pp. 84.

Sondike, S., Copperman,N., Jacobson,M. (2003) Effects of a low-carbohydrate diet on weight loss and cardiovascular risk factor in overweight adolescents, *J Pediatr*, 142, pp. 253– 258.

Srinivas N., Saisudha K., Krishna M., Chinnala and Krishna, M. B. (2004) Obesity: an overview on its current perspectives and treatment options, *Nutri. Journal*, 3(3), pp. 1.

Stanhope, K.L. and Havel, P.J. (2008) Endocrine and metabolic effects of consuming beverages sweetened with fructose, glucose, sucrose, or high-fructose corn syrup, *American Journal of Clinical Nutrition*, 88, pp. 1733–1737

Stern, L., Iqbal, N. and Seshadri, P. *et al*. (2004) The effects of low-carbohydrate versus conventional weight loss diets in severely obese adults: one-year follow-up of a randomized trial, *Ann Intern Med* ,140 (54), pp. 778 – 785.

Stevens, V.J., Obarzanek, E., Cook, N.R., Lee, I.M., Appel, L.J., Smith-West, D. et al (2001) Long-term weight loss and changes in blood pressure: results of the trials of hypertension prevention, phase II. *Ann Inter Med*,134, pp. 1–11.

Stookey, J.D. (2001) Energy density, energy intake and weight status in a large free-living sample of Chinese adults: exploring the underlying roles of fat, protein, carbohydrate, fiber and water intakes, *European Journal of Clinical Nutrition*, 55, pp. 349–359.

Sturm, R. (2007) Increases in morbid obesity in the USA: 2000–2005, *Public Health*, 121(7), pp. 492–496.

Swinburn, B.A., Sacks, G., Hall, K.D., McPherson, K. and Finegood, D.T. et al. (2011) The global obesity pandemic: shaped by global drivers and local environments, *The Lancet*, 378, pp. 804–814.

Taylor, R.W., Jones, I.E., Williams, S.M. and Goulding, A. (2000) Evaluation of waist circumference, waist-to-hip ratio, and the conicity index as screening tools for high trunk fat mass, as measured by dual- energy X-ray absorptiometry, in children aged 3–19 years, *American Journal of Clinical Nutrition*, 72, pp. 490–495.

Tchernof , A., Nolan, A., Sites, C.K., Ades, P.A. and Poehlman, E.T. (2002) Weight loss reduces C-reactive protein levels in obese postmenopausal women, *Circulation*, 105, pp. 564–569.

Teixeira, P.J., Silva, M.N., Coutinho, S.R., Palmeira, A.L., Mata, J., Vieira, P.N., Carraça, E.V., Santos, T.C. and Sardinha, L.B. (2010) Mediators of weight loss and

weight loss maintenance in middle-aged women, *Obesity*, 18(4), pp. 725-735.

Thomas, L.O. (2004) An overview of obesity and weight loss surgery, *Clinical Diabetes*, 22 (3), pp.115.

Torgerson, J.S., Hauptman,J., Boldrin, M.N. and Sjöström,L.(2004) XENical in the prevention of diabetes in obese subjects (XENDOS) study: a randomized study of orlistat as an adjunct to lifestyle changes for the prevention of type 2 diabetes in obese patients, *Diabetes Care*, 27(1), pp. 155-161.

Tuomilehto, J., Lindstrom, J., Eriksson, J.G., Valle, T.T., Hamalainen, H., Ilanne-Parikka, P. et al (2001). Prevention of type 2 diabetes mellitus by changes in lifestyle among subjects with impaired glucose tolerance. *The New England Journal of Medicine*,344, pp.1343–1350.

Ward, S.H., Gray, A.M., Paranjape, A. (2009) African Americans' perceptions of physician attempts to address obesity in the primary care setting, *Journal of General Intern Med*., 24, pp. 579–584.

Westerterp, K.R., Verboeket-van, de Venne, W.P., Westerterp-Plantenga, M.S., Velthuis-te, Wierik, E.J., de Graaf, C., Weststrate, J.A. (1996) Dietary fat and body fat: an intervention study. *Int J Obes Relat Metab Disord*, 20, pp. 1022–1026.

Weststrate, J.A., van het Hof K.H., van den Berg, H., Velthuis-te-Wierik, E.J., de Graaf, C., Zimmermanns, N.J. et al (1998) A comparison of the effect of free access to reduced fat products or their full fat equivalents on food intake, body weight, blood lipids and

fat-soluble antioxidants levels and haemostasis variables, *European Journal of Clinical Nutrition,* (52), pp. 389–395.

Whelton, S.P., Chin, A., Xin, X.,He, J.(2002) Effect of aerobic exercise on blood pressure: a meta-analysis of randomized, controlled trials, *Ann Intern Med*., 136, pp. 493– 503.

Willett, W.C., Skerrett, P.J., (2001) *Eat, drink, and be healthy: The Harvard Medical School guide to healthy eating.* New York: Simon & Schuster, 2001.

World Health Organization (2000) *Technical Report Series 894 (2000) Obesity: preventing and managing the global epidemic:* WHO consultation, Geneva.

World Health Organization. Obesity and overweight. Fact sheet Number 311. March 2013. Accessed July 15, 2013.

World Health Organization (2003) *Diet, Nutrition and prevention of chronic disease Report of Joint WHO/FAO Expert Consultation*, in *WHO Technical Report Series 916*: Geneva.

Yancy, W., Olsen, M.K, Guyton, J.R., Bakst, R.P. and Westman, E.C. (2004) A low-carbohydrate, ketogenic diet versus a low-fat diet to treat obesity and hyperlipidemia: a randomized, controlled trial, *Ann Intern Med*, 140, pp.769 –77.

Yancy, W.S., Westman, E.C., McDuffie, J.R., Grambow, S.C., Jeffreys, A.S. and Bolton, J. *et al (2010)* A randomized trial of a low-carbohydrate diet vs orlistat plus a low-fat diet for weight loss, *Arch Intern Med*.170, pp. 136-145

Yanovski, S.Z. and Yanovski, J.A. (2002) Obesity, *The New England Journal of Medicine,* 346(8), pp. 591–602.

Yunsheng, M., Bertone, E.R., Stanek, E.J., Reed, G.W., Hebert, J.R., Cohen, N.L., Philip, A.M., and Ockene, I.S. (2003) Association between Eating Patterns and Obesity in a Free-living US Adult Population, *American Journal of Epidemiology,* 158 (1).

Ziccardi, P., Nappo, F., Giugliano, G., Esposito, K., Marfella, R., Cioffi, M., D'Andrea, F., Molinari, A.M. and Giugliano, D. (2002) Reduction of inflammatory cytokine concentrations and improvement of endothelial functions in obese women after weight loss over one year, *Circulation*, 105, pp. 804–809.

Zora, D., Samir, L., Lance K. H., Janice, B. D., Kathleen, M. P. and Virginia, E. U. (2002) Effect of low-fat and/or low-energy diets on anthropometric measures in participants of the women's diet study, *Journal of the American College of Nutrition,* 21(1), pp. 38–46.

Zulfa, A., Zandile, M. and Nelia P.S. (2011) Diet and mortality rates in Sub-Saharan Africa: stages in the nutrition transition, *BMC Public Health,* 11 pp.801.

APPENDIX I

Patient's Questionnaire

ID No…… **Date of Interview**……..

Your response will be for research purposes and will not be exposed to any one for any other purpose. The information provided will help to improve dietetic care in the clinical setting.

	DEMOGRAPHIC INFORMATION		
	Questions	**Response**	**Score Code**
1.	Gender	Male Female	1 2
2.	What age group do you fall in?	18-30 31-40 41-50 51-60 ≥ 61	1 2 3 4 5
3.	What is your ethnic background?	Akan Ga/ Dangme Ewe Mole-Dagbani Hausa Others	1 2 3 4 5 6
4.	What is your current marital status?	Never married Married Separated /Divorced Widowed	1 2 3 4
5.	What is the highest level of education you have completed?	Junior secondary school Senior secondary school Tertiary school Post graduate school Vocational school	1 2 3 4 5
6.	What is your current employment status?	Employed Self employed Unemployed Pensioner House wife	1 2 3 4 5

	ALCOHOL CONSUMPTION		
7.	Have you consumed alcohol (such as beer, wine, spirits, akpeteshie, pito, palm wine or bitters) within the past 6 months?	Yes No **(If No, go to Q 11)**	1 2
8.	In the past 6 months how frequently have you had at least one drink?	Daily 5-6 days per week 1-4 days per week 1-3 days per month Less than once a month	1 2 3 4 5
9.	When you drink alcohol, on average, how many drinks do you have during one day? **<u>Please note that one drink is:</u>** 120ml of wine(1/2 medium glass of dry wine) or 285ml of beer (1/2 large beer bottle,1 full mini,1 bottle of Guinness) or 30 ml (1 tot) of spirit, whisky, gin, akpeteshie, other alcoholic bitters	Number …….	
10.	Do you drink alcohol with your meals?	Yes No	1 2

	DIET		
11.	Are your meals, time dependent?	Yes No **(if No, go to Q13)**	1 2
12.	At what times of the day do you eat breakfast, lunch & supper?	…… …… …….. B/fast lunch supper	
13.	Do you follow recommended portion sizes?	Yes No	1 2
14.	In a typical week, how many times do you follow the recommended portion sizes?	Number of days……	

15.	In a typical week, how many times do you eat fruits?	Number of days…….	
16.	In a typical week, on how many days do you eat cooked or raw vegetables? **Please note that vegetables include the following:** Spinach, kontomire, lettuce, garden eggs, tomato, fresh corn, green beans, onions, carrot, cabbage, okra, green pepper	Number of days ……(cooked) …….(raw)	
17.	Do you consciously try to cut down on your oil intake?	Yes No **(if no go to Q20)**	1 2
18.	How can you describe your present oil intake?	High Moderate Limited	1 2 3
19.	In a typical week, how often do you eat fried, oily or fatty foods? E.g. fried foods, domedo(roasted pork),pies, susages, fries(fried potatoes), fried yam, fried plantain, fast foods(papaya, check check etc)	……	
	EXERCISE		
20.	Do you engage in intentional physical activity?	Yes No **(if No, proceed to Q24)**	1 2
21.	How often do you engage in these exercises?	Once daily Once weekly Thrice weekly Once in a month Other ……..	
22.	How many minutes do you spend on exercise on a typical day?	……..Minutes	
23.	What type of exercise do you engage in?	Brisk walking Cycling Jogging Sports activities Other ……	1 2 3 4 5
	CHALLENGES		
24.	Please indicate challenges you face in committing to exercising	Too busy schedule Weather (too hot)	1 2

		Lack of exercise partner Criticism (presence of others make you uncomfortable) Other ……	3 4 5
25.	Please indicate challenges that hinders you from adhering to dietary prescriptions	Eating out Financial constraints Poor self-control Granting self-permission (just this once, a little won't hurt) Always travelling Situation at home(I eat healthy when I'm alone) Lack of understanding of dietary prescriptions Busy work schedule	1 2 3 4 5 6 7 8
26.	Do you enjoy any moral/emotional support from your spouse/partner towards adhering to life style modifications?	Yes No	1 2
27.	Do you consistently receive emotional support from friends & family members towards adhering to lifestyle modifications?	Yes No	1 2
28.	How often do you visit the dietitian?	Once a month Twice a month Once in a week	1 2 3

APPENDIX II

DIETITIAN'S QUESTIONAIRE **ID Number:**

	APPROACH		
	Questions	**Response**	
1.	What approach do you use in weight management?	Change diet alone Change diet and increase exercise Change diet and encourage supplements Change diet and prescribe weight loss medication	1 2 3 4 5
2.	What type of diet do you prescribe to your patients?	Low calorie diet alone Low calorie and low fat Low carbohydrate/high protein Low fat alone High fiber alone Low calorie/high fiber/low fat/low carbohydrate Low calorie/high fiber/low fat/low carbohydrate/high protein	1 2 3 4 5 6 7 8
	STRATEGIES		
3.	Do you assess a patient's readiness to change?	Yes No **(If no, go to Q6)**	1 2
5.	What are the common reasons patients give for not being ready to change?	See nothing wrong in their body size Not emotionally ready Worried about people's perception of their weight loss Not financially ready.	1 2 3 4 5 6
6.	Do you assess a patient's level of adherence?	Yes No **(if No, go to Q8)**	1 2

7.	How do you assess level of adherence?	Direct questions on adherence (are you following my prescriptions?) 24 hour recall on every appointment. Food frequency assessment on every appointment Take home food diary Indirect questions to elicit level of adherence.	1 2 3 4 5
8.	Do you assess expectations of weight loss	Yes No	1 2
9.	Do you Plan on short term follow-up?	Yes No	1 2
10.	On the average what is your interval for follow up?	Once a month Twice a month One a week Once in three months	1 2 3 4
11.	Do you give general advice on exercise or individualized exercise?	……..general ……..individualized	1 2
12.	Do you advice on shopping and cooking methods?	Shopping Cooking Both	1 2 3
13.	Do you involve family members during counseling?	Yes No	1 2

APPENDIX III

INFORMED CONSENT FORM FOR PARTICIPANTS

PARTICIPANT'S NUMBER----------

STUDY TITLE: Evaluation of A Weight Management Strategy In A Private Hospital In Accra

Obesity is a risk factor to several chronic non- communicable diseases. The dietitian plays a pivotal role in its management through lifestyle modifications. This study seeks to evaluate the strategies used by dietitians in weight management.

Your participation in this research is entirely voluntary. You may decide to take part or withdraw from the research at any time without anyone objecting. You will be required to give out some personal information. All information that will be collected during this research will be kept confidential. The forms will not bear the participants' names but numbers or codes.

The data obtained from this study will be useful in the formulation of interventions to better manage obesity or to provide evidence of the efficacy and sustainability of strategies already adopted.

For further enquiries you can contact the address below:

1) Mrs. Laurene Boateng, College of Health Sciences, School of Allied Health Sciences, Department of Dietetics. Tel: 0244742893
2) Dr. Matilda Asante, College of Health Sciences, School of Allied Health Sciences, Department of Dietetics. Tel: 0540683892

3) Annie Uwadia, College of Health Sciences, School of Allied Health Sciences, Department of Dietetics. Tel: 0549233972

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

……	……..
Name of Researcher	Signature
……	……
Name of Participant	Signature/ Thumbprint

APPENDIX IV

INFORMED CONSENT FORM FOR THE DIETITIAN

STUDY TITLE: Evaluation of A Weight Management Strategy In A Private Hospital In Accra

Obesity is a risk factor to several chronic non- communicable diseases. The dietitian plays a pivotal role in its management through lifestyle modifications. This study seeks to evaluate the strategies used by dietitians in weight management.

Your participation in this research is entirely voluntary. You may decide to take part or withdraw from the research at any time without anyone objecting.

The data obtained from this study will be useful in revealing the effectiveness of your strategy or identifying challenges opposing your strategy, hence formulating or modifying strategies to better manage obesity.

For further enquiries you can contact the address below:

1) Mrs. Laurene Boateng, College of Health Sciences, School of Allied Health Sciences, Department of Dietetics. Tel: 0244742893
2) Dr. Matilda Asante, College of Health Sciences, School of Allied Health Sciences, Department of Dietetics. Tel: 0540683892
3) Annie Uwadia, College of Health Sciences, School of Allied Health Sciences, Department of Dietetics. Tel: 0549233972

I …… have read and understood the nature of the proposed study. I am aware of the fact that I can withdraw from this study at any point

without receiving any objection. My signature below indicates that I have given my consent to participate in this study.

……	…….
Name of Researcher	Signature
……..	……..
Name of Participant	Signature/ Thumbprint

APPENDIX V

DESCRIPTIVE ANALYSIS OF ANTHROPOMETRIC MEASUREMENTS

Variable	Treatments	N	Mean	SD	Minimum	Maximum
Weight	Baseline	70	91.66	13.60	67	143
	3 months	70	88.29	13.17	67	141
	6 months	70	86.09	13.08	62	139
	Total	210	88.68	13.42	62	143
BMI	Baseline	70	34.16	3.89	28	44
	3 months	70	32.97	3.76	27	43
	6 months	70	32.20	3.49	27	42
	Total	210	33.11	3.79	27	44
WHR	Baseline	70	0.92	0.07	0.74	1.11
	3 months	70	0.90	0.08	0.74	1.1
	6 months	70	0.90	0.08	0.72	1.1
	Total	210	0.90	0.08	0.72	1.11
BF	Baseline	70	44.44	8.41	22	56
	3 months	70	42.76	8.27	22	55
	6 months	70	42.31	8.58	21	54
	Total	210	43.17	8.43	21	56
VF	Baseline	70	12.33	2.85	7.0	24
	3 months	70	11.41	3.06	6.0	25
	6 months	70	11.34	2.91	6.0	23
	Total	210	11.70	2.96	6.0	25

APPENDIX VI

DESCRIPTIVE ANALYSIS OF ADHERENCE TO EXERCISES

		N	Mean	SD	95% C.I.	Minimum	Maximum
Weight	None	8	84.13	7.00	78.274	78	99
	Light	4	93.25	19.35	62.467	76	110
	Moderate	32	91.97	9.30	88.616	75	114
	Strict	26	93.35	17.98	86.085	67	143
	Total	70	91.66	13.60	88.414	67	143
BMI	None	8	32.13	1.73	30.681	31	36
	Light	4	32.50	3.32	27.223	28	35
	Moderate	32	34.06	4.12	32.578	29	44
	Strict	26	35.15	3.97	33.552	28	44
	Total	70	34.16	3.89	33.230	28	44
WHR	None	8	0.88	0.11	0.784	0.74	1
	Light	4	0.94	0.06	0.850	0.89	0.99
	Moderate	32	0.92	0.06	0.895	0.76	1.02
	Strict	26	0.92	0.07	0.895	0.81	1.11
	Total	70	0.92	0.07	0.899	0.74	1.11
BF	None	8	48.00	2.00	46.328	44	50
	Light	4	34.25	10.50	17.542	22	43
	Moderate	32	43.22	8.91	40.005	28	56
	Strict	26	46.42	7.47	43.404	24	54
	Total	70	44.44	8.41	42.437	22	56
VF	None	8	10.88	2.59	8.712	9	17
	Light	4	13.00	2.45	9.102	11	16
	Moderate	32	12.91	2.67	11.944	9	19
	Strict	26	11.96	3.10	10.708	7	24
	Total	70	12.33	2.85	11.650	7	24

APPENDIX VII

DESCRIPTIVE ANALYSIS OF ADHERENCE TO NUMBER OF VISITS

		N	Mean	SD	SE	95% C.I.		Minimum	Maximum
Weight	Weekly	34	88.91	14.39	2.47	83.89	93.93	67	143
	2x Monthly	21	91.10	12.76	2.78	85.29	96.90	74	122
	Monthly	15	98.67	10.96	2.83	92.60	104.74	78	112
	Total	70	91.66	13.60	1.63	88.41	94.90	67	143
BMI	Weekly	34	33.35	4.24	0.73	31.87	34.83	28	44
	2x Monthly	21	34.38	3.15	0.69	32.95	35.82	31	44
	Monthly	15	35.67	3.72	0.96	33.61	37.72	30	40
	Total	70	34.16	3.89	0.46	33.23	35.08	28	44
WHR	Weekly	34	0.91	0.07	0.01	0.88	0.93	0.74	1.02
	2x Monthly	21	0.91	0.06	0.01	0.88	0.94	0.76	1.01
	Monthly	15	0.95	0.08	0.02	0.91	0.99	0.85	1.11
	Total	70	0.92	0.07	0.01	0.90	0.93	0.74	1.11
BF	Weekly	34	41.26	9.74	1.67	37.87	44.66	22	54
	2x Monthly	21	47.67	3.97	0.87	45.86	49.47	40	56
	Monthly	15	47.13	7.41	1.91	43.03	51.23	32	53
	Total	70	44.44	8.41	1.01	42.44	46.45	22	56
VF	Weekly	34	12.53	3.44	0.59	11.33	13.73	9	24
	2x Monthly	21	11.57	1.72	0.38	10.79	12.35	9	14
	Monthly	15	12.93	2.55	0.66	11.52	14.34	7	19
	Total	70	12.33	2.85	0.34	11.65	13.01	7	24

APPENDIX VIII

SAMPLE SIZE DETERMINATION

The sample size was estimated that, from the patients' folders available, the drop of BMI in one hospital is 20% (p1 = 0.20) whereas the drop of BMI in another hospital is about 24% (p2 = 0.55), giving 4% comparative drop in BMI between the two hospitals. For equal sample size allocation (κ = 1), 5% (α = 0.05) level of significance, and 80% (β = 0.20) power, the sample size needed for establishment of equivalence with an equivalence margin of 25% (δ = 0.15) is given by the formula

$$n_1 = n_2 = \frac{(z_\alpha + z_\beta)^2 (p_1(1-p_1) + p_2(1-p_2))}{(\delta - |\epsilon|)^2}$$

Substituting the values above into the formula, the minimum sample size required is 58.

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/ 10361516
Your Ref. No.

P. O .Box KB 143
Korle Bu
Accra
Ghana

27th May, 2013.

Ms. Annie Anyaku Uwadia,
Dept. of Dietetics,
SAHS,
Korle Bu.

Dear Ms. Uwadia,

ETHICS CLEARANCE

Ethics Identification Number: SAHS – ET. /10361516/AA/10A/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: "An Evaluation of a Weight Management Strategy in a Private Hospital in Accra"

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.

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