ABSTRACT

Siyame, Edwin Whitemore Peter. Dietary Practices of Hypertensive Patients Attending Hypertensive Clinics in Malawi (Under the direction of Dr. Jonathan C. Allen and Dr. L. Suzanne Goodell).

Malawi is experiencing increasing prevalence of hypertension. Lifestyle and diets are significantly and rapidly changing, where people are consuming diets higher in fats, carbohydrates, sugars and salt, and have reduced their physical activity. In 2010, 32.9% of the population was hypertensive, and 16.5% had 3 or more risk factors for NCDs. It is against this background that a cross sectional research study was conducted to assess the dietary practices and nutritional status of hypertensive patients in Malawi.

A total of 344 hypertensive patients were recruited and divided into two categories: patients who had been attending hypertensive clinics for <24 months and those who had been attending the clinics for >24 months. In addition, 20 nurses and clinical officers were interviewed as key informants. Quantitative data was collected using a structured hypertension questionnaire, a 24-hour dietary recall and a FFQ, and analyzed using SPSS version 22. Qualitative data was collected using a key informant interview guide and analyzed using a thematic analysis approach.

Results showed that hypertensive patients consume foods from staples, legumes, foods from animal sources, fruits, vegetables and fats & oils. However, the most frequently consumed food was *nsim*a (2-3 times/day) while legumes and meats were less frequently consumed. For a majority of patients, staples consumption was >110% of the recommended number of servings while for vegetables, fruits, legumes and meats were <90%.

A similar trend of consumption was noted between the two categories of patients with no significant differences ($P > 0.05$). Overall, the dietary practices of hypertensive patients were

poor.

One quarter of hypertensive patients had mild hypertension, with more of these patients being in the >24 months category. More than half of hypertensive patients were overweight and obese, with a higher proportion being in the >24 months category. A third of hypertensive patients had hypertension co-existing with another NCD, and the most common NCD was diabetes (as reported by 83.8% of patients). More patients (38.6%) in the >24 months category had other NCDs than those in the <24 months category (28.7%). There were no significant differences in blood pressure and BMI between the two hypertensive categories.

Two main types of advice given to hypertensive patients at hypertensive clinic were nutrition and medical advice. The type of nutrition advice given included reduce salt, sugar, fat and carbohydrate intakes, increase consumption of fruits and vegetables, eat grilled or roasted meat. In addition, hypertensive patients also underwent health education talk (which included diets, exercise, alcohol use and smoking advice), blood pressure assessment, weight measurements, medical review and prescription.

The research found that there were no dietary guidelines used in hypertensive clinics. Challenges that hypertensive patients face in implementing the advice given included difficulty to change eating habits especially at old age, lack of resources to implement all the advice given, lack of support from other household and community members, lack of equipment for exercise, shortage of drugs in hospitals, long distance to the hospital, and stigma from community members. On the other hand the challenges that nurses and clinical officers face in the course of their duty include shortage of staff at hypertensive clinics, lack of dietary guidelines for management of hypertension, shortage of hypertensive drugs, shortage of blood pressure measuring machines and batteries, overcrowding of patients at hypertensive clinics, inadequate infrastructure, and long

waiting time for hypertensive patients. This research provides data that could be used to improve

treatment of hypertensive patients in hospitals in Malawi.

Dietary Practices of Hypertensive Patients Attending Hypertensive Clinics in Malawi

by
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DEDICATION

I dedicate this work to my beautiful family (my wife Lyness Mhango and my sons Yamikani and Comfort Whitemore), my Mum (Mickness Mutanfya) and all my sisters. You endured my long absence from you so that this work could be accomplished. You encouraged me emotionally to keep moving on even when things were tough on you in my absence. May God bless you all.

BIOGRAPHY

Edwin WP Siyame was born on 30th November 1979 in a town called Chitipa in Malawi in a family of 7 children. Out of 7 children, Edwin is the only male child. Edwin attended primary school education at Ipenza Primary School, Kamuzu Barrack Primary School and Support Battalion Primary School. He attained a primary school leaving certificate at Support Battalion and was selected to pursue secondary education at Malawi Army Secondary School from 1995 to 1999. Upon successful completion of secondary education with strong credits, Edwin was selected to go to University Malawi (Bunda College of Agriculture-now Lilongwe University of Agriculture and Natural Resources) in 2000 to pursue a Bachelors' degree in Agriculture-majoring in Human Nutrition and Food Science. Edwin successfully completed his undergraduate degree in 2004 with strong credit, and in the same year he was employed by University of Malawi as a staff associate in Human Nutrition. In 2007, he was awarded a scholarship by Norwegian government through the NORAD project to go for further studies in United Kingdom to pursue a Master of Science degree in Human Nutrition-majoring in Public Health at London Metropolitan University. In 2014, Edwin was awarded another scholarship under the Feed the Future program through USAID Malawi to pursue a PhD in Nutrition at North Carolina State University in the United States of America.

Edwin has vast experience teaching, research and outreach activities. He has worked with University of Malawi (Bunda College of Agriculture) from 2004 to 2015 as a Staff Associate, Lecturer and Senior Lecturer in Human Nutrition. He has extensively interacted with local as well as international institutions when conducting collaborative research and outreach activities. Key achievements that he has done include:

He has built capacity for different nutrition implementers from government, non-governmental organization and development partners in Malawi through short and long term courses. He has trained students at both undergraduate and graduate level in nutrition to assume various roles and responsibilities in the country. He has supervised student research projects in nutrition, food science and health related subjects. In addition he has extensive work with government, non-governmental organizations and development partners in various outreach activities.

Edwin has been a national trainer for scaling up nutrition (SUN) movement implementers in Malawi. In addition, Edwin has been spearheading and coordinating development of national SUN training and IEC materials.

Edwin has been a co-investigator for the SUN operational research that involved piloting the implementation of SUN activities and documenting the entire process for national scale up.

Edwin coordinated (as a local Investigator for USAID Nutrition Collaborative Research Support Program among Bunda College, Tufts University (USA) and USAID Malawi) the development and implementation of dietetics program in Malawi that is being offered at Lilongwe University of Agriculture and Natural Resources, as one way of advancing knowledge in the area of nutrition and dietary related non-communicable diseases.

Edwin has been involved in conducting Malawi vulnerability assessment of food insecurity as one way of providing early warning to the Government of Malawi and its development partners for timely planning and intervention of food crises.

Edwin also reviewed WHO growth standards in 2010 that Malawi adopted for use in growth monitoring and promotion. The standards are vital in ensuring that children's growth is timely and adequately assessed for timely intervention in case of a problem.

Through the research that Edwin has been involved in, he has published a number of articles in peer reviewed international journals.

Edwin is a motivated, self-starter and hard-working person. He is a fast learner, excellent facilitator and team player. He has good leadership skills. His career goal is to be an action-oriented professional who will significantly contribute towards reduction of poverty, food, nutrition and income insecurity among underprivileged and marginalized populations.

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I sincerely thank the Almighty God for giving me the ability to be able to go through the entire program, and for all people that He purposely put around me during this period to help me go through the program.

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Lastly, but not least, I thank the USAID through BHEARD program for the financial support rendered to me to pursue further studies in Nutrition at NCSU. My heartfelt thanks should go to all BHEARD managers and staff at Michigan State University for all the support that they gave me during my studies.

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CHAPTER 1

INTRODUCTION

Definition and Types of Hypertension

Hypertension is a condition that is characterized by chronic high systolic pressure of equal to or more than 140 mm Hg and a diastolic pressure of equal to or more than 90 mm Hg. Prehypertension is defined as a systolic blood pressure of between 120–139 mm Hg and a diastolic blood pressure of between 80–89 mm Hg (Chobanian et al., 2003). There are different types of hypertension. Secondary hypertension is the most common type and is mostly caused by an abnormality in the arteries supplying blood to the kidneys (Chobanian et al., 2003). Hypertension can also be caused by obstruction of air during sleep, diseases and tumors of the adrenal glands, hormone abnormalities, thyroid disease, and excess consumption of salt or alcohol (Iliades, 2009). Drugs (including over-the-counter medications such as ibuprofen and pseudoephedrine) can also cause secondary hypertension. Another type of hypertension is essential hypertension. Essential hypertension usually has no secondary cause and no symptoms. If three or more measurements of high blood pressure are noticed, then the person is said to have essential hypertension. A person with essential hypertension may experience frequent headaches, tiredness, dizziness, or nose bleeds. This type of hypertension has also been associated with obesity, smoking, alcohol, dietary practices and heredity (Iliades, 2009).

Other types of hypertension include isolated systolic hypertension, malignant hypertension, and resistant hypertension. Isolated systolic hypertension is where the systolic pressure rises above 140 mm Hg, while diastolic blood pressure stays near normal range (less than 90 mm Hg) (Iliades, 2009). This is common among people over the age of 65 years and is caused by loss of elasticity in the arteries. Malignant hypertension is rare but occurs in younger adults and

women who have pregnancy toxemia (Iliades, 2009). This is characterized by fast increase in blood pressure and diastolic pressure may go over 130 mm Hg. Symptoms may include numbness in the arms and legs, blurred vision, confusion, chest pain, and headache. Resistant hypertension is the type of hypertension that does not respond to prescription of three different types of antihypertensive medications. Resistant hypertension is associated with genetics and it mostly affects the elderly, obese, female, African American, or people who have an underlying illness such as diabetes or kidney disease (Iliades, 2009).

The mechanism of hypertension is related to structural and functional abnormalities in the vasculature that leads into increased blood pressure (Calhoun et al., 2000 and Guyton et al., 1990). Several pathophysiologic factors have been reported to be the causes of essential hypertension. Examples of these pathophysiologic factors include increased sympathetic nerve activity (SNA) (Mancia et al., 1999) that may be related to heightened exposure or response to psychosocial stress; overproduction of sodium-retaining hormones and vascular resistance; long-term high sodium intake; inadequate dietary intake of potassium and calcium; increased or inappropriate renin secretion resulting in increased production of angiotensin II and aldosterone; deficiencies of vasodilators, such as prostacyclin, nitric oxide (NO), and the natriuretic peptides; alterations in expression of the kallikreinkinin system that affect vascular tone and renal salt handling (Meneton et al., 2005); abnormalities of resistance vessels, including selective lesions in the renal microvasculature; diabetes mellitus; insulin resistance; obesity; increased activity of vascular growth factors (Jonk et al., 2007); alterations in adrenergic receptors that influence heart rate, inotropic properties of the heart, and vascular tone; and altered cellular ion transport (Oparil et al., 2003 and Mizelle et al., 1993). Guyton et al., in 1991 and 1990 further reported that renal mechanisms play a primary role in the pathogenesis and maintenance of blood pressure elevation,

and that other factors (as discussed above) amplify or buffer the pressor effects of renal salt and water r retention.

Risk Factors for Hypertension and Other NCDs

Hypertension has been reported to be the main risk factor for cardiovascular diseases such as stroke, coronary artery disease and heart failure (Petriz and Franco, 2014), leading to more than 1.8 million deaths worldwide every year (WHO, 2013). Most of these deaths occur in low and middle income countries (LMICs). In 2002, non-communicable diseases (NCDs) accounted for 54% of deaths in LMICs, compared with 36% of deaths attributed to communicable diseases, maternal and perinatal conditions and nutritional deficiencies combined. The NCD contribution to deaths is predicted to rise to 65% by 2030 (Mathers and Loncar, 2005). World Health Organization (WHO) and FAO observed that NCDs are an enormous health problem in LMICs, hence they should be urgently addressed (WHO/FAO, 2003).

Hypertension is also epidemiologically associated with metabolic diseases such as obesity and diabetes (Kurukulasuriya et al., 2011). Economic improvement in many countries has resulted in increased NCDs. In developing countries, there is growing 'double burden' of malnutrition occurring at the same time among different population groups (Shetty, 2013). Rapid urbanization and internal migrations, demographic shifts in population, inactive lifestyles and other factors from the liberalization of markets, globalization and environmental degradation are contributing to increase in these NCDs (Shetty and Shetty, 2009).

Modernization of societies and economic development has led to people consuming diets high in fats, sugars and refined and processed foods. This is referred to as the nutrition transition (Popkin, 1994). Changing dietary patterns (nutrition transition) combined with sedentary lifestyle have been known to be significant cause of disability and premature deaths due to chronic NCDs.

These include obesity, diabetes mellitus, cardiovascular disease, hypertension and stroke, and some types of cancer (Shetty, 2013). Out of the 30% worldwide deaths due to CVDs, alcohol and tobacco use, high blood pressure, body mass index, cholesterol, blood glucose, low fruit and vegetable intake, and physical inactivity contribute to 61% of loss of healthy life years and 61% of deaths (WHO, 1998). The World Economic Forum warns that NCDs are a severe threat to economic development and that the economic burden of NCDs will reach $47 trillion by the year 2030 (Bloom et al., 2011).

Studies on hypertension have further revealed that patients with hypertension are at increased risk of myocardial infarction, congestive heart failure and renal failure. Evidence also shows that the burden of hypertension on public health corresponds with the increasing prevalence of hypertension. Because of this, detection, treatment, prevention and control should be given the highest priority in addressing hypertension (Knuiman et al., 1986). It is further recognized that hypertension is also caused by a number of factors, which include interaction of pathological mechanisms, environmental factors, and a complex genome background (Newton-Cheh et al., 2009). Examples of pathological causes include alteration in renal salt-water homeostasis, hyperstimulation of the sympathetic nervous system, hormonal dysfunction, and single gene mutation. This means that hypertension can be caused by interaction of several pathophysiological stimuli (e.g., obesity and diabetes) with environmental factors (e.g., diet, lifestyle, tobacco, and alcohol abuse) and genetics (Newton-Cheh et al., 2009). The impact of genetics (heredity) is estimated to account for 15–40% of the variation in incidence of cases.

These factors lead to vascular dysfunctions such as dysfunction in endothelial vasodilation and artery stiffness. Systemic high blood pressure may also lead to impairments in cardiac apparatus. The long-term overload on myocardium may result in heart dilation and contraction

impairment (Bernardo et al 2010). Cardiac hypertrophy may progress into heart failure if the cause is hypertension or cardiac congenital pathology. Hypertension can also be an independent risk factor for other cardiac conditions such as myocardial infarction and arrhythmia (Levy et al., 1996).

Global Prevalence of Hypertension and Other NCDs

CVDs account for nearly 30% of deaths worldwide (WHO, 2009). In 2000, it was found that 972 million adults (26.4%) worldwide were hypertensive, with almost equal numbers for males and females (26.6% males and 26.1% females) (Kearney et al., 2005). Total numbers were predicted to increase from 972 million in 2000 to 1.56 billion in 2025 worldwide. WHO in 2003 reported that in 2001, 60% of the 56.5 million deaths (half of the deaths attributable to cardiovascular diseases; obesity and diabetes) were attributed to chronic diseases and that the proportion of the burden of NCDs was expected to increase to 57% by 2020. Out of the 57% that will occur in developing countries, more than 70% of deaths will be due to ischaemic heart disease, stroke, and diabetes (WHO, 1998). For example, the report noted that CVDs are now more common in India and China than in all the economically developed countries in the world put together (WHO, 2002). A blood pressure as low as 116/75 mm Hg has been found to be associated with CVD risk and the risk doubles for each 20/10-mm Hg increase (Vasan et al., 2002). The prevalence of diabetes has been estimated that it will increase by more than 2.5 folds from 84 million in 1995 to 228 million in 2025 in the developing world.

Prevalence of Hypertension and Other NCDs in Sub-Saharan Africa

Although infectious diseases still predominate in sub-Saharan Africa, NCDs contribute 79% of the worldwide deaths in developing countries (Schmidhuber and Shetty, 2005). The increase in these diseases is occurring at a faster rate in developing countries than it did in

developed countries half a century ago (Popkin, 2002). Shetty (2013) reported that NCDs are currently affecting more people in developing countries, accounting for 80% of all NCD-related deaths. Most of these NCDs are co-morbidities associated with obesity. The Global Burden of Disease Study reported that 20% of deaths in Sub Sahara Africa were caused by non-communicable diseases (Lopez et al., 2006), and that by 2020 the increase will reach 40% (Murray and Lopez, 1996). Unwin et al. in 2001 reported that the prevalence of diabetes and hypertension are increasing in African countries. For example, in South Africa, 20-33% of people have hypertension using the cut-off point of >160/95 mm Hg (Steyn et al., 1995) and in other countries such as Mozambique, Zimbabwe and Botswana, 28-33% of adult population aged 25-64 years were hypertensive (WHO, 2009). In a study conducted in Tanzania, it was found that the probability of dying from NCDs in developing countries is higher than in developed countries (Setel et al., 2000). Studies have further reported that patients with NCDs are poorly managed in sub-Saharan Africa (Harries et al., 2008). It is further reported that developing countries may be particularly affected with NCDs as they spread around the globe due to their inadequate capacity to manage the NCDs due to financial constraints.

Prevalence of Hypertension in Malawi

Malawi is not spared from the impact of hypertension and other NCDs. Lifestyle and diets are significantly and rapidly changing. Just like other developing countries, Malawi is experiencing rapid urbanization and changes in diet composition (diets high in fats, sugars and salt). In addition, urbanization has resulted in decrease in people's physical activity hence creating the pre-conditions for an increase in the prevalence of NCDs (Msyamboza, 2010). In 2010, 32.9% of the population was hypertensive and out of these, 94.9% were not on medication and/or were not aware that they were hypertensive. Only 6% were on treatment or were once told by a health

worker that they had a raised blood pressure (Msyamboza, 2010). A total of 8.7% of the study population had raised blood cholesterol of which 11.0% were females and 6.3% were males. The study further reported that 5.6% of the population had diabetes mellitus (6.5% being males and 4.7% being females). The prevalence of raised blood pressure, diabetes and smoking were found to be higher in rural than urban areas. Risk factors for NCDs among the studied population were high: 15% of adults were smokers, 22% drink alcohol and 40% have low intake of fruits and vegetables. The study further revealed that 9.5% were physically inactive and overweight prevalence was 21.9%. Overall, 16.5% of the respondents had 3 or more risk factors for NCDs. The increasing burden of hypertension and other NCDs in Malawi is a major setback for health systems that are already overburdened and under-funded (Msyamboza, 2010).

Dietary Practices in Relation to NCDs

Through research, a strong and consistent relationship between diet and chronic diseases has been established. Diet plays a key role as a risk factor for chronic diseases. Diets rich in fruits, vegetables, and low-fat dairy products that include whole grains, poultry, fish, and nuts, that contain only small amounts of red meat, sweets, and sugar-containing beverages, and that contain decreased amounts of total and saturated fat and cholesterol have been found to have a protective effect against CVDs (Sacks et al., 2001 and Yusof et al., 2012). Nutrition transition has resulted in replacement of these diets with diets that are high in saturated fats, sugars, and salt. Consumption of foods high in saturated fats, sugars and salt coupled with decreased physical activity has resulted in increased prevalence of NCDs.

The Role of Healthcare Practitioners and Treatment Plan for Hypertensive Patients

Healthcare practitioners have a role in assisting hypertensive patients achieve their treatment goal. They need to help hypertensive patients in terms of nutritional advice, where they

need to advise patients on the types of foods to avoid, limit or include in their diets. Health care professionals also advise hypertensive patients to be physically active, i.e., patients should be exercising to ensure good health. In addition, health care professionals also give medical advice to hypertensive patients that can assist in lowering blood pressure. As health care professionals, they need to work together with hypertensive patients to come up with treatment plans based on whether the patient is diagnosed with primary or secondary high blood pressure and if there is a suspected or known cause of the hypertension (https://www.nhlbi.nih.gov/health-topics/high-blood-pressure). A treatment plan can address treatment for other conditions or change the medicine if it is suspected to be the cause of the hypertension (for secondary hypertension), inclusion of lifestyle changes (for primary hypertension) and inclusion of medication if lifestyle changes alone are unable to control or lower blood pressure. However, it is recommended that there should be a combination of both lifestyle and medicines to manage hypertension (https://www.nhlbi.nih.gov/health-topics/high-blood-pressure). In addition, healthcare providers should encourage hypertensive patients to follow the agreed treatment plan so as to prevent or delay high blood pressure-related complications.

Food Availability and the Typical Diet of People in Malawi

Maize is a staple food crop for Malawi. It is grown by 97% of farming households and accounts for 60% of total calorie consumption (Denning et al., 2009). In addition to maize, cassava, rice, millet and sorghum are also consumed. Food availability in Malawi mainly depends on season. For example, fruits and vegetables are commonly available during rainy season, and scarce during the dry season. This implies that vegetables and fruits are not readily available during dry season and if available, they are expensive for most Malawians. This affects consumption patterns as the intake declines during the periods when they are less available. Malawi promotes

consumption of foods based on the six food groups: Staples (cereals and roots and tubers), legumes, foods from animal sources, fruits, vegetables, and fats and oils. However, Malawian diets are mainly composed of staples (a thick porridge made from maize flour locally known as *Nsima*). It usually provides a significant amount of energy for more than 70% of Malawians (FAOSTAT, 2009). *Nsima* is usually consumed with side dishes, mostly vegetable and legumes. Because a significant proportion of a meal comes from staples, Malawian diets are usually monotonous and undiversified. Because staples provide a bulk of the diet for most Malawians, the meals are deficient in many nutrients. Meat and meat product consumption in Malawi is low (Speedy, 2003 and Chilimba et al., 2011), as most Malawians cannot afford to buy meat and meat products.

Dietary Assessment Methods

Different dietary assessment methods are available to assess someone's diet. However, the choice of the method to use depends on the need and the situation of the researcher/health professional (Thompson and Byers, 1994; and Biro et al., 2002). The following methods have been reviewed in terms of their use, weaknesses and strengths.

Dietary Records

In this method, the respondent records the foods, beverages and the amounts of each consumed over a period of days. The amounts consumed may be measured using a scale or other household measures or may be estimated by using models, pictures, or no particular aid (Thompson and Byers, 1994). In the dietary records approach, respondents record the name of the food, preparation methods, recipes for food mixtures, and portion sizes. The method required that at the end of the recording period, a trained interviewer reviews the records with the respondent to clarify entries and to probe for forgotten foods (Bingham et al., 1994; and Thompson and Byers,

1994). Food records can provide accurate quantities of foods during the recording period, as such they are regarded as the "gold standard" against which other dietary assessments are compared.

The strength of food records is that it usually tends to reduce the problem of food omission and it provides a detailed food description, as it is done during eating time. On the other hand, the weaknesses are that there is bias in the selection of the sample and in the measurement of the diet. The approach may further pose a challenge if the respondents are not motivated and literate (Thompson and Byers, 1994).

Since the approach also requires that respondents should record and measure all the foods eaten, respondents may alter the dietary behaviors to ease the work of recording the foods. This may be a weakness if the purpose of the assessment is to measure usual dietary behavior. However, if the purpose of the assessment is to enhance awareness of dietary behavior and change that behavior, then this effect can be seen as a strength (Thompson and Byers, 1994).

The 24-Hour Dietary Recall

In this approach, the respondent is asked to recall and report all the foods and beverages consumed in the past 24 hours prior to the assessment. The approach requires well-trained interviewers, as most of the information is collected by asking probing questions (Hock et al., 2018; Thompson and Byers, 1994 and Hu, 2008). The method requires that the interviewer should be familiar with the foods available in the market and also be familiar with preparation practices. Probing is important as it helps to ensure that particular details of the foods, such as preparation method, forgotten foods, common additions to foods (e.g., butter on toast) and eating occasions not originally reported (e.g., snacks and beverage breaks) are captured (Thompson and Byers, 1994 and Hu, 2008).

The strengths of 24-hour dietary recall is that literacy of the respondent is not required as a trained interviewer records all the information from the respondent, and there is little burden on the respondent. The 24-hour dietary recall approach is more likely to have a representative sample of the population than are those who agree to keep food records. In addition, there is little room for respondents to modify their eating habits as the approach occurs after the food has already been eaten (Hock et al., 2018 and Thompson and Byers, 1994).

On the other hand, the weakness of the approach is that individuals may not report their food consumption accurately due to reliance on memory and the interview situation and may not be able to capture day-to-day variations in dietary intakes (Koppmair et al., 2017, Thompson and Byers, 1994 and Hu, 2008).

Food Frequency

This approach requires the respondent to report their usual frequency of consumption of each food from a list of foods for a specific period. Food frequency usually asks information on frequency of food consumption (though sometimes quantity can also be captured) from a list of foods provided. Portion sizes are sometimes collected to estimate relative or absolute nutrient intakes (Hock et al., 2018, Hu, 2008 and Thompson and Byers, 1994). The term "semiquantitative dietary history" is sometimes used to indicate a general food frequency questionnaire that allows for a limited quantification of serving size (Thompson and Byers, 1994).

Food frequency is meant to estimate the respondent's usual intake of foods. Hence, it can be used to assess an individuals' recent changes in diet as recalled in a given period of time. The approach can be used to rank individuals according to their usual consumption of foods or groups of foods and, when portion sizes are included, to rank individuals according to nutrient intake (Hock et al., 2018 and Thompson and Byers, 1994).

Food frequency has a weakness in that few details of dietary intake are provided with less accurate quantities of intakes (Thompson and Byers, 1994 and Hu, 2008). In other instances, food frequency may have incomplete listing of foods coming from errors in frequency estimation and errors in estimation of usual serving sizes (Hock et al., 2018 and Thompson and Byers, 1994).

Dietary History

Dietary history is any dietary assessment that asks the respondent to report about past diet. It does not only limit to collecting data about frequency of intake of various foods but also about the typical composition of meals (Thompson and Byers, 1994). The term diet history is best reserved for diet assessment methods that ascertain a person's usual food intake in which many details about characteristics of foods as usually consumed are assessed in addition to the frequency and amount of food intake (Thompson and Byers, 1994).

The major strength of the diet history method lies in its assessment of usual meal patterns and details of food intake (as in records or recalls). In dietary history, a joint analysis of the effects of mixed meals is also possible. The weakness is that respondents are required to make a decision on the usual foods eaten as well as amounts of those foods eaten. This may be a challenge for most respondents (Thompson and Byers, 1994).

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PROBLEM STATEMENT AND JUSTIFICATION

Non-communicable diseases (of which hypertension is one) were once considered as a significant health problem only for developed countries or affluent societies such that terms like "diseases of the affluent, diseases of the west, or diseases of urbanization" were used (WHO, 2003). This meant that NCDs were considered not to be a problem for the LMICs or rural areas. This understanding has resulted in many developing countries not prioritizing management and treatment of most NDCs such as hypertension, diabetes, and others. There are neither policies nor dietary guidelines for the management of hypertension and their risk factors despite evidence of its increase. In Malawi, however, all hospitals providing secondary and tertiary services have hypertensive clinics that help hypertensive patients with nutrition advice as well as free anti-hypertensive drugs. Due to lack of specific dietary guidelines in these hypertensive clinics, nutritional advice is based on the service provider's knowledge of hypertension. As a result, the advice that is given to hypertensive patients is not standardized and specific.

Also, little research has been conducted to determine the type of foods that hypertensive patients eat to manage their condition. It is hypothesized that once these patients are diagnosed with hypertension and they start attending hypertensive clinics, they are furnished with nutritional advice on the type of foods to exclude, limit and include in their diets. Hypertensive patients who have been attending hypertensive clinic for a long time may tend to relax on the nutritional advice given, hence are more affected with hypertension than the newly diagnosed patients. We hypothesize that newly diagnosed patients tend to adhere to the nutritional advice and are healthier than patients who have been attending hypertensive clinics for a long time.

Diet has a significant role in lowering severity of hypertension (Msyamboza et al. 2013) and adherence to the nutrition advice given should significantly improve the lives of hypertensive

patients. It is also one of the most cost effective and sustainable means of managing hypertension and other NCDs especially in countries where most people live below poverty line (Msyamboza et al. 2013).

This research, therefore, investigated the dietary practices of two groups of hypertensive patients attending hypertensive clinics in referral hospitals in Malawi, and how the dietary advice they received from nurses and clinical officers influenced their dietary practices. The changes made in eating habits were also compared to severity of hypertension for each group. One group was hypertensive patients who had been attending hypertensive clinics for more than 24 months and the other group was for hypertensive patients who had been attending hypertensive clinics for less than 24 months. The 24-month cut off point was arbitrarily chosen. The hypothesis was that hypertensive patients who had been attending hypertensive clinic for less than 24 months would be better at adhering to the dietary advice given due to the state of shock of being newly diagnosed as being hypertensive. On the other hand, hypertensive patients who had been attending hypertensive clinics for more than 24 months would relax and not adhere to dietary advice, as they would depend more on hypertensive drugs.

Dietary advice given during these hypertensive clinic sessions was assessed to determine the type of advice given and patient's interpretation and perception of the advice. The results obtained in this research may help to improve dietary management of hypertensive patients in hospitals in Malawi.

CHAPTER 2

LITERATURE REVIEW

This section discusses nutrients and foods that have a correlation with blood pressure as well as foods for a healthy diet.

Salt

The recommended salt intake for both hypertensive and prehypertensive people is less than 1.5 g (USDHHS and USDA, 2016). Strong evidence exists about the positive linear relationship between salt intake and the risk of hypertension. In a randomized controlled trial conducted by Sacks et al., (2001), reducing sodium intake from high to intermediate level reduced the systolic blood pressure by 2.1 mm Hg during the control diet and by 1.3 mm Hg during the DASH diet (rich in vegetables, fruits, and low-fat dairy products). Further reduction of sodium intake from intermediate to low level resulted in reductions of 4.6 mm Hg during the control diet and 1.7 mm Hg during the DASH diet. These effects were reported in hypertensive and normotensive participants. A combination of DASH diet and low sodium level resulted to a reduced mean systolic blood pressure. Cutler et al., (1997) also found that lowering sodium intake reduced blood pressure by 4.8/2.5 and 1.9/1.1 mm Hg (systolic/diastolic) in hypertensive and normotensive subjects respectively. Another randomized controlled trial found that reduced sodium intake and weight loss had a positive impact on treating hypertension. It was also reported that reduced sodium intake and weight loss constitute a feasible, effective, and safe nonpharmacologic therapy of hypertension in older persons (Whelton et al., 1998).

Sugar

The recommendation for sugar consumption is less than 10% of total daily energy intake. This recommendation also helps to prevent other metabolic diseases such as diabetes and obesity

that are associated with hypertension (Kurukulasuriya et al., 2011) and therefore prevent or help in management of hypertension. Reaven and Ho in 1991 found that substituting either glucose or sucrose for the vegetable starch fed to Sprague-Dawley rats led to significant increase in blood pressure, plasma insulin and plasma triglyceride concentrations. Sucrose-enriched diet produced more effects than glucose-rich diet. Similar observations have also been reported in human beings with hypertension. In a study conducted by Saygin et al., in 2015, it was reported that chronic consumption of high fructose corn syrup cause cardiac and endothelial injury of aorta by hyperuricemia and induced oxidative stress and inflammation.

Total Fats

It is recommended that consumption of total fats should be reduced to less than 30% of daily total energy intake, saturated fat to less than 10% of total daily energy intake, trans-fats less than 1% of total daily energy intake, and cholesterol less than 200 mg per day (McGuire, 2011). Strong and consistent evidence shows that replacing saturated fats with polyunsaturated fats is associated with reduced risk of cardiovascular diseases and death. A randomized controlled trial conducted by Appel et al (2005) found that a partial substitution of carbohydrate with either protein or monounsaturated fat lowers blood pressure, improves lipid profile, and reduces cardiovascular risk. The study was conducted to determine the effect of substituting total saturated with a monounsaturated fatty acid or protein. The study constituted a diet rich in carbohydrates; a diet rich in protein (half from plant sources); and a diet rich in unsaturated fat (mainly monounsaturated fat). The results showed a reduction in blood pressure, low-density lipoprotein cholesterol, and estimated coronary heart disease risk as compared with baseline. When the results were compared with the carbohydrate diet, the protein diet decreased mean systolic blood pressure by 1.4 mm Hg and by 3.5 mm Hg diastolic pressure among hypertensives; and decreased LDL cholesterol by 3.3

mg/dL, HDL cholesterol by 1.3 mg/dL and triglycerides by 15.7 mg/dL. On the other hand, unsaturated fat diet decreased systolic blood pressure by 1.3 mm Hg and diastolic blood pressure by 2.9 mm Hg among hypertensives. The unsaturated fat diet, however, did not have a significant effect on LDL cholesterol, and increased HDL cholesterol by 1.1 mg/dL and lowered triglycerides by 9.6 mg/dL.

Fruits and vegetables

It is recommended that at least 4-5 servings of fruits and vegetables should be consumed per day. A diet rich in fruits and vegetables, low-fat dairy foods and reduced saturated and total fat can substantially lower blood pressure. This type of diet also helps to prevent and treat hypertension. In a randomized controlled clinical trial conducted by Appel et al., (1997), it was found that a diet rich in fruits, vegetables, and low-fat dairy products and with reduced saturated and total fat (combination diet) reduced the blood pressure by 5.5/3.0 mm Hg more than the control diet (low in fruits, vegetables, and dairy products). A diet rich in fruits and vegetables reduced systolic blood pressure by 2.8 mm Hg and diastolic blood pressure by 1.1 mm Hg more than the control diet. Among hypertensive people (BP >140/90 mm Hg), the combination diet reduced systolic and diastolic blood pressure by 11.4 mm Hg (systolic) and 5.5 mm Hg (diastolic) more than the control diet. While those without hypertension, the reductions were 3.5 mm Hg (systolic) and 2.1 mm Hg (diastolic). Fogli-Cawley et al., in 2007 conducted a cross sectional study to assess the relationship between dietary patterns consistent with the 2005 dietary guidelines for Americans (DGA) as measured by the DGA Index. The index had an inverse relationship with waist circumference, triacylglycerol concentration, both diastolic and systolic blood pressure, prevalence of abdominal adiposity, and hyperglycemia. The results further showed lower

prevalence of metabolic syndrome among individuals in the highest DGAI quintile category than their counterparts in the lowest category of DGAI quantile.

Vitamin E

Higher daily intakes of vitamin E is recommended especially for the elderly and those exposed to oxidative stress factors. Vitamin E is mainly obtained from animal feeds and vegetable oils, as they appear to contain α-tocopherol in their leaves and other green parts. Vitamin E is also contained, to lesser extents, in seeds and cereal grains (Combs, 2012). Increased consumption of vitamin E is beneficial to hypertensive patients in that vitamin E functions as a scavenger of free radicals in membranes hence quenching the progress of lipid peroxidation chain reaction (Combs, 2012). Vitamin E also inhibits inflammation, cell adhesion, platelet aggregation, and smooth muscle cell proliferation. Vitamin E is recognized to play a role in the normal metabolism of all cells, and protects against the potentially damaging effects of reactive oxygen species formed during metabolism or that are encountered in the environment (Combs, 2012). In a double-blind, placebo-controlled study by Stephens et al. where a group of patients were given 800 IU daily of α-tocopherol found that it significantly reduced the risk of primary trial endpoint of cardiovascular death and non-fatal myocardial infarction (Stephens et al., 1996). In another study by Rimm et al., (1993) an association between a high intake of vitamin E and a lower risk of coronary heart disease in men was found. In this study, men who had higher intakes of vitamin E intakes of more than 60 IU/d) had a multivariate relative risk of 0.64 as compared with men whose intakes were below 7.5 IU/d and men who did not take vitamin E supplements (Rimm et al., 1993).

Vitamin C

Vitamin C plays a role in preventing and managing hypertension. National Health and Nutrition Examination Survey (NHANES I) reported that subjects with highest vitamin C intakes

showed less cardiovascular death than those with lower estimated vitamin C intakes (Enstrom et al., 1992). In the same study, the concentration of vitamin C in plasma was found to be highly negatively correlated with values of several cardiovascular risk factors, including blood pressure, total serum cholesterol, and LDL cholesterol (Toohey et al., 1996).

Calcium

A study by Wang et al., reported a reduced risk of hypertension in subjects with a higher quintiles of dietary calcium and dietary vitamin D intake, although it did not change with calcium or vitamin D supplements (Wang et al., 2008). In addition, adjustment for dietary calcium significantly attenuated the inverse association of low-fat dairy intake with risk of hypertension. The study further reported that intakes of low-fat dairy products, calcium, and vitamin D had an inverse relationship with the risk of hypertension in middle-aged and older women. This suggests the potential roles that Calcium and vitamin D may play in the primary prevention of hypertension and cardiovascular complications (Wang et al., 2008).

Magnesium

Studies have found an inverse relationship between high intakes of magnesium and the risk of hypertension (Houston and Harper, 2008). Jingcheng and Mobai, (1995) found that patients with essential hypertension who drink hard-water (high in calcium and magnesium) had lower blood pressure than their counterparts who drank soft water (Jingcheng and Mobai, 1995). Other studies found that a diet high in magnesium (500–1000 mg/d) may lower blood pressure (Jee et al., 2002 and Touyz, 2003).

Potassium

The recommended potassium intake for prehypertensive and hypertensive people is 4.7 g/day (McGuire, 2011). Potassium affects almost every cellular function in the body and its role

in blood pressure regulation had been supported by many clinical and epidemiologic studies (Zhou et al. 2000). Vascular vessels and the kidney are the key organs that are strongly affected by potassium balance. In a study conducted by Zhou et al., (2000) and Liu et al., (1994), potassium supplementation lowered blood pressure in Dahl salt-sensitive rats that were fed a high-sodium diet. This reduced the incidence of stroke and its related complications. In addition, it was found to have a preventive effect against cardiac hypertrophy, mesenteric vascular damage, and renal injury. A meta-analysis of 33 randomized trials looking at the effects of increased potassium intake on blood pressure concluded that potassium supplementation (≥60 mmol per day in all but 2 trials) lowered systolic pressure by an average of 4.4 mm Hg and diastolic pressure by an average of 2.5 mm Hg in hypertensive subjects. The study further reported a reduction in systolic pressure and diastolic pressure by an average of 1.8 mm Hg and 1.0 mm Hg respectively in normotensive subjects (Whelton et al., 1997).

High potassium intake has been associated with decreased risks for CVDs In populations consuming high amounts of potassium (20 to 40 mmol/d) from diets high fruits and vegetables, hypertension affects only 1% of the population (Houston and Harper, 2008). One population study in St. Lucia found that an increase in potassium intake by only 20 to 30 mmol/d (742–1173 mg/d) in the diet reduced blood pressure by 2 to 3 mm Hg in the study population (Khaw and Rose, 1982). Similar results were further observed in Yanomamo Indians in Brazil, who consumed mostly a vegetarian diet (Houston and Harper, 2008). Observational studies also found that increasing potassium intake by 750 to 1000 mg/d can lower BP by 2 or 3 mm Hg (Ascherio et al., 1992 and Tunstall-Pedoe, 1999). A meta-analysis review of 19 clinical trials done by Cappuccio and MacGregor in 1991 found that oral potassium supplements significantly lowered both systolic BP and diastolic BP (5.9 mm Hg and 3.4 mm Hg, respectively) (Cappuccio and MacGregor, 1991).

Another meta-analysis of 33 randomized controlled trials (Whelton et al., 1997) made similar conclusions. Geleijnse et al., in 2003 also found that hypertension could be prevented if there was reduced intake of sodium and increased intake of potassium.

Whole grains

Consumption of more whole grains (more than 3 servings per day) as opposed to refined grains (should be less than 3 oz or less than 85 g) is recommended. Wang et al., (2007) reported that increased intake of whole-grain reduced the risk of hypertension in middle-aged and older women. Intake of whole and refined grains results in changes in blood pressure. The bran and the germ of whole grains contain most of the vitamins, minerals, phytochemicals, and other nutrients hence their potential role in primary prevention of hypertension and its cardiovascular complications. Other studies also found a reduced risk of type II diabetes with higher intakes of whole grains (Meyer et al., 2000 and Liu et al., 2000). The relative risk between the highest and lowest quartiles of whole-grain consumption was 0.65 after adjusting for age, sex, geographic area, smoking status, body mass index, energy intake, and intakes of vegetables, fruit, and berries. Sahyoun et al. in 2006 also found a significant inverse relationship between whole-grain intake and the metabolic syndrome and mortality from cardiovascular disease. Tighe et al. (2010) found a 6 and 3 mm Hg decrease in systolic blood pressure in subjects fed wheat, or wheat + oats, respectively, compared to a control group that was fed a refined diet.

Dietary Fiber

It is recommended that 14 g of fiber or foods that are high in fiber should be consumed per 1000 kcal (Sahyoun et al. 2006). Dietary fiber has been suggested to provide protection against CVDs. Fiber helps to slow down absorption and digestion of carbohydrates that lead to a reduced demand for insulin (Sahyoun et al. 2006). Insoluble fiber shortens the time that the food stays in

intestines. This allows less time for carbohydrates to be absorbed. Several epidemiologic studies have reported the protective effect of fiber intake against hypertension and type 2 diabetes. Whole grains are rich sources of fiber hence the reported protective effects (Sahyoun et al., 2006). Burke et al. in 2001 found a protective effect of protein and fiber on systolic blood pressure. When compared to control subjects, the overall reduction in systolic blood pressure was 5.9 mm Hg.

Dairy Products

It is recommended to consume 2-3 servings of fat free or low-fat dairy products per day (Ackley et al. 1983). These products include milk, yogurt, cheese, and fortified soy beverages. Studies have found that consumption of dairy products, especially those rich in calcium, have a protective effect against hypertension (Ackley et al., 1983). Wang et al in 2008 also reported an inverse relation between hypertension and consumption of dairy products, calcium and vitamin D. A randomized placebo controlled study found that *L. helveticus* LBK-16H fermented milk containing bioactive peptides lowered blood pressure in hypertensive subjects (Seppo et al., 2003). A mean difference of 6.7 ± 3.0 mm Hg in systolic blood pressure and 3.6 ± 1.9 mm Hg in diastolic blood pressure was reported between the test group and control groups. Hata et al., in 1996 also found that consumption of sour milk for 8 weeks significantly reduced systolic blood pressure by 14.1 ± 3.1 mm Hg and diastolic blood pressure by 6.9 ± 2.2 mm Hg. Similar results by FitzGerald et al., were reported in 2004 where the renin-angiotensin-aldosterone system was targeted for blood pressure control. In this system, angiotensinogen is broken down by renin to produce angiotensin I, which is broken down by angiotensin-I-converting enzyme (ACE) to angiotensin II. Angiotensin II has a vasoconstriction effect and can cause hypertension. Milk proteins, both caseins and whey, are good sources of ACE inhibitory peptides, hence have the potential to reduce

hypertension. Alvarez-León et al. in 2006 also reported an inverse association between the intake of dairy products and hypertension, stroke and colorectal cancer.

Physical Activity

It is recommended that both pre-hypertensive and hypertensive people should be physically active and maintain a healthy body weight (a BMI of between 18.5 to 24.99 kg/m^2) (Brill, 2011). A 60-minute accumulation of moderate intensity exercise per day would be recommended. This recommendation is appropriate especially in cases where there is need to manage obesity. WHO recommends 60 minutes a day of moderate-intensity activity for all health benefits unlike the 30-minute recommendation of moderate activity, which is appropriate for cardiovascular/metabolic health (FAO/WHO, 2003).

There is strong and consistent evidence on the linear relationship between regular physical activity and prevention of chronic diseases (Arraiz et al., 1992; Krauss et al., 2000 and Blair et al., 1996). Studies have reported that vigorous exercise increases plasma HDL and apolipoprotein A-I and decreases plasma triacylglycerol, very low-density lipoprotein (VLDL), and atherogenic small, dense LDL concentrations (Williams et al., 1986, 1990, 1992). For hypertensive individuals, there is need to apply this recommendation with care so as to avoid other complications (Pate et al., 1995). For most hypertensive patients, it is better to start with moderate intensity exercise training and then gradually increase in intensity (Hagberg et al., 1987).

Physical exercise also helps to prevent weight gain or reduce body weight especially among obese people. There is need to maintain a regular physical exercise because weight gain accompanies aging and is independently associated with coronary heart disease (Willett et al., 1995) and stroke (Rexrode et al., 1997). Paffenbarger et al., in 1991 reported that collegiate sports-play did not have an effect on hypertension incidence. In addition, exercises such as contemporary

walking, stair climbing, or light sports play did not also have any effect. In the study, a negative relationship between vigorous sports participation and hypertension risk was found with a direct relationship between risk and weight-for-height, weight gain, or parental hypertension.

Alcohol Consumption

A strong positive relationship between regular, heavier (more than 2 drinks per day) alcohol intake and hypertension has been reported in several cross-sectional and prospective studies. The relationship is evident in both sexes and several races and is independent of the type of alcoholic beverage, adiposity, education, smoking, salt intake, and several other traits (Klatsky, 1996). Results from clinical experiments show that blood pressure falls when one stops drinking and that it rises again within days after resuming drinking. Excessive alcohol consumption is an important and insufficiently recognized risk factor of hypertension (Saunders et al., 1981). In 2008, Sesso et al., found that light-to-moderate alcohol consumption decreased hypertension risk in women and increased it in men. In women, the risk starts to appear when consuming more than 4 drinks per day and in men it starts to appear when moderately drinking (more than 1 drink per day). However, when other factors such as body mass index, diabetes, and high cholesterol were factored, the benefits of alcohol in the light-to-moderate range disappeared and strengthened the adverse effects of heavy alcohol intake. More studies presenting evidence of the relationship between alcohol intake and hypertension and its related cardiovascular complications are reviewed in Klatsky and Gunderson (2008).

Several epidemiological studies have also shown that alcohol consumption is associated with the development of 5-30% of hypertension cases in the general population. Aging causes muscular atrophy and losses in renal and liver tissue functions. Alcohol consumption among an

older population may, therefore, increase the odds of developing hypertension (Nakanishi et al., 2002; Ohmori et al., 2002; Thadhani et al., 2002 and Nakamura et al., 2007).

Tobacco Use

Complete cessation of smoking by both prehypertensive and hypertensive individuals is recommended. In a study conducted by Paffenbarger et al., (1991) smoking and hypertension were the strongest risk factors for mortality within an individual. A combination of smoking and lack of physical activity were the most dangerous risk factors among the studied population. Krauss et al., (2000) recommends that there is need to prevent weight gain among habitual smokers who stop smoking.

CHAPTER 3

Study 1: Assessment of Diets Consumed by Hypertensive Patients (Dietary Practices)

Dietary practices for both categories of hypertensive patients were assessed to determine of the advice that health professionals give hypertensive patients had resulted in changes in their eating habits. In the assessment, 24-hour dietary recall and food frequency questionnaires were used to determine frequency of food consumption and nutrient intakes for the two categories of patients.

Study Objectives

1. To assess the type, amount and frequency of foods eaten by hypertensive patients who have been attending hypertensive clinics for less than 24 months and more than 24 months in Malawi.

2. To compare the dietary practices of hypertensive patients who have been attending hypertensive clinics for less than 24 months and more than 24 months in Malawi.

Study Research Question

1. Are dietary practices of hypertensive patients who have been attending hypertensive clinics for less than 24 months and more than 24 months different from each other?

METHODS

Study Area

The research was conducted in Malawi. Malawi has four referral hospitals (known as Central Hospitals) namely Mzuzu (in Northern Region), Kamuzu (in Central Region), Queen Elizabeth and Zomba (in Southern Region). These hospitals have hypertensive clinics where hypertensive patients go for nutritional and medical services. For hospitals, hypertensive clinics are conducted weekly but on different days of the week. During hypertensive clinic, hypertensive patients are given a health education talk on nutrition advice, identification of hypertensive symptoms and hypertensive management tips. After the health education talk, patients go through the regular process of measurements (weight and blood pressure), one-to-one counseling and medical review based on the measurement outcome.

Study Design

This was a cross sectional study that collected quantitative data at one point in time. Data collection took place from August to September 2016.

Study Participants and Recruitment

This study recruited hypertensive patients who have been attending hypertensive clinics in any of the four central hospitals in Malawi. Hypertensive patients were recruited and divided into two categories. The first category was for hypertensive patients who had been attending hypertensive clinics for less than 24 months while the second category was for hypertensive patients who had been attending hypertensive clinics for more than 24 months. For both categories, adult males and females more than 18 years were targeted as potential participants. Pregnant women and children less than 18 years old were excluded from this study.

Hypertensive patients were interviewed at the hospital during the day of the clinic. At the beginning of the clinic session, the nurse or clinical officer briefly introduced the research to all hypertensive patients using a written script/note for nurse/clinical officer (Appendix 4). In addition, the nurse or clinical officer allowed the researcher to explain the research to hypertensive patients. This was done to ensure that hypertensive patients clearly understood what the research was all about and that any information that may have been misrepresented by the nurse or clinical officer in the introduction was clarified. After the research procedure was explained, hypertensive patients were given an opportunity to ask questions. For participants who agreed to participate in the study, the research assistants went through the participant-screening tool (Appendix 1) to determine eligibility of the patient in the study.

Once eligibility was determined and the hypertensive patient agreed to participate in the study, the research assistant went through the written informed consent form for hypertension patients (Appendix 2). The form further explained to hypertensive patients about the study and their right to participate or not to participate in the study. Once the patients consented to participate in the study, research assistants signed the consent form on behalf of the respondents so as to conceal the identity of the patient.

Sample Size

A total sample size of 344 hypertensive patients in all the four hospitals was interviewed. The desired sample size was calculated using the following formula:

$$n = \frac{[z^2 (1-p)\, p]}{e^2}$$

where n=sample size required

z=confidence interval (1.96)

p=prevalence of hypertension in Malawi (33%)

e= margin of error at 5% (0.05)

The formula above estimated a target sample size of 308 hypertensive patients. A non-response rate of 10% was factored to get a final sample size of 344. Out of the 344 participants, 172 were hypertensive patients who have been attending hypertensive clinics for less than 24 months and the other 172 were those that have been attending hypertensive clinics for more than 24 months. For each hospital, 86 hypertensive patients were interviewed (43 hypertensive patients who have been attending hypertensive clinics for less than 24 months and 43 hypertensive patients who have been attending hypertensive clinics for more than 24 months). Quota sampling design (nonprobability sampling) was used (Burns et al., 2008) to select participants for each hospital and category. This approach was used because there were no data on the number of hypertensive patients who have been attending hypertensive clinics for less than 24 months and more than 24 months. Clinics only keep aggregate data for the number of patients they have seen on a particular clinic session. From the records the clinics had, it was not possible to categorize patients based on time they have been attending hypertensive clinics.

Data Collectors' Training for Structured Interviews

The researcher and local advisor trained research assistants (for both anthropometric measurements and hypertension questionnaire) on how to conduct one-to-one structured interviews using a structured hypertension questionnaire, 24-hour dietary recall and food frequency questionnaire. The researcher developed the questionnaires based on research questions and objectives.

During training, the researcher, local advisor and research assistants went through the questionnaires to make sure that research assistants understood all the questions in the questionnaires. After training, research assistants role-played by interviewing one another in turn to get familiar with the questions and improve their interviewing skills. To improve the quality of

questionnaires, pretesting was also done after training. Pretesting was done at Nchezi hypertensive support group (one of the groups that was formed under Kamuzu Central Hospital). In total, data was collected from 10 hypertensive patients during pretesting. The interviewed hypertensive patients were similar to the target population that was finally interviewed for final data collection. Feedback from pretesting helped to improve the questionnaires by re-wording questions, adding answer options to questions and finding appropriate terms that are used by nurses and clinical officers when conducting hypertensive clinic.

Data Collection

Four research assistants used a structured hypertension questionnaire (Appendix 6) to do one-to-one structured interviews with hypertensive patients who consented to participate in the study. All interviews were conducted in local language (Chichewa) at the hospital on the day of hypertension clinic. Nurses and Clinical Officers followed their normal clinic protocols and did not deviate from their typical methods to accommodate this research study. Components of the questionnaire included demographic characteristics, nutritional advice given, and hypertensive patients' interpretation and perception of the advice given at the clinic by nurses and clinical officers.

Research assistants also administered a 24-hour dietary recall (Appendix 7) and a food frequency questionnaire (FFQ) (Appendix 8) to collect data on type and amounts of foods eaten, and frequency of consumption of those foods respectively. A 24-hour dietary recall was used to collect hypertensive patients' current food habits by asking what foods and drinks that the patient ate in the past 24-hours prior to the interview. A 5-step multiple pass approach was used to administer the 24-hour dietary recall (Conway et al., 2003). In this approach, a quick list of foods

was done, forgotten foods were probed, time and occasion of eating was asked, detail cycle (description of food, cooking methods, brands, etc.), and then final probes were done.

FFQ was used to collect information on long-term eating habits of hypertensive patients by asking about their usual food and drink intake in the past 12 months. The FFQ consisted of 8 food groups that are commonly eaten in Malawi. The FFQ list was developed based on the six food groups from the Malawi food guide. The six food groups in the Malawi food guide were modified to come up with the 8 foods. Staples were split into cereals and roots and tubers, eggs and fish were put as separate food groups. This was done to emphasize the foods that are recommended for hypertensive patients at the clinic. Nine consumption frequencies were used on the FFQ: 1 = Never/Less than once per month, 2 = 1-3 times per month, 3 = once/week, 4 = 2-4 times per week, 5 = 5-6 times per week, 6 = once/day, 7 = 2-3 times per day, 8 = 4-5 times per day and 9 = 6 or more times per day. In addition to frequency, amounts of intakes were also recorded.

To help with estimation of amounts to be recorded for both 24-hour dietary recall and FFQ, the researcher prepared and measured different types of food prior to data collection. These foods were measured using common utensils that are locally available and used. These included cups, spoons (of different sizes), and different portions of foods (such as fruits). The measurements were done so as to determine the quantities of food and drink for each utensil used. Research assistants carried and used these utensils during interview to help estimate the quantity of food eaten by hypertensive patients.

Data Analysis

Hypertension questionnaire: Data collected through the hypertension questionnaire was entered and analyzed using Statistica l Package for Social Science (SPSS) version 22 (SPSS, I., 2013). SPSS was also used to compare variables between the two hypertensive categories, where

ANOVA and Student t-test were performed. In addition, Pearson's bivariate correlations were done for dietary and non-dietary variables with blood pressure.

24-hour recall: A NutriSurvey package (Erhardt, 2014) was used to analyze data from 24-hour dietary recall and FFQ where daily nutrient intakes were calculated to determine energy and nutrient adequacy. Energy and nutrient intakes from NutriSurvey were exported to SPSS for further analysis. The food database used for NutriSurvey program is based on the German Bundeslebensmittelschlüssel (BLS, version II.3, 1999), which is based on several national and international food tables. The NutriSurvey standard food database is reduced to about 1000 foods from about 3000 foods and it is complemented with some extra dishes. In this research, the recommendations of the German Society for Nutrition (DGE) (default for the program), were used to compare nutrient intakes. The DGE recommendations are based on age and sex of the person as summarized in Table 1.

Table 1: Recommendations for macronutrient RDAs.

Group	Energy (kcal/d)	Water (g/d)	Protein (g/d)	Fat (g/d)	CHO (g/d)	Dietary Fiber (g/d)
Women 19-24 years	1938.9	2700	48	77	351	30
Women 25-50 years	1938.9	2600	47	73	332	30
Women 51-65 years	1836.9	2250	46	65	293	30
Women older 65 years	1632.8	2250	44	58	255	30
Men 19-24 years	2551.2	2700	59	96	439	30
Men 25-50 years	2449.1	2600	59	92	419	30
Men 51-65 years	2245.1	2250	58	81	360	30
Men older 65 years	2040.9	2250	54	73	324	30
Children 0-3 months	484.7	680	11	24	47	-
Children 4-12 months	714.3	1000	10	30	91	-
Children 1-3 years	1071.5	1300	13.5	41	155	-
Children 4-6 years	1479.7	1600	16	51	219	23
Children 7-9 years	1836.9	1800	24	62	265	25
Children 10-12 years (f)	2040.9	2150	35	71	292	28
Children 13-14 years (f)	2245.0	2450	45	78	316	30
Youths 15-18 years (f)	2040.9	2800	46	81	373	30
Children 10-12 years (m)	2347.1	2150	34	78	328	28
Children 13-14 years (m)	2755.3	2450	46	93	385	30
Youths 15-18 years (m)	2551.2	2800	60	100	458	30
Pregnant > 4 months	2199.1	2700	58	83	374	30
Nursing mother	2586.9	3100	63	96	433	30

RDAs are mainly used for planning meals for individuals, as it ensures that all individuals are meeting their daily energy and nutrient intakes. This research investigated adequacy of energy and nutrient intakes of hypertensive patients and the use of RDAs was maintained because they provide a higher chance that hypertensive patients are meeting their intakes.

Food frequency questionnaire: Healthy Eating Index (HEI) (McCullough et al., 2000), Diet Variety Score (DVS) and Diet Variety Score for Recommended foods (DVSR) (Kant et al., 2000, and McNaughton et al., 2008) were analyzed from FFQ. Using these indices and scores, daily food intakes (HEI), overall dietary quality (DVS), and adherence to dietary advice (DVSR) was calculated, and data were exported to SPSS for further analysis and comparison between the two hypertensive groups.

Healthy eating index was calculated by considering servings per day of 8 equally weighted food components [grains, vegetables, fruits, meat, total fat (as a percent of total daily energy intake), cholesterol (mg/day), sodium (mg/d) and variety as measured by the number of food items eaten more than 3 times per week (McCullough et al., 2000). A score of 10 (best adherence) was given to each food if the person ate the required servings or more and if no serving was eaten, a score of 0 (poorest adherence) was given. If fewer servings were consumed, then the score was calculated proportionately (McCullough et al., 2000). The overall score ranged from 0-80 points. However, a total score out 80 was converted to a total score of 100 points.

Dietary variety score and dietary variety score for recommended foods were calculated by summing up the number of food items consumed at least once a week from the 8 foods on the FFQ. Each food item consumed was given a score of 1 and the total score was 8. Using these 8 foods, a score of 5 or more represented a dietary variety while a score of less than 5 represented no dietary variety. Because the food items on the FFQ were the ones that are also recommended at hypertensive clinics, adherence to the dietary advice (by assessing DVSR) was based on the same list of foods as DVS (i.e 8 food items were used to calculate both DVS and DVSR).

RESULTS

Demographic Characteristics of Hypertensive Patients

Quantitative data were collected from 345 hypertensive patients (representing 100% response rate). As per study design, 173 respondents had been attending hypertensive clinic for less than 24 months and 172 respondents had been attending hypertensive clinic for more than 24 months. For each hospital (except Kamuzu central hospital), data were collected from 86 respondents while for Kamuzu central hospital, data were collected from 87 respondents. The target for each hospital was 86 respondents though Kamuzu Central Hospital happened to have one more respondent (Table 2).

Table 2: Demographic characteristics of hypertensive patients attending hypertensive clinics in Malawi.

Variable (n=345)		Frequency	Percentage
Hospital	Mzuzu Central	86	24.9
	Kamuzu Central	87	25.2
	Queen Elizabeth Central	86	24.9
	Zomba Central	86	24.9
Sex	Male	70	20.3
	Female	275	79.7
Marital Status	Monogamous	208	60.3
	Polygamous	14	4.1
	Widow	91	26.4
	Divorced	23	6.7
	Single	5	1.4
	Separated	4	1.2
Education level	Adult Literacy	14	4.1
	Primary	206	59.7
	Secondary	81	23.5
	Tertiary	13	3.8
	University	9	2.6
	Don't Know	16	4.6
	None	6	1.7
Occupation	Farmer	101	29.3
	Employed	39	11.3
	Business	97	28.1
	None	102	29.6
	Casual Laborer	4	1.2
	Retired	2	0.6

In terms of sex, there were more females (79.7%) than males (20.3%) that participated in the study. During the qualitative data collection, nurses and clinical officers reported that females' health seeking behavior was better than that of males hence more females than males attend hypertensive clinics.

The overall mean age of respondents was 58 ± 11 years. The minimum age was 18 years and the maximum age was 87 years. The mean age for males was 61.5 ± 11 years and a range of 35-82 years while for females the mean age was 57 ± 11 years and a range of 18-87 years. For hypertensive patients in the less than 24 months category, the mean age was 56 ± 12.5 years with a range of 18-87 years while for the more than 24 months category, the mean age was 60.9 ± 10.1 years with a range of 31-83 years. The mean age shows that most respondents were older (above 55 years).

In terms of marital status, more than half of the respondents were monogamously married (60.3%), followed by those who were widows (26.4%) and divorced (6.7%). For men, the majority was monogamously married (81.4%) and 7.1% were widowers. As for females, 54.9% were monogamously married and 31.3% were widows. Female headed-households usually tend to have challenges in taking care of their households as they have limited access to resources.

A majority of the respondents (83.2%) had attended primary (59.7%) or secondary school (23.5%). The majority of respondents were farmers (58.9%) or doing small business (28.1%). In terms of hospital distribution, the trends for education levels were similar to the trend between the two categories. There were more respondents who had attended primary or secondary school. In terms of occupation, there were more respondents who were farmers or doing small businesses across all the hospitals.

The mean duration of attending hypertensive clinic for patients in the category of less than 24 months was 14.69 ± 7.8 months. The minimum duration was 1 month and the maximum duration was 24 months. For the more than 24 months category, the mean duration of attending hypertensive clinic was 117.3 ± 84 months. The minimum duration was 26 months and the maximum duration was 420 months.

Types, Amounts and Frequency of Food Consumption

In this research, a list of food items was developed to form the food frequency questionnaire. A total of 8 food items were included on the food frequency questionnaire. The food items were based on Malawi food guide that has six food categories. However, in the FFQ that was developed, food categories were expanded so as to isolate food items that are of particular importance to hypertension. The list, therefore, included cereals, roots and tubers, legumes, vegetables, fruits, meat, fish, and eggs. The mean daily intake for each food was calculated from the 24-hour dietary recall and the results are presented in Figure 1.
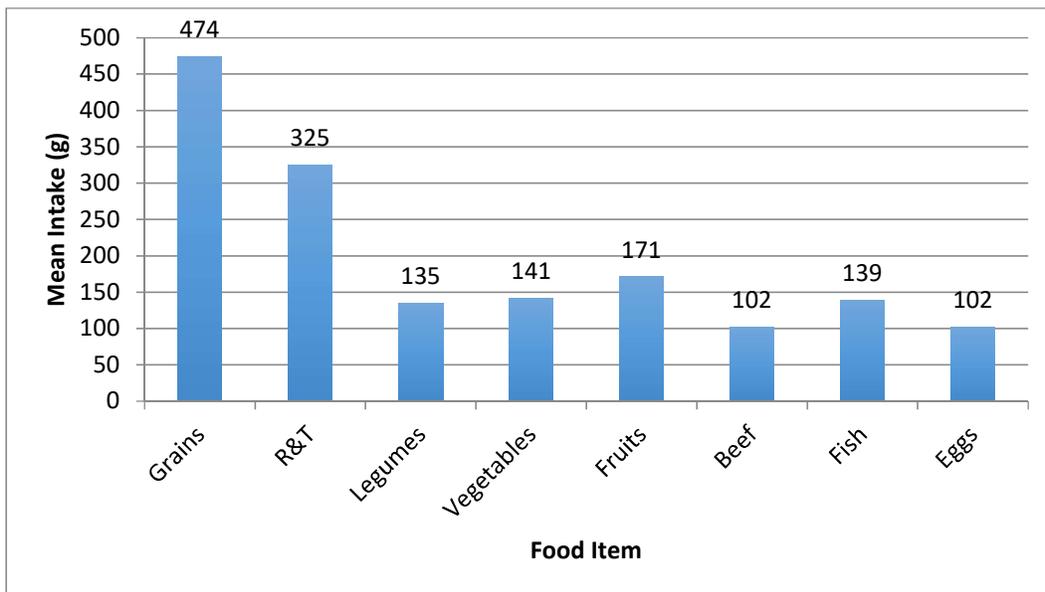
Figure 1: Mean daily intake of different food items from FFQ by hypertensive patients attending hypertensive clinics in Malawi.

Grains and Roots and Tubers (Staples Category)

Grains in this study included foods in the cereal category where maize, rice, and bread fall. From the results obtained from this study, the mean daily grain intake for all hypertensive patients was 474 ± 129 g/d. The trend of consumption based on category of patients was similar to the general population. The mean daily grain intake for patients in the less than 24 months category was 484 ± 133 g/d and that of hypertensive patients in the more than 24 months category was 464 ± 125 g/d. These mean intakes were not significantly different from each other ($P > 0.05$). In addition to grains, roots and tubers are also consumed and it is a staple food for some populations and they contribute to total daily energy intake.

In terms of frequency of consumption, the majority of hypertensive patients (94.7%) consumed 2-3 times per day grains or products made from grains (Figure 2). As discussed earlier, maize is the staple food and most Malawians consume *nsima* at least twice a day hence the high proportion of hypertensive patients who reported to be consuming grain at least three times a day.
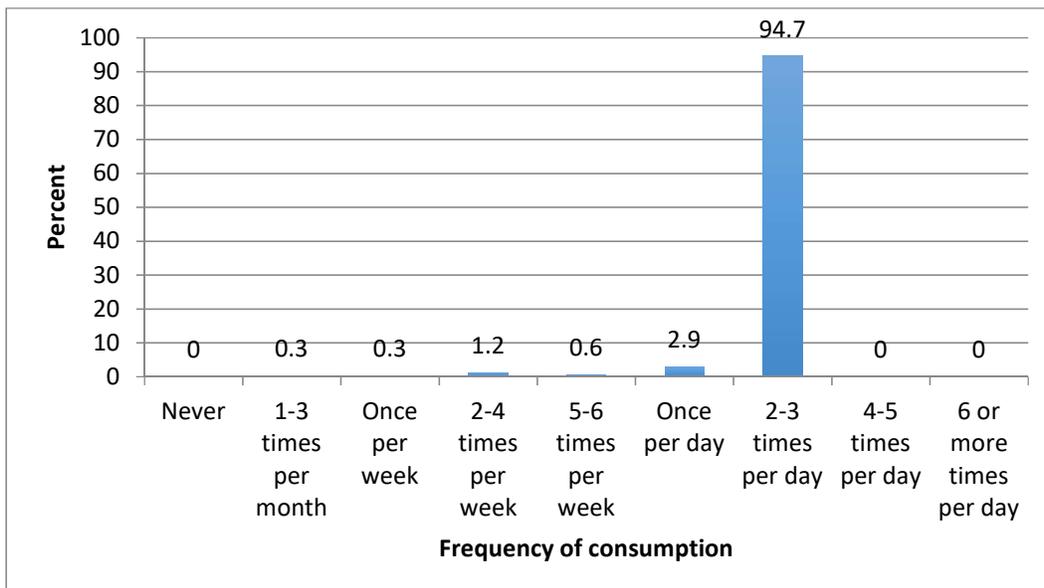
Figure 2: Frequency of grain consumption (percent of the population sampled who consumed grain at the indicated frequency).

Legumes

Legumes include foods such as beans, soybeans, pigeon peas, groundnuts etc. These foods were consumed among hypertensive patients on a regular basis. The mean legume consumption for all hypertensive patients was 135 ± 103 g/d. As for categories of patients, patients in the less than 24 months category had a relatively higher legume intake (138 ± 112 g/d) than patients in the more than 24 months category (132 ± 95 g/d) though they were not significantly different from each other ($P > 0.05$).

Almost half (47%) of hypertensive patients reported to consume legumes at least once a week. Other frequencies of legumes consumption by hypertensive patients were 1-3 times per month (as reported by 18.3%) and 2-4 times per week (as reported by 18.6%) (Figure 3)
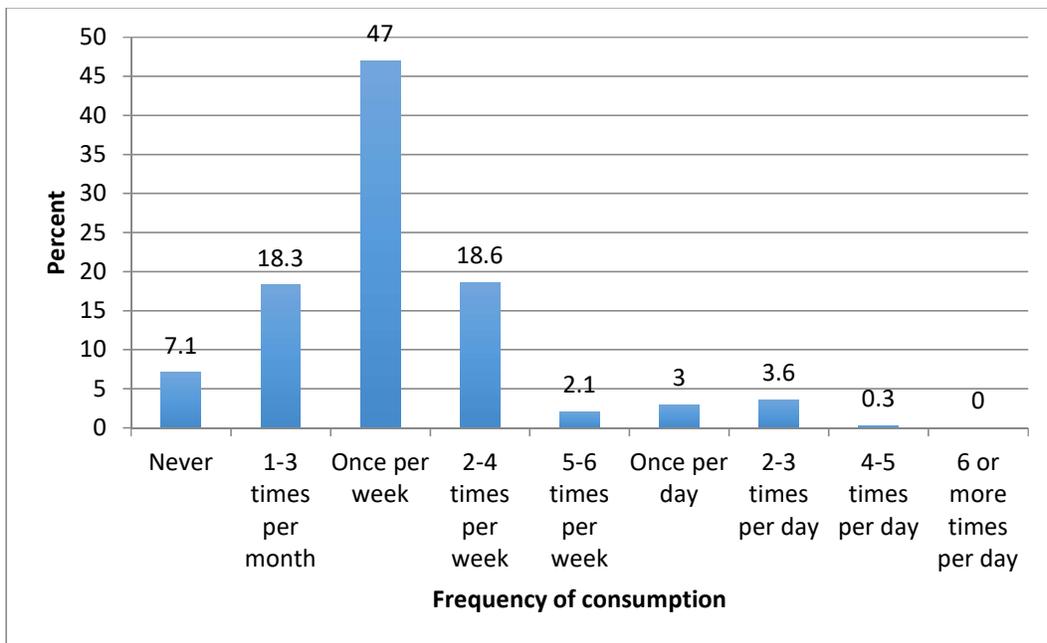
Figure 3: Frequency of Legume consumption among hypertensive patients attending hypertensive clinics in Malawi.

Fruits and Vegetables

The average fruit and vegetable consumption among hypertensive patients was 171 ± 105 g/d and 141 ± 96 g/d respectively). The differences were not significantly different from each other ($P > 0.05$). The mean fruit (165 ± 103 g/d) and vegetable (139 ± 103 g/d) consumption for hypertensive patients in the less than 24 months category was relatively lower than patients in the more than 24 months category (176 ± 106 g/d and 144 ± 89 g/d respectively). However, the study found that the frequency of vegetables consumption was relatively higher than the frequency of fruit consumption. More hypertensive patients (87.9%) reported to be consuming vegetables 2-3 times per day. As for fruits, only 24.2% and 24.8% of hypertensive patients reported to be consuming fruits once per week and 2-4 times per week respectively (Figure 4).
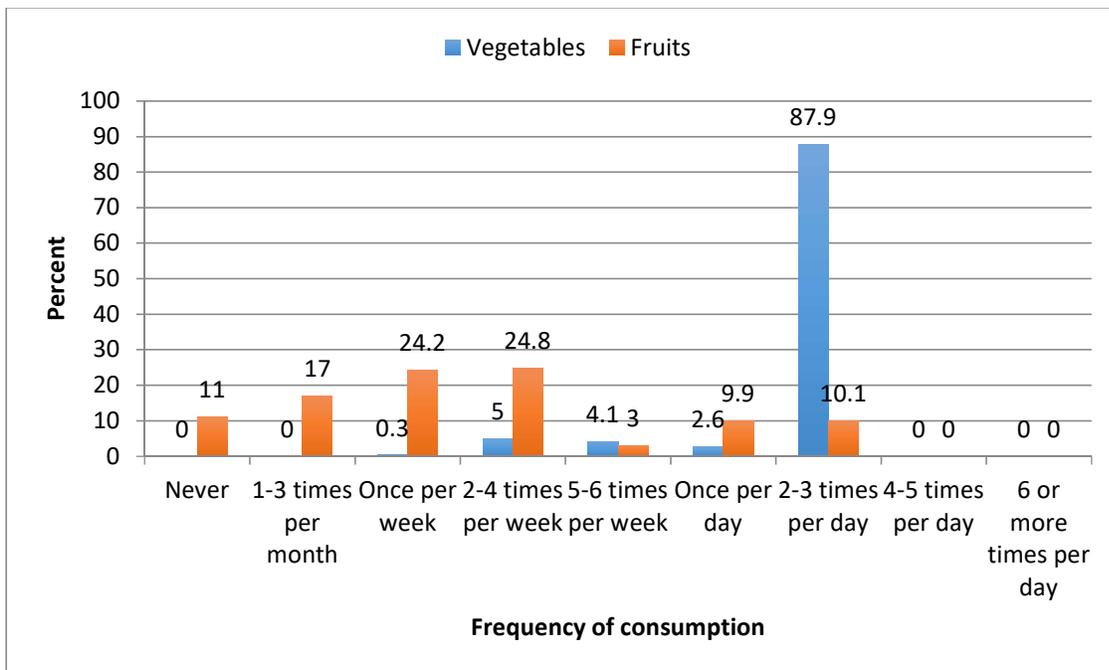
Figure 4: Frequency of fruit and vegetable consumption among hypertensive patients attending hypertensive clinics in Malawi.

Beef, Fish and Eggs

The average beef consumption among hypertensive patients was 102 ± 54 g/d. The mean consumption of beef among hypertensive patients in the less than 24 months category was 100 ± 55 g/d, for fish was 137 ± 85 g/d and for eggs it was 101 ± 50 g/d, while the mean meat consumption for hypertensive patients in the more than 24 months category was 105 ± 54 g/d, and for fish was 141 ± 94 g/d and for eggs it was 102 ± 41 g/d. Frequency of meat consumption (Figure 5), was less than the frequently of consumption for eggs and fish.
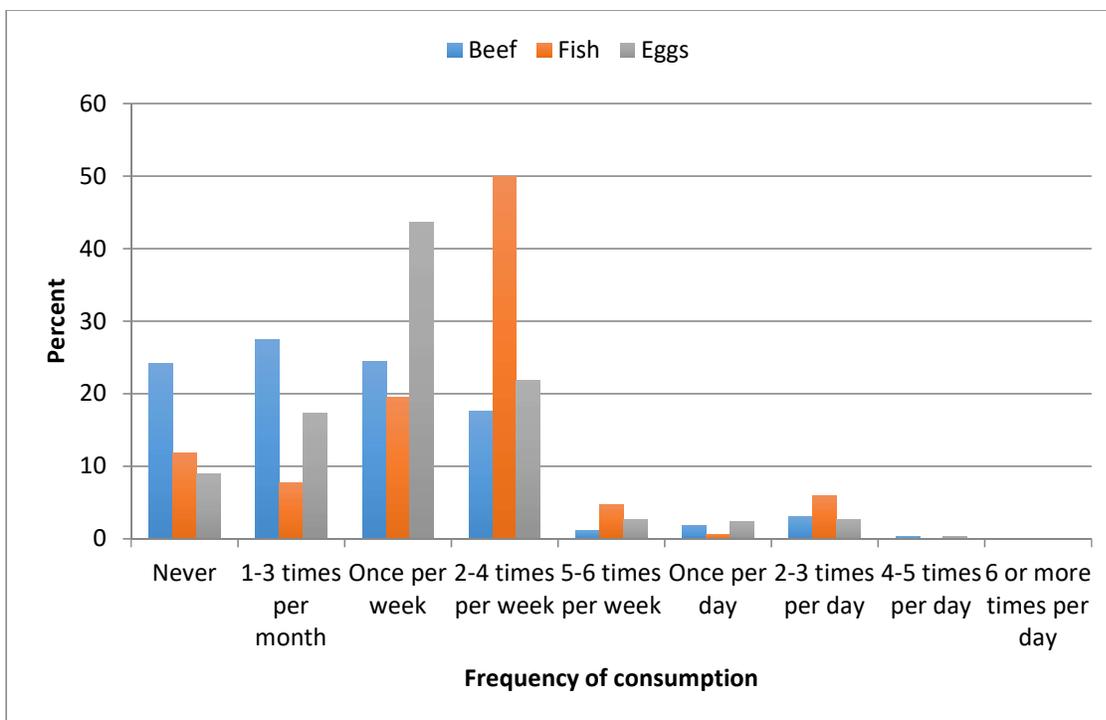
Figure 5: Frequency of meat consumption among hypertensive patients attending hypertensive clinics in Malawi.

From Figure 5, frequency of beef consumption was low among most respondents (1-3 times per month). Results further show that eggs were at least consumed once per week as reported by 43.7% of hypertensive patients, and almost half (49.9%) of hypertensive patients reported to have consumed fish 2-4 times per week. Considering the types, frequency and amounts of foods

that hypertensive patients reported through FFQ, Health Eating Index (HEI), Dietary Variety Score (DVS) and Diet Variety Score for recommended foods (DVSR) were calculated.

Health Eating Index

HEI used 8 food items to calculate the points for each hypertensive patient. The scores ranged from 0-80 points and the total score out of 80 was converted to 100 points. The mean score for all hypertensive patients was 49.1 points (minimum was 11 and maximum was 84 points). When category of patients were considered, hypertensive patients in the less than 24 months category had an average score of 48.2 points (minimum was 15 and maximum was 84 points) and for hypertensive patients in the more than 24 months category was 50 points (minimum was 11 and maximum was 76 points). From these results, it is seen that the quality of diets for hypertensive patients is poor. Despite hypertensive patients consuming a variety of foods (as discussed below), the quantities of various foods eaten are low.

Overall results show that more than half (51.3%) of hypertensive patients had more than 50 points while 48.7% had less than 50 points. This trend was similar to hypertensive patients in the more than 24 months category where 51.2% of the patients had less than 50 points and 48.8% had more than 50 points. As for hypertensive patients in the less than 24 months category, it was the opposite. More than half (53.8%) had more than 50 points and 46.2% had less than 50 points.

Dietary Variety Score and Dietary Variety Score for Recommended Foods

Considering dietary variety score (DVS) and dietary variety score for recommended foods (DVSR) for the 8 food categories on FFQ, results show that the mean number of food items consumed was 6 (with a minimum of 2 food items and a maximum of 8 food items). For hypertensive patients in the less than 24 months category, the mean number of food items consumed was 5.9 (with a minimum of 2 food items and a maximum of 8 food items). For

hypertensive patients in the more than 24 months category, the mean food items consumed was 6.5 with a minimum of 3 food items and a maximum of 8 food items). Hypertensive patients who had reported consuming five or more foods items at least once a week were considered to have dietary variety. As such, 89.5% of all hypertensive patients were found to have dietary variety and 14.1% had inadequate dietary variety. A similar trend was noted for hypertensive patients in both categories. In the less than 24 months category, 79.0% of patients had dietary variety and 92.4% of patients in the more than 24 months category had dietary variety.

Though the eating habits of hypertensive patients was poor, 80.5% of the patients reported to have changed their eating habits since they were diagnosed with hypertension. A similar trend was observed among hypertensive patients in the less than 24 months category where 79.5% reported to have changed their eating habits. As for hypertensive patients in the more than 24 months category, 81.4% reported to have changed. When hypertensive patients were asked whether their eating habits changed once they started attending hypertensive clinic, a majority of them reported to have changed (86.5% for all patients, 88.3% for patients in the less than 24 months category and 90.1% for patients in the more than 24 months category). The proportions are similar to those that reported that their eating habits had changed once they were diagnosed to be hypertensive.

Energy and Nutrient Intakes from 24-hour dietary recall and FFQ

Macronutrient Intake

A summary of the results for micronutrient intake (energy, water, protein, carbohydrates and total dietary fiber) among hypertensive patients for both categories is presented in Table 3.

Table 3: Macronutrient intake among hypertensive patients attending hypertensive clinics in Malawi (mean ± SD).

	Energy (kcal/d)		Water (g/d)		Protein (g/d)		Carbohydrates (g/d)		Total Dietary Fiber (g/d)	
	24 HR	FFQ	24 HR	FFQ	24 HR	FFQ	24 HR	FFQ	24 HR	FFQ
Total	3402l ± 1105	4029 ± 1291	10521 ± 480	769 ± 442	112.3 ± 50.9	127.7 ± 49.3	631 ± 244.0	747 ± 247	98 ± 40	114 ± 38
<24 months	3502 ± 1136	3971 ± 1366	1086 ± 514	816 ± 494	114.5 ± 52.1	124.7 ± 49.1	631 ± 233	731± 260	98 ± 40	110 ± 39
>24 months	3299 ± 1066	4087 ± 1214	1017 ± 444	724 ± 385	110.1 ± 49.7	130.5 ± 49.5	631 ± 255	762 ± 234	97 ± 40	117 ± 36
P-value*	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05	>0.05	> 0.05	> 0.05

*P value tested the significance of the difference between hypertensive patients in <24 and >24 months categories attending hypertensive clinic

From the results obtained, the average energy intake from 24-hour dietary recall for the whole sample was 3402 ± 1105 kcal/d. The mean energy intake for hypertensive patients who have been attending hypertensive clinic for less than 24 months was 3502 ± 1136 kcal/d while for those who have been attending hypertensive clinic for more than 24 months was 3299 ± 1066 kcal/d. The mean energy intake from FFQ for all hypertensive patients was 4029 ± 1291 kcal/d, with those in the less than 24 months category being 3971 ± 1366 kcal/d and for patients in the more than 24 months category being 4087 ± 1214 kcal/d. Considering energy intake from 24-hour dietary recall as a percent of recommended daily allowance (RDA), a majority of the respondents (91.8%) were consuming more than 110% of energy above RDA. Results based on category of patients had a similar trend to the results reported for the overall sample (Figure 6).
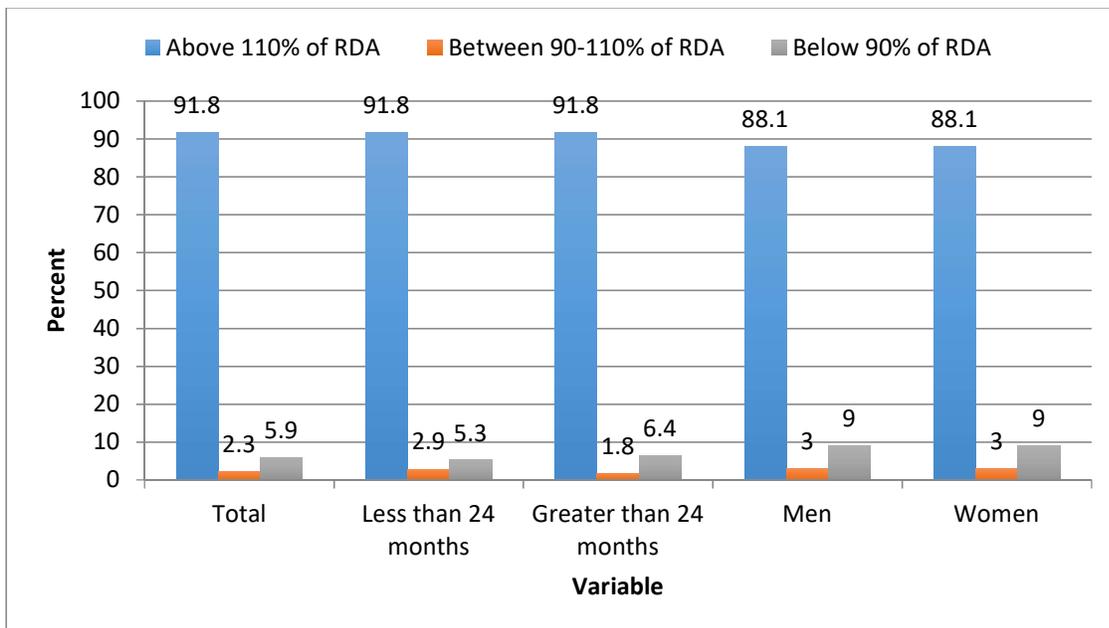
Figure 6: Distribution of energy intake as a percent of RDA among hypertensive patients attending hypertensive clinics in Malawi.

The mean water intake for all hypertensive patients from 24-hour dietary recall was 10521 ± 480 g/d. In terms of categories, the mean water intake from 24-hour dietary recall for hypertensive patients in the less than 24 months category was 1086 ± 514 g/d and for those in the

more than 24 months category, the mean water intake was 1017 ± 444 g/d. The mean water intake from FFQ for all hypertensive patients was 769 ± 442 g/d. As for hypertensive patients in the less than 24 months category, the mean water intake from FFQ was 816 ± 494 g/d, while that of patients in the more than 24 months category was 724 ± 385 g/d. A majority of patients (95.3%) were drinking less water than their RDA. A similar trend was also found for both category and sex of the patient (Figure 7).
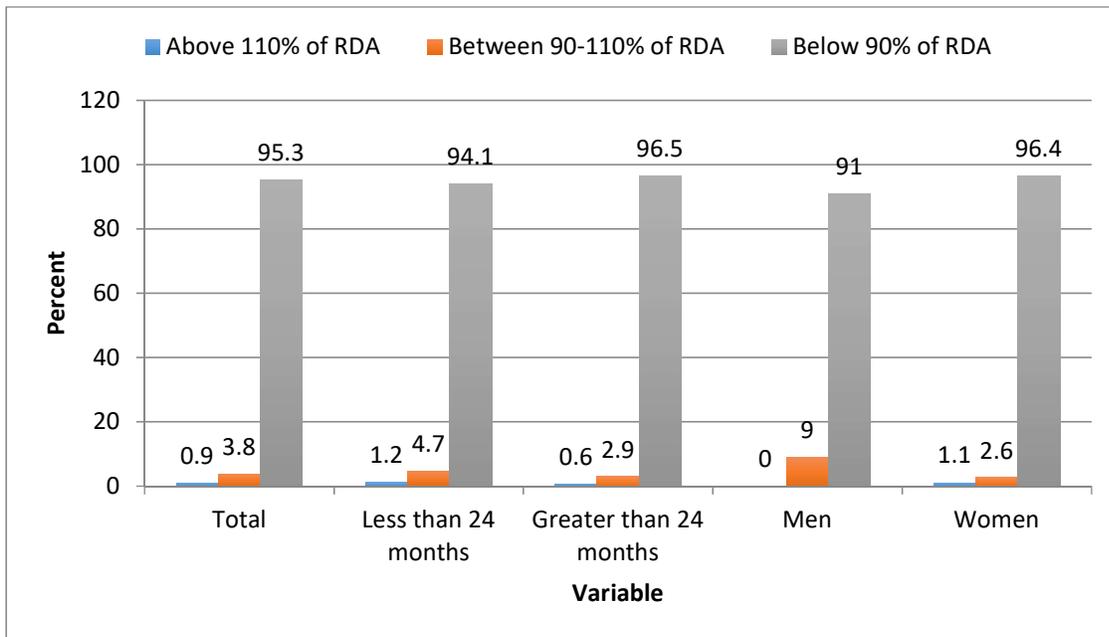
Figure 7: Distribution of water intake as a percent of RDA among hypertensive patients attending hypertensive clinics in Malawi.

The mean overall protein intake from 24-hour dietary recall was 112.3 ± 50.9 g/d. The intake for patients who have been attending hypertensive clinic for less than 24 months was relatively higher (114.5 ± 52.1 g/d) than patients who have been attending hypertensive clinic for more than 24 months (110.1 ± 49.7 g/d). Protein intake for hypertensive patients in the more than 24 months category from FFQ was higher (130.5 ± 49.5 g/d) than those in the less than 24 months category (124.7 ± 49.1 g/d). Comparing 24-hour dietary recall protein intake to RDAs, results show that the protein intake for 85.0% of the patients was above 110% of the RDA. A similar trend

was found when protein intake was analyzed based on the category and sex of the patients (Figure 8).
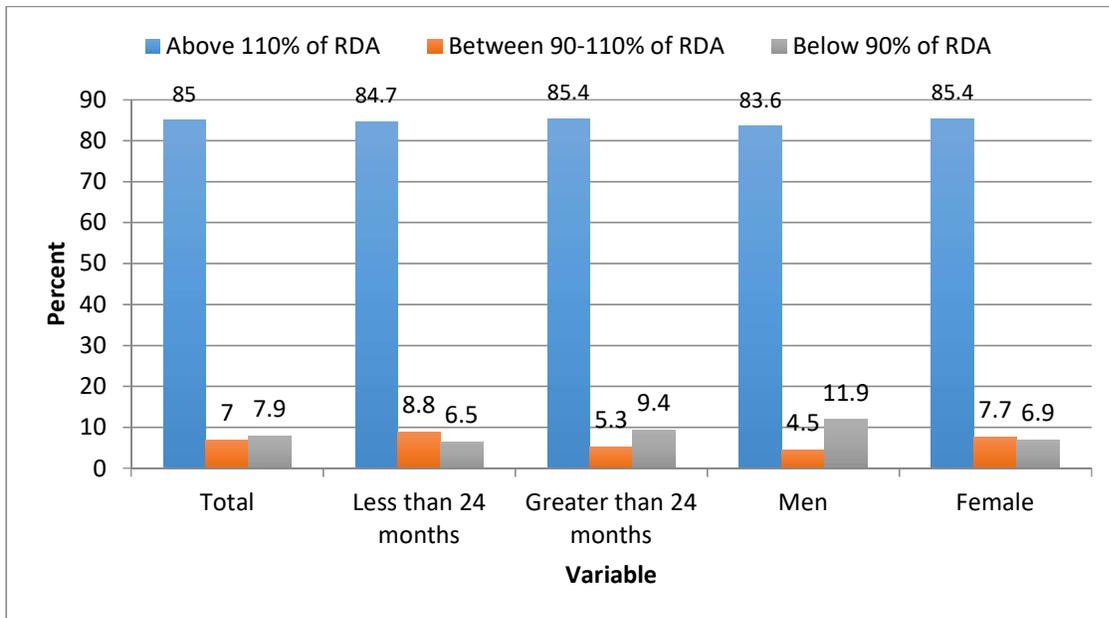
Figure 8: Distribution of protein intake as percent of RDA among hypertensive patients attending hypertensive clinics in Malawi.

Total fat intake from 24-hour dietary recall for all hypertensive patients was 55.3 ± 26.1 g/d. The mean total fat intake for patients who have been attending hypertensive clinic for less than 24 months was 53.4 ± 24.4 g/d while for patients who have been attending hypertensive clinic for more than 24 months it was 57.3 ± 27.6 g/d. The mean intake of total fats from FFQ for hypertensive patients in the less than 24 months category was relatively lower (59.2 ± 25.0 g/d) than the mean total fat intake for hypertensive patients in the more than 24 months category (63.9 ± 27.3 g/d).

When 24-hour dietary recall total fat intake was compared to RDAs, the results showed that a majority of the respondents (63.3%) had their total fat intake below 90% of their RDA. This was followed by 22.0% of patients who had their total fat intake above 110% of their RDA and

only 14.7% of the patients had their total fat intake between 90 and 110% of their RDA (Figure 9).
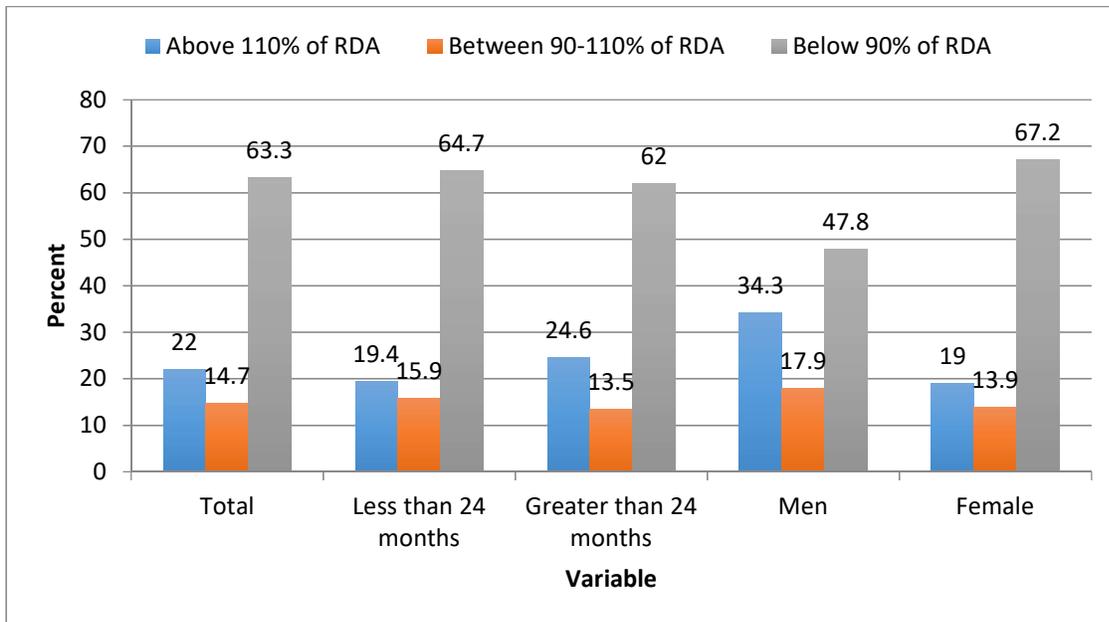
Figure 9: Distribution of total fat intake as percent of RDA among hypertensive patients attending hypertensive clinics in Malawi.

Carbohydrate intake among hypertensive patients was found to be high. The mean carbohydrate intake from 24-hour dietary recall for all hypertensive patients was 631 ± 244.0 g/d. Among the less than 24 months category, the mean carbohydrate intake was 631 ± 233 g/d, which was relatively lower than in the more than 24 months category (631 ± 255 g/d). The mean carbohydrate intake from FFQ for hypertensive patients in the less than 24 months category was relatively lower (731 ± 260 g/d) than hypertensive patients in the more than 24 months category (762 ± 234 g/d).

Comparing 24-hour dietary recall carbohydrate intake as percentage of RDA (130 g/d), it was found that the majority of patients (93.5%) have their carbohydrate intake above 110% of their RDA (Figure 10).
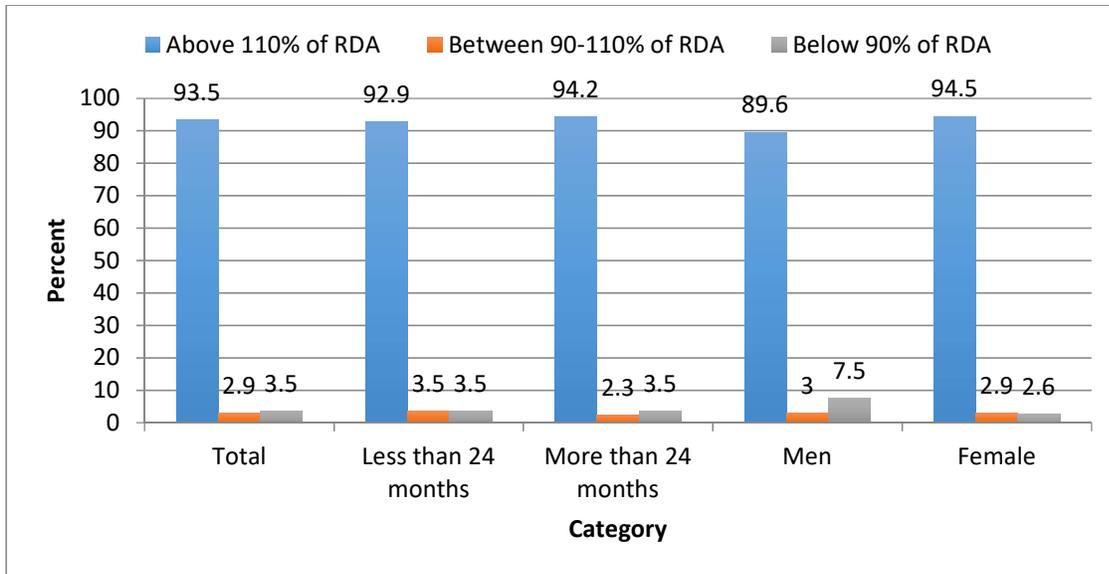
Figure 10: Distribution of carbohydrates intake as a percent of RDA among hypertensive patients attending hypertensive clinics in Malawi.

Dietary fiber intake from 24-hour dietary recall was 98 ± 40 g/d on average for all hypertensive patients. For patients who have been attending hypertensive clinic for less than 24 months, the mean intake of dietary fiber was 98 ± 40 g/d while those in the more than 24 months category was 97 ± 40 g/d. The mean dietary fiber intake for all hypertensive patients from FFQ was 114 ± 38 g/d. As for categories, hypertensive patients in the less than 24 months category has a relatively lower intake (110 ± 39 g/d) than the more than 24 months category (117 ± 36 g/d). Almost all patients (98.2%) had their 24-hour dietary recall dietary fiber intake of more than 110%. Again, a similar trend of intake was reported among patients who have been attending hypertensive clinic for less than 24 months and more than 24 months (Figure 11).
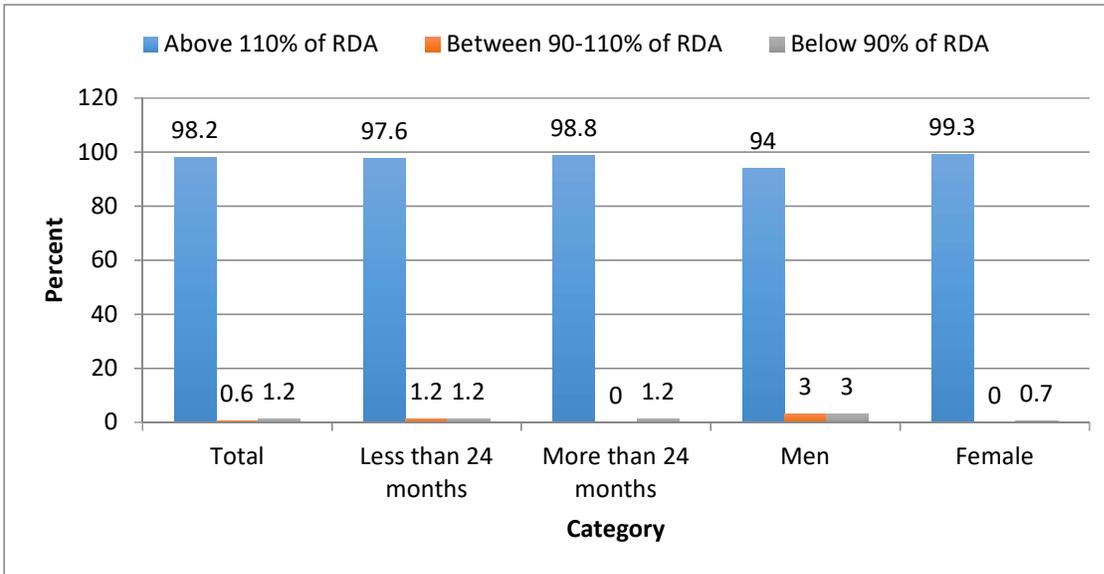
Figure 11: **Distribution of dietary fiber intake as a percent of RDA among hypertensive patients attending hypertensive clinics in Malawi.**

Mineral Intake

Mineral intake (Sodium, potassium and calcium) among hypertensive patients were assessed and the results are summarized in Table 4.

Table 4: Mineral intake among hypertensive patients attending hypertensive clinics in Malawi.

	Sodium (mg/d)		Potassium (mg/d)		Calcium (mg/d)	
	24 HR	FFQ	24 HR	FFQ	24 HR	FFQ
	3212 ±	4710 ±	5002 ±	5638 ±	407.8 ±	648.2 ±
Total	2643	2925	1996	2050	200.4	358.4
	3228 ±	4617 ±	5090 ±	5594 ±	413.4 ±	632.3 ±
<24 mos	2792	3051	2063	2213	201.2	359.4
	3206 ±	4796 ±	4916 ±	5681 ±	402.1 ±	663.3 ±
>24 mos	2503	2808	1931	1887	200.0	358.1
P-value*	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05	> 0.05

*P value tested the significance of the difference between hypertensive patients in <24 and >24 months categories attending hypertensive clinics.

The mean sodium intake for all hypertensive patients from 24-hour dietary recall was 3212 ± 2643 mg/d. For hypertensive patients in the less than 24 months category, their mean sodium intake from 24-hour dietary recall was 3228 ± 2792 mg/d. For those in the more than 24 months category, the mean sodium intake was 3206 ± 2503 mg/d. The mean sodium intake from FFQ for hypertensive patients in the less than 24 months category was relatively lower (4617 ± 3051 mg/d) than the more than 24 months category (4796 ± 2808 mg/d) though not significantly different from each other. For all the categories of hypertensive patients, more than half of the patients had their 24-hour dietary recall sodium intakes of more than 110% of their RDAs, and only less than 10% of hypertensive patients had their sodium intake of less than 90% of their RDAs (Figure 12).
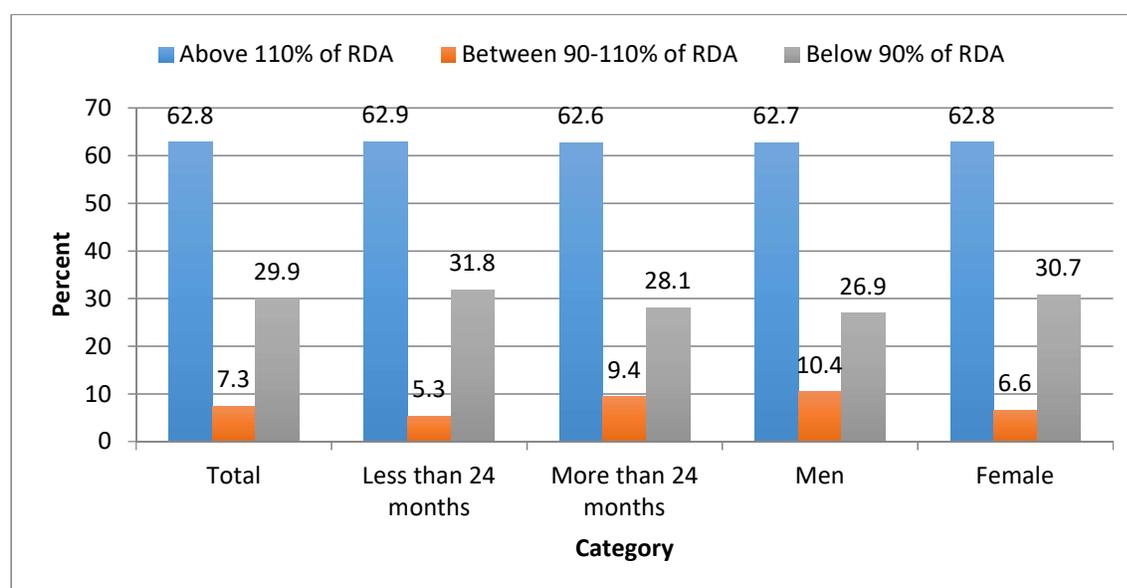
**Figure 12: Distribution of sodium intake as a percent of RDA among hypertensive patients attending hypertensive clinics in Malawi.**

The mean potassium intake from 24-hour dietary recall for all hypertensive patients was 5002 ± 1996 mg/d. For hypertensive patients in the less than 24 months category, the mean potassium intake was 5090 ± 2063 mg/d and for those in the more than 24 months category, the mean potassium intake was 4916 ± 1931 mg/d. The mean potassium intake from FFQ for all

hypertensive patients was 5638 ± 2050 mg/d. The mean potassium intake from FFQ for hypertensive patients in the less than 24 months category was 5594 ± 2213 mg/d and that of hypertensive patients in the more than 24 months category was 5681 ± 1887 mg/d. Comparing 24-hour dietary recall potassium intake as a percent of RDA, most hypertensive patients had their potassium intake of more than 110% of their RDAs (Figure 13).
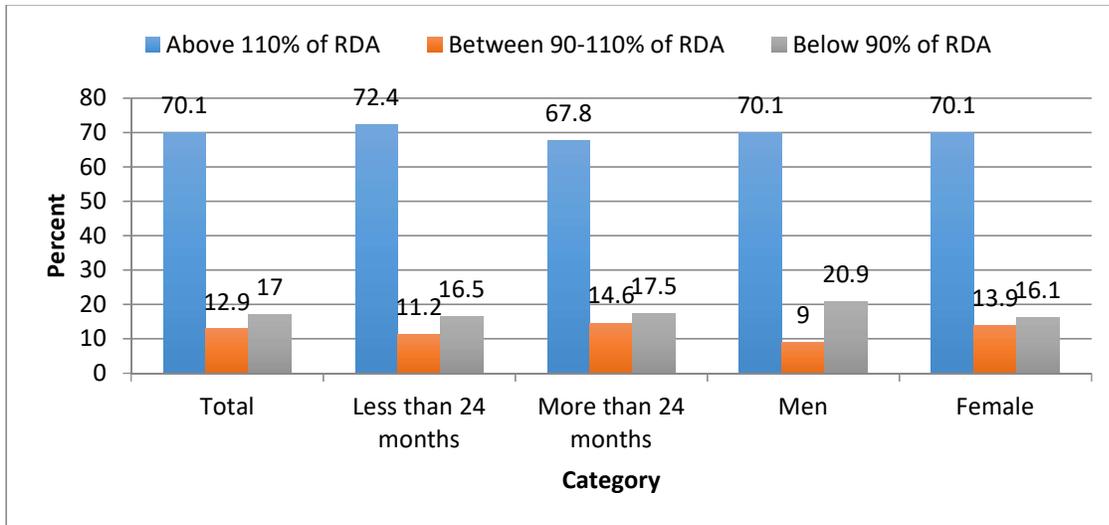
Figure 13: Distribution of potassium intake as a percent of RDA among hypertensive patients attending hypertensive clinics in Malawi.

Calcium intake from 24-hour dietary recall for all hypertensive patients was 407.8 ± 200.4 mg. For hypertensive patients in the less than 24 months category, the mean calcium intake was 413.4 ± 201.2 mg/d and for the more than 24 months category, the mean calcium intake was 402.1 ± 200.0 mg/d. The mean calcium intake for all hypertensive patients from FFQ was 648.2 ± 358.4 mg/d. The mean calcium intake for hypertensive patients in the less than 24 months category was relatively lower (632.3 ± 359.4 mg/d) than patients in the more than 24 months category (663.3 ± 358.1 mg/d).

When 24-hour dietary recall intakes were compared to the RDAs, it was found that a majority of hypertensive patients (more than 90%) had their calcium intake below 90% of their

RDAs, only 2.3% of the patients had their calcium intake above 110% of their RDAs and only

1.8% had their calcium intake between 90 and 110% of their RDAs (Figure 14).
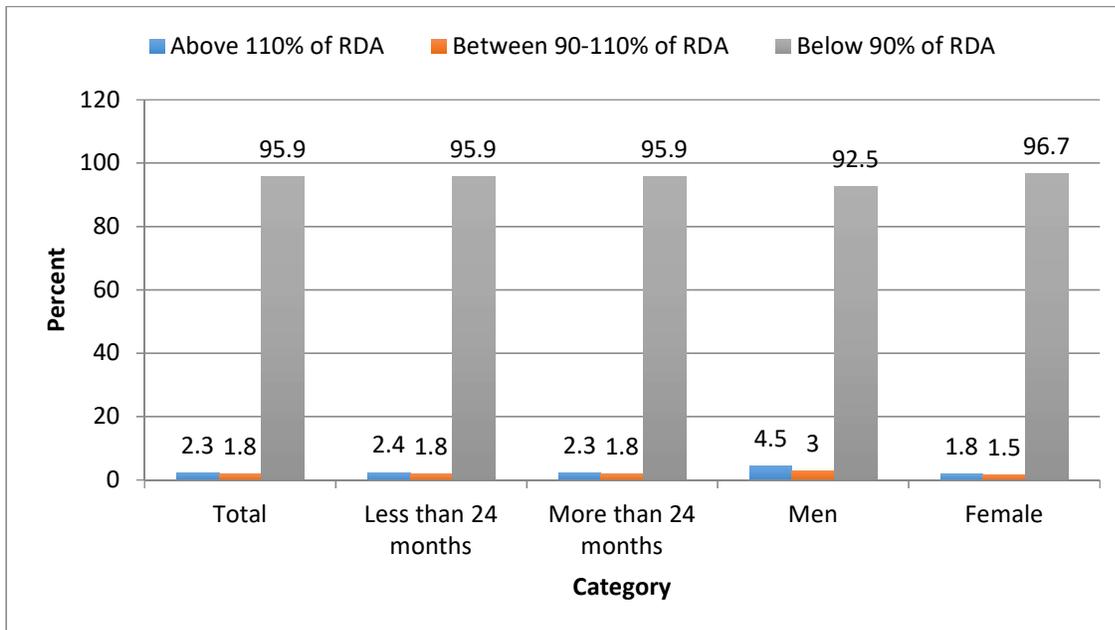
Figure 14: Distribution of calcium intake as a percent of RDA among hypertensive patients attending hypertensive clinics in Malawi.

Fat Intake

A summary of the results for fat (total fat, polyunsaturated fatty acids and cholesterol) is

presented in Table 5.

Table 5: Fat intake among hypertensive patients (mean ± SD).

	Total Fat (g/d)		Polyunsaturated fatty acids (mg/d)		Cholesterol (mg/d)	
	24 HR	FFQ	24 HR	FFQ	24 HR	FFQ
Total	55.3 ± 26.1	64.2 ± 26.0	21.3 ± 11.9	23.5 ± 11.4	124.9 ± 120.3	140.0 ± 156.2
<24 months	53.4 ± 24.4	59.2 ± 25.0	20.6 ± 11.6	22.6 ± 10.8	136.8 ± 131.9	147.2 ± 77.0
>24 months	57.3 ± 27.6	63.9 ± 27.3	22.0 ± 2.3	24.3 ± 11.8	112.8 ± 106.4	138.7 ± 156.7
P-value*	0.178	0.003	0.025	0.178	0.189	0.06

*P value tested the significance of the difference between hypertensive patients in <24 and >24 months categories attending hypertensive clinics

From this research, the mean intake of PUFAs from 24-hour dietary recall for all hypertensive patients was 21.3 ± 11.9 mg/d. For hypertensive patients in the less than 24 months category, the mean PUFAs intake from 24-hour dietary recall was 20.6 ± 11.6 mg/d and for those in the more than 24 months category, the mean intake of PUFAs was 22.0 ± 2.3 mg/d. The mean intake from 24-hour dietary recall and FFQ were significantly different in the less than 24 months category (P = 0.025) while in the more than 24 months category they were not significantly different (P > 0.05).

The mean PUFA intake from FFQ for all hypertensive patients was 23.5 ± 11.4 mg/d. The mean PUFA intake for patients in the less than 24 months category was 22.6 ± 10.8 mg/d and that of patients in the more than 24 months category was 24.3 ± 11.8 mg/d. The mean intakes of PUFAs from 24-hour dietary recall and FFQ were significantly different from each other (P = 0.015).

When 24-hour dietary recall intakes of PUFAs were compared to the RDA of patients, the results show that more hypertensive patients had their PUFA intake of more than 110% of their RDAs. Overall, 84.2% of hypertensive patients had their PUFA intake of above 110% of their RDA. A similar trend was observed for both categories of patients and both sexes (Figure 15). More than 80% of hypertensive patients had their PUFA intakes of more than 110% of their RDA.
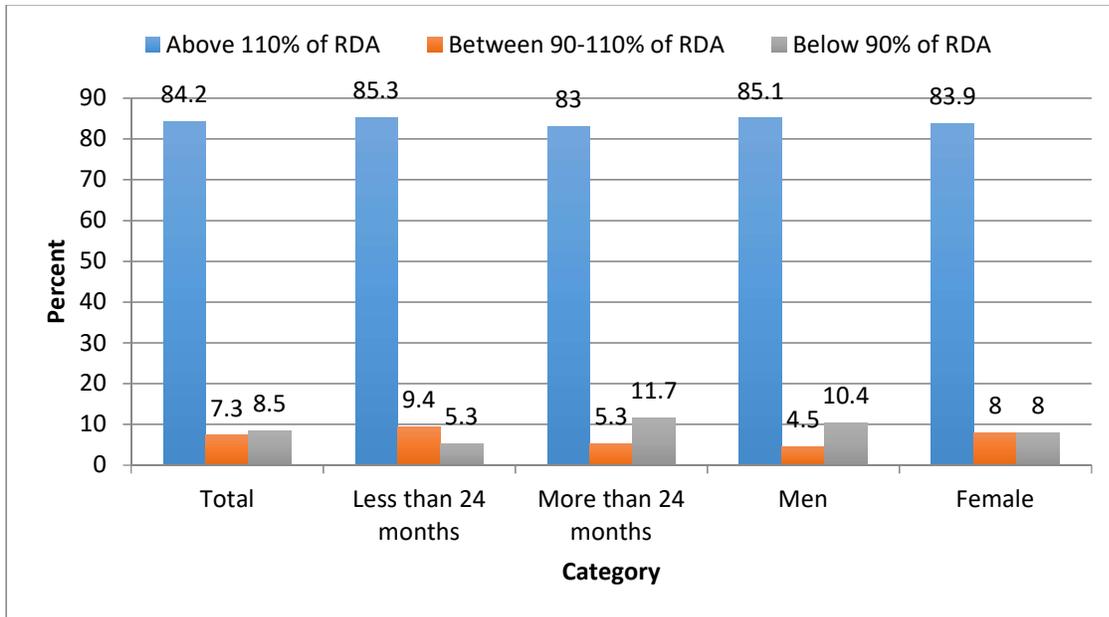
Figure 15: Distribution of PUFAs intake as a percent of RDA among hypertensive patients attending hypertensive clinics in Malawi.

The mean cholesterol intake from 24-hour dietary recall for all hypertensive patients was 124.9 ± 120.3 mg/d. The mean cholesterol intake for patients in the less than 24 months category was 136.8 ± 131.9 mg/d and patients in the more than 24 months category was 112.8 ± 106.4 mg/d. The mean cholesterol intake from FFQ for all hypertensive patients was 140.0 ± 156.2 mg/d. As for the category of hypertensive patients, patients in the less than 24 months category had a relatively lower intake than patients in the more than 24 months category (147.2 ± 77.0 mg/d).

When 24-hour dietary recall intakes were compared to the RDAs, almost all patients (97.1%) were found to have their cholesterol intake of more than 110% of their RDAs. A similar

trend of cholesterol intake was also reported in both categories of patients and both sexes (Figure 16).
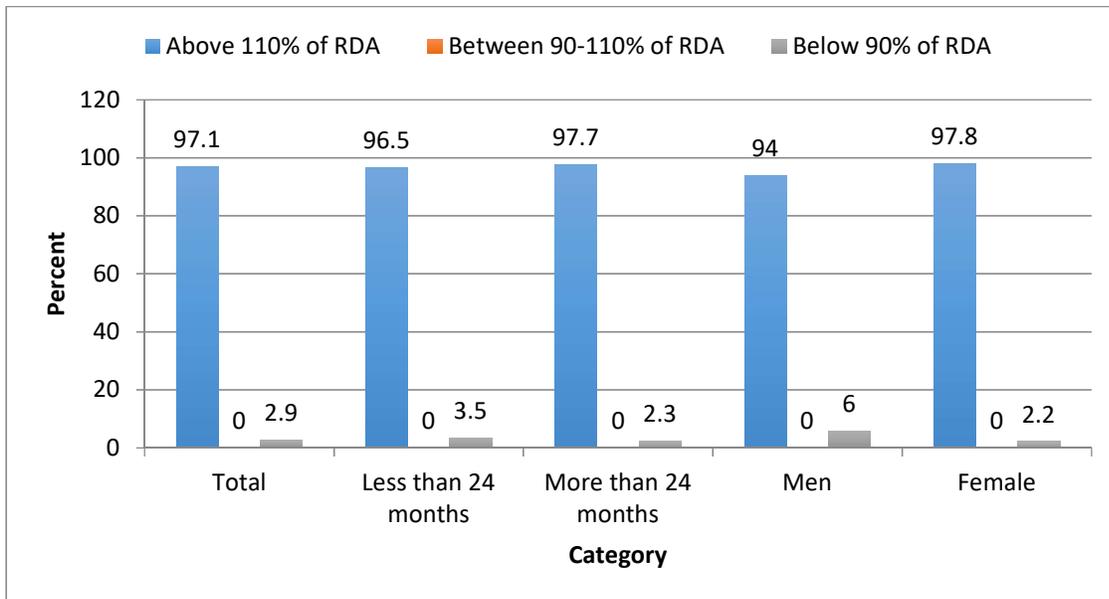
**Figure 16: Distribution of cholesterol intake as percent of RDA among hypertensive patients attending hypertensive clinics in Malawi.**

DISCUSSION

The mean age of hypertensive patients was more than 55 years. As a result, most of the hypertensive patients could have an increased risk of developing hypertension due to advanced age. In addition, age may contribute to the severity of hypertension. According to several epidemiological studies, age is associated with the development of hypertension as it causes muscular atrophy and losses in renal and liver tissue functions. Alcohol consumption among older population may, therefore, increase the odds of developing hypertension (Nakanishi et al., 2002; Ohmori et al., 2002; Thadhani et al., 2002 and Nakamura et al., 2007). From the results obtained in this study, there was a positive relationship between hypertension and age but not with salt intake. This suggests that the hypertension among the respondents was not sodium sensitive.

Fruit and vegetable consumption among hypertensive patients was found to be low. According to DeSalvo et al., 2016 the recommended vegetable consumption is more than 400 g/d. This could be as a result of variation in fruit and vegetable availability in Malawi, as they are season dependent (Nyambose, Koski, and Tucker, 2002). Unless they are in season, most hypertensive patients find fruits to be expensive to buy hence cannot afford to eat fruits on daily basis. As for vegetables, they are priced affordably even when they are off-season, but most Malawians have an attitude of not wanting to eat vegetables. Similarly, Hall et al. (2009) found that fruit and vegetable consumption was low among men and women and that the low prevalence tended to increase with age and decrease with income (Hall et al., 2009). In another study, it was reported that micronutrient density among men and women was inadequate due to low mean intake of vegetable and fruit (<2.5 servings/d) (Charlton and Rose, 2001). This contributes to low fruit and vegetable consumption. There is, therefore, the need to encourage and promote (teach) food processing and preservation techniques to hypertensive patients so that they can process and

preserve fruits and vegetables that can be consumed even at a time when they are not in season. This could ensure availability of cheap fruits that can boost fruit intake of hypertensive patients. Continuous awareness of the importance of increasing fruits and vegetables consumption among hypertensive patients is also needed.

Animal and animal products (such as beef, fish, eggs etc) consumption was found to be low among hypertensive patients. These results agree with what Speedy in 2003 reported that Malawi was one of the countries with least consumption of meat (4.5kg/capita/y), milk (3.7kg/capita/y), eggs (1.7kg/capita/y) and fish (10kg/capita/y) (Speedy, 2003). In another study by Chilimba et al., (2011) it was reported that more than half (52%) of total dietary calorie intake is derived from maize, and the consumption of animal products from all sources is typically low, accounting for 64 kcal/person/d and fish accounts for 9 kcal/person/d (Chilimba et al., 2011). In addition, Denning et al., reported that maize accounts for 60% of total calorie consumption among Malawians (Denning et al., 2009). Nyambose, Koski and Tucker in 2002 reported that in rural areas of Malawi, foods from animal sources are rarely eaten, and that a majority of Malawians obtain their energy from grains and cereals, and iron mostly comes from vegetable sources (Nyambose, Koski and Tucker, 2002).

Considering the results from this study, frequency of fish consumption was relatively higher as compared to other meats because small fish (called *usipa*) are generally more affordable and accessible by a majority of Malawians. Based on these results, there is need for awareness of the nutritional value of such foods among hypertensive patients. In addition, there is need to promote homestead farming (backyard gardens and rearing of small livestock and fish farming) that can boost consumption of these foods.

Results from HEI, DVS and DVSR showed poor eating habits and poor dietary diversity among hypertensive patients. According to McCullough et al., (2000); Kant et al., (2000), and McNaughton et al., (2008) the results on HEI, DVS and DVSR should be interpreted with caution as sometimes patients tend to underreport food that are supposed to be limited or excluded from their diets and overreport on foods that are recommended, and this is a main challenge of self-reported dietary surveys.

The mean energy intake among hypertensive patients was high. The intake between the two categories of patients was not significantly different from each other (3502 ± 1136 kcal/d for less than 24 months category and 3299 ± 1066 kcal/d for more than 24 months category, $P = 0.138$). In addition, energy intake from FFQ (reflecting their long term eating habits) and 24-hour dietary recall were not significantly different from each other ($P > 0.05$). From these results, we can conclude that the two methods of analysis give different results.

A study conducted by Ndekha et al. (2000), found that maize provided 63% of total daily energy intake and that intake decreases during rainy season due to reduced consumption of roots and tubers, fruit, legumes and vegetables. Increased energy intake poses a threat where hypertensive patients could be overweight or obese, hence at increased risk for hypertension (Appel et al., 2005). High intake of energy among hypertensive patients was also consistent with what FAOSTAT in 2009 reported that only 29% of calories in Malawi come from non-staples (FAOSTAT, 2009). Malawi's diet is predominantly staple based, and most of total daily energy intake comes from staples. The staple food for Malawi is maize (corn), as such a majority of hypertensive patients reported to have consumed *Nsima* (a thick porridge made from corn flour). As mentioned (Ndekha et al., 2000), maize provided 63% of total daily energy intake; Chilimba et al., (2011) found that more than half (52%) of total dietary calorie intake is derived from maize;

and Denning et al., reported that maize accounts for 60% of total calorie consumption among Malawians (Denning et al., 2009). Most hypertensive patients in this study had consumed *Nsima* on a daily basis as their staple food, possibly accounting for high energy intake among this group.

The high-energy intake relative to RDA may suggest that more people have increased risk of becoming overweight and obese. Imbalances between energy intake and energy expenditure may result in weight gains or losses, mainly in the form of fat (Appel et al., 2005).

Protein intake was found to be high among hypertensive patients of both groups and sexes and there were no significant differences in their intakes ($P = 0.616$). The high protein intake among hypertensive patients could be coming from legume consumption, which was relatively higher than meat consumption. Legumes could also be contributing towards fiber intake that was found to be high among hypertensive patients. In addition, vegetable consumption was found to be relatively higher, which could also be contributing towards high fiber intake among hypertensive patients.

Protein in tissues is broken down into amino acids, combined with amino acids from dietary protein, and then rebuilt in the body to form the required body proteins. This process is called protein turnover. In the adult human body, 250 g/day of protein is synthesized and degraded (Waterlow, 1984). This compares to a median daily adult intake of 55 to 100 g/d of protein. Degraded protein in the body is usually excreted as CO_2 in expired air and nitrogen in urine in form of urea by the kidney, with smaller contributions from ammonia, uric acid, creatinine, and some free amino acids. It is estimated that 11 to 15 g/d of nitrogen is excreted. After protein has been re-synthesized, urea is carried from the liver to the kidney, where it is excreted into the urine (Appel et al., 2005). Excess consumption of protein among hypertensive patients may lead to overworking of kidneys to excrete nitrogen.

Proteins also contribute to energy needs when there is inadequate energy intake or when the body had utilized its limited endogenous carbohydrate stores. Protein breakdown has been found to be high in highly traumatized or septic individuals, resulting in losses of protein in the body. These large losses can affect recovery of an individual and can sometime lead to death (Klein and Wolfe, 1990). Carbon skeletons of amino acids can also be used to synthesize glucose (glucogenic amino acids) and fat (ketogenic amino acids). Excess consumption of protein, therefore, may contribute to increased endogenous carbohydrate stores and body fat, which may increase the risk of developing hypertension.

Overall fat intake for hypertensive patients was found to be below 90% of their RDA and there were no significant difference between the two categories ($P = 0.178$). In addition, fat intake from FFQ was significantly higher than intake from 24-hour dietary recall ($P = 0.003$). This suggests that hypertensive patients may have reduced their total fat intake based on their current eating habits (from 24-hour dietary recall). Because high fat intake is directly associated with the onset of hypertension, patients are more likely to adhere to the advice of reducing total fat intake as compared to other nutrients such as protein and energy intake from carbohydrate sources. Overall hypertensive patients are advised to reduce total fat intake. The results obtained in this research could be a reflection of the effect of the nutrition advice that they are given at hypertensive clinic. Patients could be avoiding obvious sources of fat such as cooking oil, animal source fats and meats high in fat hence the reduced total fat intake among hypertensive patients. Hypertensive patients may be more aware of the effects of fat on hypertension, hence paying more attention to total fat intake.

Fat is a major source of fuel energy for the body and aids in the absorption of fat-soluble vitamins and carotenoids. IOM recommends 20-35% of total energy intake should come from total

fats (Appel et al., 2005). Increased consumption of fat increases the risk of coronary heart diseases (CHDs), reduction in high-density lipoprotein (HDL) cholesterol concentration, increase in serum triacylglycerol concentration, and higher responses in postprandial glucose and insulin concentrations, which may be risk factors for developing CHDs.

Carbohydrates (sugars and starches) are mainly used as sources of energy for different cells, especially the brain, which uses carbohydrates as it sole source of energy (Appel et al., 2005). The Recommended Dietary Allowance (RDA) for carbohydrate is 130 g/d based on the average minimum amount of glucose utilized by the brain. However, the median intake of carbohydrates is approximately 220 to 330 g/d for men and 180 to 230 g/d for women when protein and fat intakes are also considered (Appel et al., 2005).

Results obtained in this study showed high carbohydrate intake among hypertensive patients of both groups. However, there was no significant difference in the mean carbohydrate intake between the two categories ($P = 0.990$). Between males and females, the mean carbohydrate intake was also not significantly different from each other ($P = 0.372$) though it was higher in males than in females. The high carbohydrate intake is in line with the high consumption of maize as reported by FAOSTAT in 2009 (29% of calories in Malawi come from non-staples), Ndekha et al., 2000 (maize provided 63% of total daily energy intake), Chilimba et al., 2011 (52% of total dietary calorie intake is derived from maize) and Denning et al., 2009 (maize accounts for 60% of total calorie consumption among Malawians). In this study, consumption of grains was also found to be high (484 g/d) compared to recommendation of <128 g/d (DeSalvo et al., 2016). This also contributed to high intake of carbohydrates among hypertensive patients in this study. If the average energy requirement for a healthy adult person of 2100 kcal/d is considered, then the average carbohydrate intake of 474 g/d is contributing 90% of daily total energy intake.

Excess consumption of carbohydrates may result in accumulation of more fat in the body. Despite hypertensive patients reducing total fat intake, if there is excess carbohydrate intake then the carbohydrates will be converted into fat. Hypertensive patients need to be taught about the effects of consuming more carbohydrates so that they should make sure that they reduce energy intake from all sources.

Dietary fiber intake was found to be high among hypertensive patients with no significant differences within the patient category ($P = 0.747$) or sex. High dietary fiber intake among hypertensive patients could be as a result of patients being encouraged to consume more fruits and vegetables hence consuming more fiber. In addition, the staple diet for Malawians is based on corn, with low intake of meat, oils and refined sugars (FAOSTAT, 2009; Ndekha et al., 2000; Chilimba et al., 2011 and Denning et al., 2009). In addition, the relatively high consumption of vegetable could contribute to high dietary fiber intake.

Fiber is important to humans in that it delays the gastric emptying of ingested foods into the small intestine (Roberfroid, 1993), hence satiety (the feeling of fullness) (Bergmann et al., 1992). This may contribute to weight control, as there is reduced food intake. High dietary fiber intake delays gastric emptying hence reduced postprandial blood glucose concentrations which may have a beneficial effect on insulin sensitivity. According to Birketvedt et al., (2000), diets high in fiber may assist in weight loss hence may be helpful in the management of hypertension. Fiber also slows down the absorption of dietary fat, cholesterol, enterohepatic recirculation of cholesterol and bile acids, resulting in reduced blood cholesterol concentrations. WHO also reported that increased consumption of fiber has a protective effect against coronary heart disease and has also been used in diets to lower blood pressure (WHO/FAO, 2003). Consumption of fruits, vegetables and wholegrain cereals should therefore be encouraged among hypertensive patients in

order for them to get adequate fiber. IOM recommends an adequate intake (AI) for total fiber of 38 g/d for men and 25 g/d for women. These recommendations have been observed to protect against coronary heart disease. Ascherio et al, (1992) reported a negative association between dietary fiber intake and risk of hypertension in men, with hypertension being an important risk factor for CHD.

Hypertensive patients need to be encouraged to diversify dietary fiber sources such as fruits and vegetables. This will increase the benefits that fruits and vegetables offer in the management of hypertension. Studies have shown that diets high in dietary fiber positively affect plasminogen activator inhibitor type 1 and factor VII activity (Djoussé et al., 1998; Mennen et al., 1997; Sundell and Ranby, 1993). Also, whole-grain cereal products have also been shown to be protective against CHD, as they are good sources of phytochemicals, such as phytate and phytoestrogens, which have an effect on CHD. Looking at the high fiber intake in this study, hypertensive patients are likely to benefit from these intakes though there is need to diversify the sources of fiber to avoid consuming more carbohydrates from grains, as it has been noticed in this study.

Sodium intake among hypertensive patients was found to be high as compared to their RDAs. Despite the differences in mean sodium intakes between the two categories and sexes, the differences were not significant ($P > 0.05$). Increased consumption of sodium increases the risk and severity of hypertension (DeSalvo et al., 2016). From the results obtained in this research from both hypertensive patients and Nurses and Clinical Officers, the advice given to hypertensive patients by Nurses and Clinical Officers was general i.e. without specifying the amount of salt to consume. Lack of specific quantities may result in some hypertensive patients consuming more salt since the phrase 'reduce salt intake' is subjective. Hypertensive patients need to be told the

exact amounts of salt that they need to consume in order to reduce the high sodium intakes that have been reported in this study.

Though it may be difficult for most hypertensive patients to understand the standard measures, local measuring utensils could be used to measure the quantities. Reduced salt intake can be achieved by restricting daily salt (sodium chloride) intake to less than 5 g/d. The reduction should also consider total sodium intake from all dietary sources (salt added to food when cooking and already processed foods as these are the major sources of sodium for Malawians).

A majority of hypertensive patients had potassium intakes of more than 110% of the RDA. However, there were no significant differences between mean potassium intakes of the two categories or between sexes ($P > 0.05$). Increased consumption of potassium is beneficial in lowering blood pressure. It is recommended to increase consumption of dietary potassium to prevent and treat hypertension (Appel et al., 1997; National High Blood Pressure Education Program and American Heart Association). Daily adequate consumption of fruits and vegetables is required if adequate potassium is to be achieved.

Zhou et al., in 2000 and Liu et al, in 1994 found that potassium supplementation had a blood pressure lowering effect in Dahl salt-sensitive rats. Supplementation was also found to reduce the incidence of stroke and death, and prevented cardiac hypertrophy, mesenteric vascular damage, and renal injury (Zhou et al., 2000 and Liu et al, 1994). In a meta-analysis of 33 randomized trials that looked at the effects of increasing potassium intake on blood pressure found that potassium supplementation (≥ 60 mmol/d) lowered systolic pressure by an average of 4.4 mm Hg and diastolic pressure by an average of 2.5 mm Hg in hypertensive subjects. It also lowered systolic pressure by an average of 1.8 mm Hg and diastolic pressure by an average of 1.0 mm Hg in normotensive subjects (Whelton et al., 1997).

The intake of calcium among hypertensive patients in this study was low. This could be attributed to the low consumption of dairy and meat products that were reported among hypertensive patients. The finding are in agreement with what Speedy in 2003 found that consumption of meat and meat products was low (meat 4.5kg/capita/y, milk 3.7kg/capita/y, eggs 1.7kg/capita/y and fish 10kg/capita/y). Chilimba et al., in 2011 further reported that consumption of animal products from all sources is low.

Hypertensive patients need to be encouraged to consume animal foods especially small fish, as they are readily available and affordable and are good sources of calcium. Studies have found that consumption of dairy products, especially those rich in calcium, have a protective effect against hypertension (Ackley et al., 1983). Wang et al., in 2008, also reported an inverse relation between hypertension and consumption of dairy products, calcium and vitamin D. In a study conducted by Hermansen (2000), it was reported that dietary calcium supplementation lowered systolic blood pressure between 20·5 and 21·7 mm Hg and that the reduction was higher among hypertensive subjects.

Consumption of PUFAs was found to be high in hypertensive patients in this study. The high intakes of PUFA could be a result of cereal and vegetable oils consumption among hypertensive patients. In populations living on a predominantly plant-based diet, vegetable oils (such as soy beans) and cereals are important sources of PUFA (Michaelsen et al., 2011). In this study, consumption of legumes was relatively high which may have contributed to high consumption of PUFAs. Fish is an important source of PUFAs but because of its low intake, it may not provide significant amounts of PUFAs (Michaelsen et al., 2011).

Increased consumption of PUFAs is beneficial to hypertensive patients in that PUFAs are associated with reduced risk of cardiovascular disease events and death and the opposite may occur

with increased consumption of saturated fats (Appel et al., 2005). Studies have shown that replacing saturated fats with polyunsaturated fats is beneficial to hypertensive patients as it reduces the risk of cardiovascular diseases (Millen et al., 2016; DeSalvo et al., 2016 and Appel et al., 2005).

In this study, 97.1% of hypertensive patients had cholesterol intake of more than 110% of their RDAs. A similar trend of cholesterol intake was also reported in both categories of patients and both sexes, and the differences were not significantly different from each other ($P = 0.189$). Cholesterol is mostly obtained from foods of animal origin such as eggs and meat. Though not frequently consumed, animal foods (especially eggs and liver) are commonly consumed among Malawians. Because of the high content of cholesterol, meats may greatly contribute to high cholesterol intakes. For example, the liver contains 375mg/3 oz slice, and egg yolk contains185 mg per 1 50 g egg. On the other hand, products that contain milk are moderate sources of cholesterol.

Studies have found that high intake of cholesterol increases the risk of CHDs. Studies have reported a positive linear relationship between cholesterol intake and low-density lipoprotein cholesterol concentration (CHD) (DeSalvo et., 2016). Due to evaluation of the relationship, the 2015 Dietary Guidelines for American removed the recommendation to limit consumption of dietary cholesterol to 300 mg/d as there is no evidence for quantitative limit (DeSalvo et., 2016). Increased consumption of dietary cholesterol induces atherosclerosis (as reported in studies conducted in animal species and not in humans) (Bocan, 1998; McNamara, 2000; Rudel, 1997). Other prospective epidemiological studies also reported the positive relationship between dietary cholesterol and other nutrients to the increased risk of developing CHDs (Kritchevsky and Kritchevsky, 2000; McNamara, 2000). A significant relative risk was also observed in the Western Electric Study (Stamler and Shekelle, 1988).

LIMITATIONS FOR STUDY 1

Use of a different food composition tables (FCT) in NutriSurvey that is based on foods that are not consumed in Malawi. Malawi does not have its own food composition tables hence an alternative FCT had to be used. In this regard, if foods were not found in a FCT, similar foods had to be used. This posed a challenge in that the alternative foods could lead to underestimation or overestimation of nutrient intakes. Also, mixed dishes that are consumed in Malawi were not available in the NutriSurvey package that was used. This may also have contributed to underestimation or overestimation of energy and nutrient intakes. The findings that have been reported in this should therefore be taken with care as there could be errors in determining the actual intake of energy and nutrients among hypertensive patients.

Use of daily recommended energy and nutrient intake references for healthy persons among hypertensive patients. Hypertensive patients have altered energy and nutrient requirements Using references of healthy people for hypertensive patients may result in overestimation (for nutrients that are supposed to be limited or excluded) and underestimation (for nutrients that they are supposed to increase) of the true requirements.

Underreporting of prohibited foods could have occurred even if hypertension patients know that they consume a lot of such foods. Deliberate underreporting could be done to impress the interviewer that they are following the advice even though such foods are consumed in large quantities. On the other hand, overestimation of recommended foods could have occurred even though such foods are not consumed. This could be due to the knowledge of hypertensive patients about the importance of such foods hence they would overreport.

Dietary recall for this research was based on respondents' memory. It is hard for some respondents to recall foods and amounts that were consumed the previous day. This may have

resulted in not reporting some foods that were consumed hence underreporting the energy and nutrient intakes for hypertensive patients.

CONCLUSIONS FOR STUDY 1

From the results discussed in this chapter, six food groups (as categorized by the Malawi Food Guide-Staples, Legumes, Foods from animal sources, Fruits, Vegetables and Fats & Oils) were reported to be consumed by hypertensive patients. The frequency of consumption varied among the food groups. The most frequently consumed (2-3 times per day) food groups were staples (grains/cereals and vegetables). On the other hand, foods such as legumes and meats were reported to be consumed but not frequently (with a majority consuming less than 2-4 times per week). For staples, the amounts that were consumed were above (more than 110%) the recommended intakes per day while for foods such as vegetables, fruits, legumes and meats the intakes were on the lower side as recommended per day.

The types, amount, and frequency of foods eaten by hypertensive patients in the less than 24 months category and more than 24 months category were not significantly different from each other. They both had a similar trend of the types of food they eat, frequency of consumption, and amounts. This was also noticed when different nutrients intakes from both 24-hour dietary recall and FFQ were calculated. A higher proportion of hypertensive patients reported consuming more energy, protein, carbohydrates, fiber, vitamin E, sodium, potassium, magnesium, polyunsaturated fatty acids and cholesterol than the daily recommended allowances. On the other hand, water, calcium and total fat intakes were underconsumed by a majority of hypertensive patients. There were no significant differences in energy and nutrient intakes between the two categories of hypertensive patients and between males and females.

The dietary practices of hypertensive patients were found to be poor as there is overconsumption of carbohydrates, proteins, energy, sodium, PUFAs, cholesterol and others. The dietary practices were not significantly different from the two hypertensive categories

(hypertensive patients who have been attending hypertensive clinics for less than 24 months and those that have been attending hypertensive clinic for more than 24 months).

RECOMMENDATIONS FOR STUDY 1

1. Changing long standing eating habits is a gradual process and could be very challenging and difficult for most patients. As such, there is need for continued awareness to hypertensive patients about the importance of changing their eating habits such as diversifying their diets and the need to reduce overconsumption of proteins, carbohydrates and sometimes fats.

2. There is strong need to have specific dietary guidelines that are feasible to hypertensive patients and easy to use by all health workers. This could standardize the nutrition advice that is given to hypertensive patients and help to foster good eating habits among hypertensive patients.

3. There is need to promote food processing and preservation techniques among hypertensive patients so that they can process and preserve fruits and vegetable to be consumed during the season when these foods are not in season. This would improve dietary diversity among hypertensive patients, as it was found that hypertensive patients were not diversifying their diets.

4. There is need to promote homestead farming among hypertensive patients to contribute towards diversified consumption of foods such as meat and fruits.

CHA PTER 4

Study 2: Nutritional status and prevalence of other NCDs among hypertensive patients

This study investigated the body mass index of hypertensive patients in the two categories by measuring their weight and height. In addition, blood pressure was also assessed. The outcomes of these assessments were correlated to energy and nutrient intakes and hypertension episodes.

Study Objectives

1. To measure blood pressure of hypertensive patients who have been attending hypertensive clinics for less than 24 months and more than 24 months in Malawi.

2. To assess the body mass index (BMI) of hypertensive patients who have been attending hypertensive clinics for less than 24 months and more than 24 months in Malawi.

3. To determine the prevalence of diabetes among hypertensive patients attending hypertensive clinics in Malawi.

Study Research Questions

1. Does the BMI of hypertensive patients who have been who have been attending hypertensive clinics for less than 24 months and more than 24 months differ?

2. To what extent does diabetes co-exist with hypertension among hypertensive patients attending hypertensive clinics in Malawi?

METHODS

Study Design

This was a cross sectional study that measured anthropometric parameters (weight, height and blood pressure) of hypertensive patients who consented to participate in the study. Anthropometric measurements are well established and widely used as indicators of health and nutritional status in both children and adults (Khongsdier et al., 2005). BMI is one of the indices that is widely accepted in assessing nutritional status in adults (Khongsdier et al., 2005).

Study Participants and Recruitment

This study recruited hypertensive patients who attend hypertensive clinics in any of the four central hospitals in Malawi. Two categories of hypertensive patients who gave consent to participate in the study were selectively recruited. The first category was for hypertensive patients who have been attending hypertensive clinics for less than 24 months while the second category was for hypertensive patients who have been attending hypertensive clinics for more than 24 months. For both categories, adult males and females more than 18 years were targeted as potential participants. Pregnant women and children less than 18 years old were excluded from this study.

Sample Size

A total sample size of 344 hypertensive patients in all the four hospitals was interviewed and their height, weight, and blood pressure taken. The sample size was calculated using the following formula:

$$n = \frac{[z^2 (1-p) p]}{e^2}$$

where   n=sample size required

z=confidence interval (1.96)

p=prevalence of hypertension in Malawi (33%)

e= margin of error at 5% (0.05)

Based on the formula above, a sample size of 308 hypertensive patients was required for a 95% confidence interval. A non-response factor of 10% was considered to get a final sample size of 344. Out of the 344 participants, 172 were hypertensive patients who have been attending hypertensive clinics for less than 24 months and the other 172 were those that have been attending hypertensive clinics for more than 24 months. For each hospital, 86 hypertensive patients were interviewed (43 hypertensive patients who have been attending hypertensive clinics for less than 24 months and 43 hypertensive patients who have been attending hypertensive clinics for more than 24 months). Quota sampling design (nonprobability sampling) was used (Burns et al., 2008) to select participants for each hospital and category. This approach was used because there were no data on the number of hypertensive patients who have been attending hypertensive clinics for less than 24 months and more than 24 months. Clinics only keep aggregate data for the number of patients they have seen on a particular clinic session. From the records the clinics had, it was not possible to categorize patients based on length of time they have been attending hypertensive clinics.

Research assistants' training

The researcher and the local advisor trained interviewers on how to measure the anthropometric parameters of height and weight. Standard protocols (Gibson, 2005) for taking weight and height were followed. The nurse or clinical officer was responsible for measuring blood

pressure using sphygmomanometer. During training, research assistants practiced how to measure weights, heights, and blood pressure. Before using the weighing scales everyday, standard weights (a 1-kg packet of sugar) was used to make sure they were accurate. Height boards were checked to make sure they were calibrated to the nearest 0.1 cm (Gibson, 2005). Repeated measurements for all instruments were done during training to check consistency of the equipment to produce the same result if used repeatedly. This also helped in improving intra- and inter-individual reliability, as the person gets more familiar with the use of the equipment. Just like the hypertension questionnaires, research assistants practiced on the use of equipment during pretesting before the start of data collection to make sure that research assistants were familiar with the equipment. During data collection, the same digital weighing scales and height boards were used throughout the study. As for the sphygmomanometer, the research team used the one that each clinic uses. This meant that sphygmomanometers varied in terms of brand and calibration from clinic to clinic.

Data Collection

Three research assistants (2 for anthropometry and 1 nurse/clinical officer for blood pressure) took anthropometric measurements (weight, height, and blood pressure) of hypertensive patients after patients responded to the hypertension questionnaire. Three measurements of blood pressure were taken for each patient and averaged for a single value to be recording (Williams et al., 2004). This helped to minimize variation in blood pressure due to the patient being nervous/restlessness at the beginning of measurements. Table 6 presents the cut off points for blood pressure.

Table 6: Cut off points for blood pressure.

BP Category	Systolic (mmHg)	Diastolic (mmHg)
Optimal	<120	<80
Normal	<130	<85
Pre-hypertensive	130-139	85-89
Hypertension		
Grade 1 Hypertension (mild)	140-159	90-99
Grade 2 Hypertension (moderate)	160-179	100-109
Grade 3 Hypertension (Severe)	≥ 180	≥ 110
Isolated Systolic Hypertension		
Grade 1	140-159	<90
Grade 2	≥ 160	<90

Source: Williams et al., 2004

Electronic scales and height boards/stadiometers were used to measure weight and height respectively to determine BMI as categorized in Table 7. Measurement of weight and height followed standard protocols for taking these measurements as outlined by Gibson (2005). All anthropometric measurements were done at the clinic on the clinic day. Nurses and Clinical Officers followed their normal clinic protocols and did not deviate from their typical methods to accommodate this research study.

Table 7: Cut off points for body mass index.

Cut off point	Interpretation
<18.49	Thin/underweight
18.50-24.99	Normal
25.00-29.99	Overweight
30.00-39.99	Grade 1 Obesity
40.00-49.99	Grade 2 Obesity
>50.00	Grade 3 Obesity

Data Analysis

Anthropometric data were analyzed using Microsoft Excel where BMIs were calculated for each individual and later exported to SPSS version 22 for further analysis and comparison between the two categories of hypertensive patients. Blood pressure measurements were directly entered and analyzed using SPSS where analysis of variance and correlations were performed. Analysis of variance was used to test if there are significant differences between variables, while correlations were done to see the relationship between nutrient and energy intakes and blood pressure measurements.

RESULTS

Blood Pressure Assessment

Overall, a quarter (25.7%) of patients had mild hypertension, followed by moderate hypertension (16.1%) and the least proportion was in isolated systolic hypertension grade 2 (5.8%). Other proportions are as summarized in Figure 17.
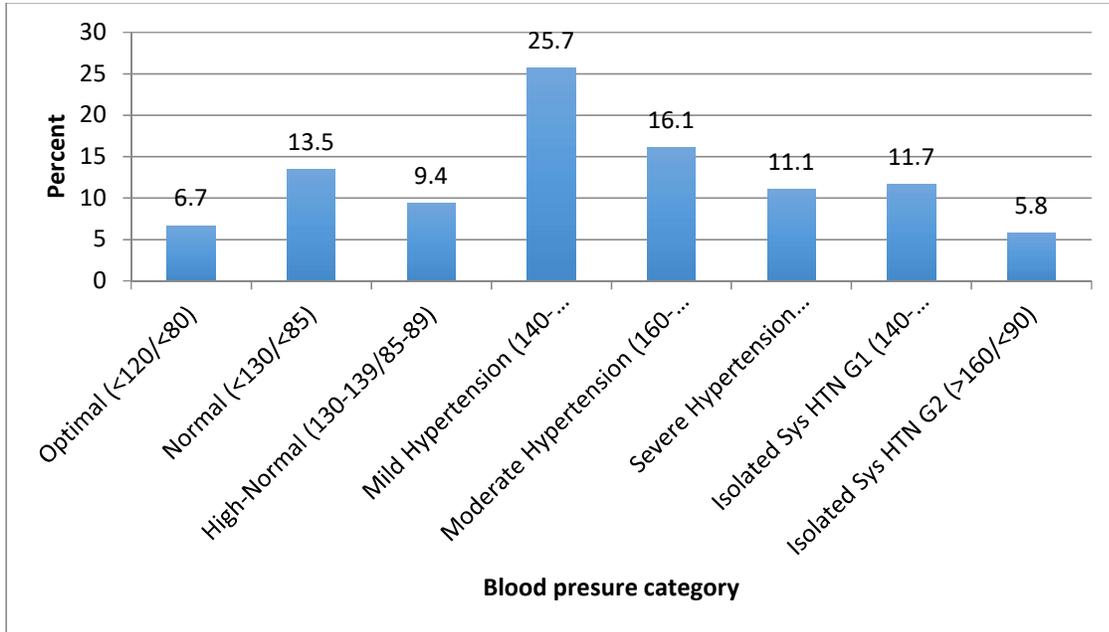
Figure 17: Distribution of blood pressure among hypertensive patients attending hypertensive clinics in Malawi.

As for the category of patients, 27.3% of patients in the less than 24 months category had mild blood pressure and the least proportion (5.2%) had isolated systolic blood pressure. For the more than 24 months category, the majority (24.1%) also had mild blood pressure and the least proportion (6.5%) was for hypertensive patients with isolated systolic blood pressure (Table 8). There were significantly more patients in the more than 24 months category who had high blood pressure ($P < 0.05$).

Table 8: Distribution of blood pressure among hypertensive patients by category of patients.

Category	Less than 24 months (n=172)		More than 24 months (n=170)	
	Freq	%	Freq	%
Optimal (<120/<80 mm Hg)	10	5.8	13	7.6
Normal (<130/<85 mm Hg)	26	15.1	20	11.8
High-Normal (130-139/85-89 mm Hg)	19	11	13	7.6
Mild Hypertension (140-159/90-99 mm Hg)	47	27.3	41	24.1
Moderate Hypertension (160-179/100-109 mm Hg)	27	15.7	28	16.5
Severe Hypertension (>180/>110 mm Hg)	17	9.9	21	12.4
Isolated Sys HTN G1 (140-159/<90 mm Hg)	17	9.9	23	13.5
Isolated Sys HTN G2 (>160/<90 mm Hg)	9	5.2	11	6.5

An analysis was also made to compare distribution of blood pressure by sex (Figure 18). The highest proportion of women were found to have mild blood pressure while more men were found to have moderate blood pressure. Again, there were significantly more men with isolated systolic blood pressure than women ($P < 0.05$).
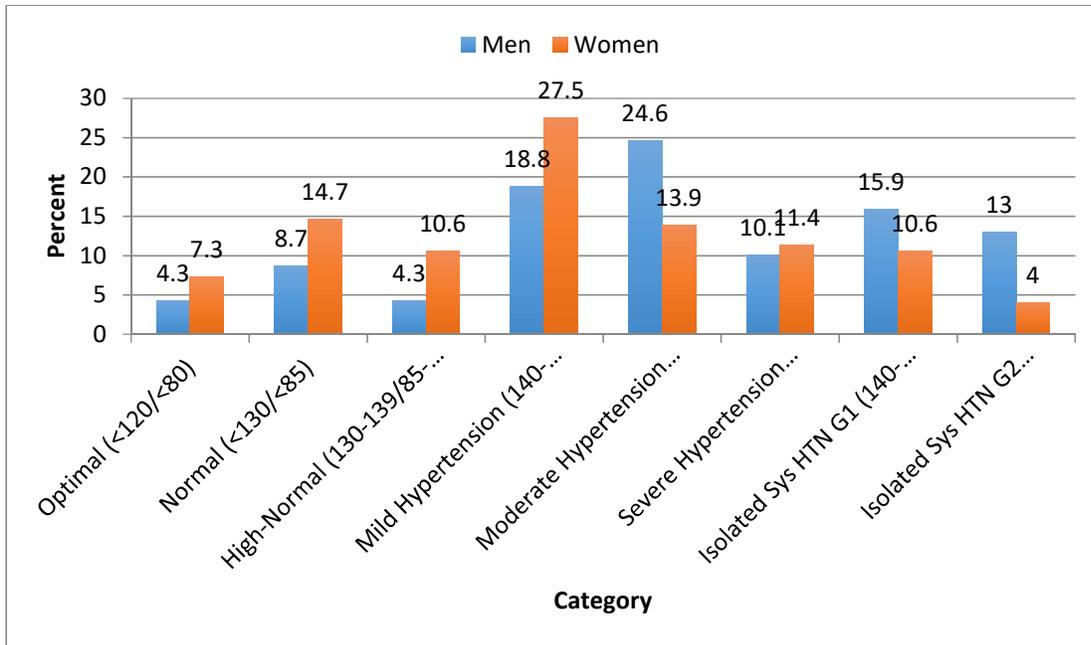
Figure 18: Distribution of blood pressure among hypertensive patients attending hypertensive clinics in Malawi by sex.

Body Mass Index (BMI) Assessment

From the results obtained in this study, more than half of the hypertensive patients were found to have a BMI of more than 25.0 (67.2%) with a higher proportion being overweight (37.0%) (Figure 19).
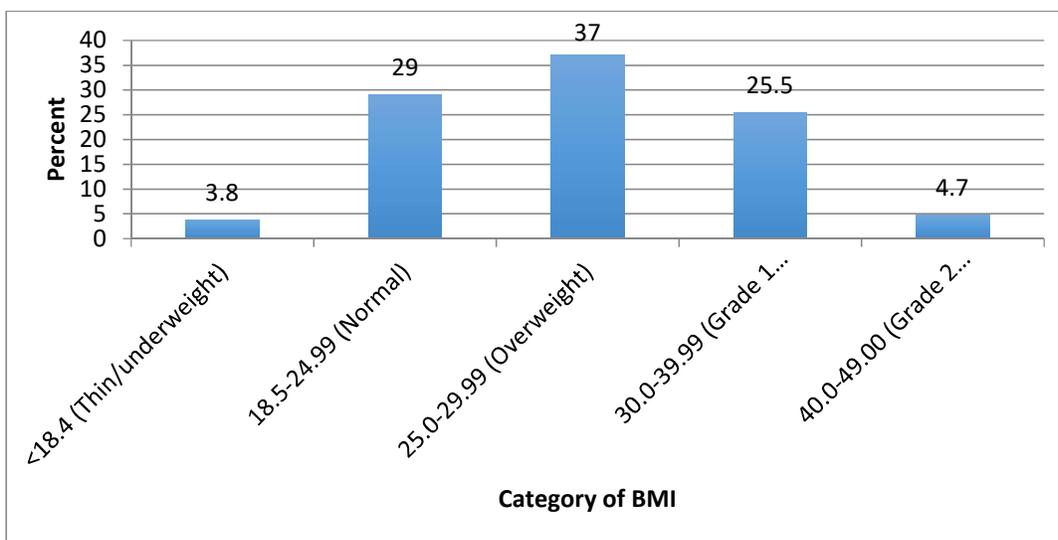
Figure 19: Distribution of BMI among hypertensive patients attending hypertensive clinics in Malawi.

In terms of patient category, there were significantly more patients (33.5%) of less than 24 months in the normal category (18.5 – 24.99) than those in the more than 24 months (24.6%) ($P < 0.05$). More patients (41.5%) in overweight category were from the more than 24 months category and 32.4% in the less than 24 months category (Figure 20).
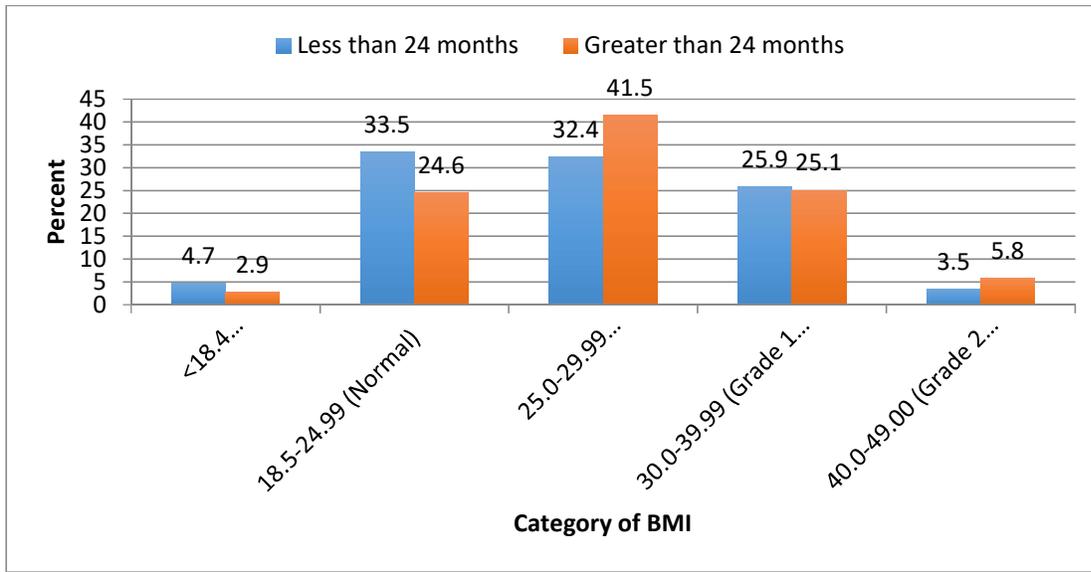
Figure 20: Distribution of BMI of hypertensive patients attending hypertensive clinics in Malawi by category.

For all the hospitals and categories, it was found that more women had higher BMIs than men (Figure 21).
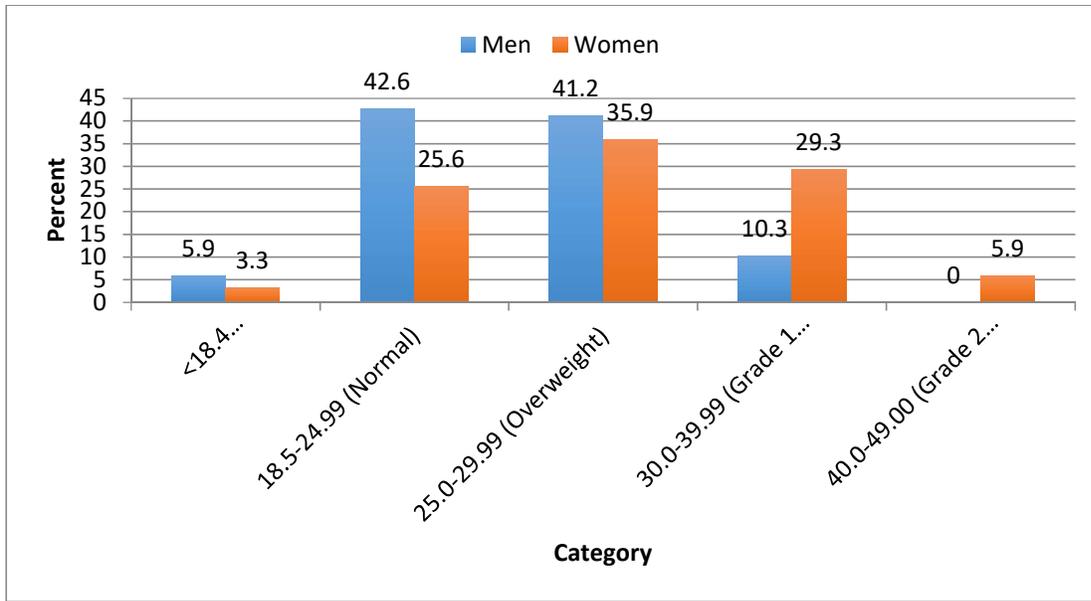
Figure 21: Distribution of BMI of hypertensive patients attending hypertensive clinics in Malawi by sex.

Despite a majority of hypertensive patients being overweight and obese, a majority of them (83.1%) were not on any weight reduction program. This was also the case when categories of patients were considered. For hypertensive patients in the less than 24 months category, 82.5% were not on any weight control program and 83.7% of patients in the more than 24 months category were not on any weight control program.

Correlations Among Variables

Dietary intakes and BMI and age were correlated with blood pressure, and a summary of the correlations is presented in Table 9.

Table 9: Correlation of blood pressure and other risk factors among hypertensive patients attending hypertensive clinics in Malawi.

		Systolic	Diastolic	Age	BMI	Energy	Sodium	Fat	Potassium	Calcium	Cholesterol
Systolic	Pearson Correlation	1	.747**	.164**	.222**	.013	-.026	.060	-.020	.014	-.049
	Sig. (2-tailed)		.000	.002	.000	.815	.629	.272	.711	.796	.367
Diastolic	Pearson Correlation	.747**	1	-.112*	.231**	.009	-.027	.050	.003	.019	-.039
	Sig. (2-tailed)	.000		.038	.000	.869	.626	.352	.959	.727	.476
Age	Pearson Correlation	.164**	-.112*	1	-.127*	.024	-.040	-.017	-.032	.016	-.070
	Sig. (2-tailed)	.002	.038		.019	.656	.462	.759	.560	.769	.197
BMI	Pearson Correlation	.222**	.231**	-.127*	1	.000	.045	-.003	-.042	-.025	-.075
	Sig. (2-tailed)	.000	.000	.019		.993	.403	.954	.441	.643	.164
Energy	Pearson Correlation	.013	.009	.024	.000	1	.231**	.699**	.789**	.542**	.240**
	Sig. (2-tailed)	.815	.869	.656	.993		.000	.000	.000	.000	.000
Sodium	Pearson Correlation	-.026	-.027	-.040	.045	.231**	1	.190**	.218**	.270**	.034
	Sig. (2-tailed)	.629	.626	.462	.403	.000		.000	.000	.000	.530
Total Fat	Pearson Correlation	.060	.050	-.017	-.003	.699**	.190**	1	.604**	.505**	.345**
	Sig. (2-tailed)	.272	.352	.759	.954	.000	.000		.000	.000	.000
Potassium	Pearson Correlation	-.020	.003	-.032	-.042	.789**	.218**	.604**	1	.834**	.238**
	Sig. (2-tailed)	.711	.959	.560	.441	.000	.000	.000		.000	.000
Calcium	Pearson Correlation	.014	.019	.016	-.025	.542**	.270**	.505**	.834**	1	.205**
	Sig. (2-tailed)	.796	.727	.769	.643	.000	.000	.000	.000		.000
Cholesterol	Pearson Correlation	-.049	-.039	-.070	-.075	.240**	.034	.345**	.238**	.205**	1
	Sig. (2-tailed)	.367	.476	.197	.164	.000	.530	.000	.000	.000	

**. Correlation is significant at the 0.01 level (2-tailed)   *. Correlation is significant at the 0.05 level (2-tailed)

From Table 9 there was negative correlation between sodium intake and diastolic (r=-0.027) and systolic (r=-0.26) blood pressure, although the correlation was weak (r=-0.027 for diastolic and r=-0.26 for systolic) and not significant ($P > 0.05$). Despite total energy intake being high among hypertensive patients, there was a nonsignificant positive but weak correlation with blood pressure (r=0.009 for diastolic and r=0.013 for systolic). Blood pressure and total fat intake showed a positive weak and not significant correlation (r=0.05 for diastolic and r=0.06 for systolic). Dietary fiber had a negative correlation with diastolic (r=-0.016) and systolic (r=-0.015). The correlations were not significant (p>0.05). The correlation between diastolic blood pressure and potassium intake was positive, weak (r=0.003) and not significant ($P > 0.05$). As for systolic blood pressure, it was negative, weak (r=-0.020) and not significant (p>0.05). As for diastolic and systolic blood pressure and age, there was a negative (r=-0.112) but significant correlation ($P > 0.05$) between diastolic blood pressure and age. On the other hand, a positive (r=0.164) and significant correlation ($P < 0.05$) was noted between age and systolic blood pressure. The correlation between calcium intake and blood pressure was positive, weak (r=0.019 for diastolic and r=0.014 for systolic) and not significant ($P > 0.05$). Cholesterol intake and blood pressure correlation was negative and not significant (r=-0.039 for diastolic and r=-0.049 for systolic).

A correlation with non-dietary factors showed that age had a negative (r=-0.112) and significant ($P < 0.05$) correlation with diastolic blood pressure and a positive (r=0.164) and significant ($P < 0.05$) correlation with diastolic blood pressure. On the other hand, body mass index had a positive and significant ($P < 0.05$) correlation with diastolic (r=0.231) and systolic (r=0.222) blood pressure. The different nutrients were positively correlated with each other, probably because they were confounded by the quantity of food eaten on the day of record.

Co-existence of Hypertension with Other NCDs

From the results obtained, a third of hypertensive patients had other diagnosed NCDs, of which diabetes was the most common (occurring in 83.8% of the patients). Other NCDs included stroke (occurring in 10.3% of the patients), Ulcers (occurring in 1.7%), cancer (occurring in 0.9%) and asthma (occurring in 1.7%). In terms of category of patients, more (38.6%) of the patients in more than 24 months category had other NCDs than in less than 24 months category (28.7%).

From the results obtained in this study, there were more patients with diabetes, HIV and cancer in the less than 24 months category. On the other hand, the more than 24 months category had more patients with stroke, ulcers and asthma (Figure 22).
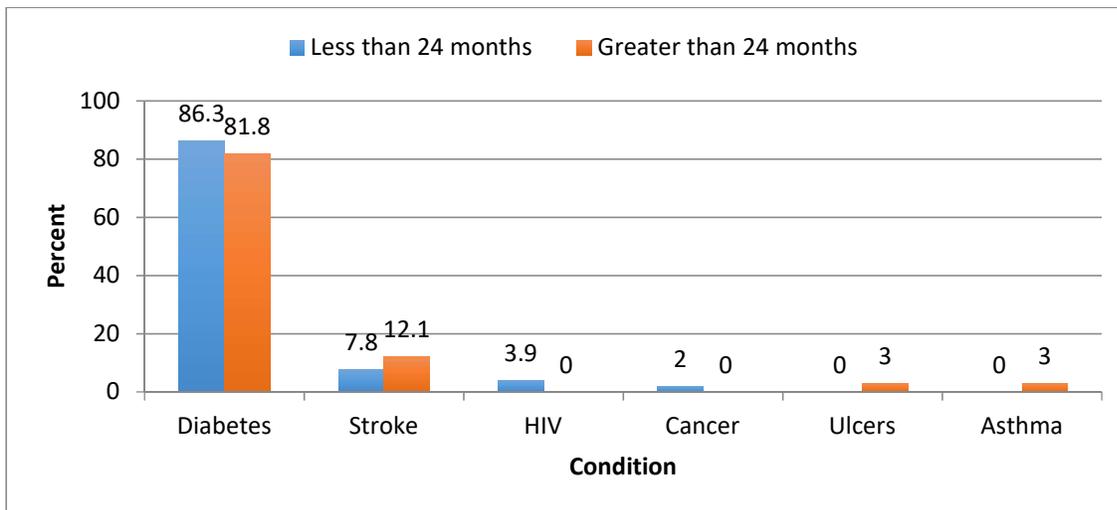
Figure 22: Types of NCDs co-existing with hypertension among hypertensive patients attending hypertensive clinics in Malawi by category.

The mean duration of existence of the other NCD for the less than 24 months category patients was 38.7 ± 31 months. The range of duration was 2 to 144 months. The mean duration is more than the category of the patient (less than 24 months) because some patients were first diagnosed with other condition (such as diabetes, stroke) before being diagnosed of being hypertensive. For patients in the more than 24 months category, the mean duration of the existence of other NCD was 87.4 months $\pm$ 54.1 months.

DISCUSSION

From the results obtained in this research, the mean age for hypertensive patients in the more than 24 months category (60.9 ± 10.1 years) was relatively higher than hypertensive patients in the less than 24 months category (56 ± 12.5 years). However, the mean age for the two categories was not significantly different from each other ($P > 0.05$). Therefore, it is not surprising that more patients in the more than 24 months category had high blood pressure. In addition, this may further point to the fact that patients in the more than 24 months category could have relaxed with the dietary advice given, resulting in poor health status in this category.

The findings in this research agrees with Franklin et al., in 2001, who found that isolated systolic hypertension was the most frequent subtype of uncontrolled hypertension among the study's population, that more than half of the subjects with hypertension were more than 50 years of age, and that isolated systolic blood pressure was common among the older population, hence required a greater reduction in systolic blood pressure (Franklin et al., 2001). Elevated systolic blood pressure was reported by Franklin et al., to be a more potent predictor of adverse cardiovascular outcomes among the elderly population than is elevated diastolic blood pressure. In addition, isolated systolic pressure was strongly age dependent (Franklin et al., 2001). Both the Framingham Heart Study and the nationally representative National Health and Nutrition Examination Survey (NHANES) III (conducted in 1988 to 1994) found an increasing systolic blood pressure occurring throughout adult life in untreated patients (Franklin et al., 1997 and Burt et al., 1995).

In this research it was found that hypertension was more prevalent among females than males. These findings are in line with what other studies found. Gu in 2013 found that the prevalence of hypertension increased with age and that men and women had similar prevalence,

but more women were treating their hypertension than men (Gu, 2013). Hammami et al. in 2011 found that the prevalence of hypertension was higher in females than in males. It was further reported that higher body mass index, diabetes mellitus and disability were important risk factors for the prevalence of hypertension.

More than half of the hypertension patients in this current study were overweight and obese. Furthermore, more patients in the more than 24 months category were overweight and obese than hypertensive patients in the less than 24 months category. In addition, more women had higher BMIs than men. These findings are similar to what Flegal et al., found in 2012 that prevalence of overweight and obesity was higher in females than in males, though not statistically different. Similar findings were also reported by Flegal et al., in 2010 where more females were overweight and obese than males.

From the results obtained in this study, there was a positive correlation between energy intake, total fat intake, potassium intake, calcium intake, BMI and blood pressure, though they were weak. Based on these results, the hypertension that we see among hypertensive patients in this research may not be sodium sensitive. When linear regression was done between blood pressure and other variables, age and BMI were the most important and significant predictors of high blood pressure among hypertensive patients in this study.

In a study by Hypertension Study Group in 2001, it was found that a higher body mass index, higher education status and prevalent diabetes mellitus were important risk factors for the prevalence of hypertension among the studied population. In addition, Hammami et al., (2011) found that higher BMI, diabetes mellitus and disability were important correlates of the prevalence of hypertension among the studied population. In a study done by Jones et al., (1994) it was concluded that a strong association between BMI and blood pressure exists for lean as well as for

obese subjects (Jones et al., 1994). Muntner et al., (2004) found an increase in blood pressure among children and adolescents that was partially attributable to an increased prevalence of overweight (Muntner et al., 2004).

In this study, energy intake was positively correlated with hypertension among the hypertensive patients. Because of the high carbohydrate intake that was reported in this study and that Malawi depends on maize as its staple food, it was not surprising that the energy intake among hypertensive patients was high. In addition, the dietary diversity for most Malawians is poor due to overdependency on maize.

These findings are in line with what Denning et al., in 2009 reported that maize accounts for 60% of total calorie consumption among Malawians. FAOSTAT in 2009 also reported that maize provides more than 70% of total daily energy intake among Malawians (FAOSTAT, 2009). Furthermore, Speedy in 2003 and Chilimba et al., in 2011 reported that Malawian diets are usually monotonous and undiversified because staples provide a bulk of the diet (Speedy, 2003 and Chilimba et al., 2011).

In a study Svetkey et al., in 1999, it was found that a DASH diet and reduced sodium intake were negatively correlated with blood pressure. DASH diets lower the cholesterol concentrations without significant effects on triacylglycerol (Sacks et al., 2001). Moore et al., (2005) also found that diets that are rich in fruits, vegetables, and low-fat dairy products and reduced in saturated fat, total fat, and cholesterol, and modestly increased in protein were significantly associated with reduced blood pressure in cases where sodium intake was not reduced or where there was no weight loss. In addition, studies have also reported that the effects of diet on blood pressure may be influenced by demographic characteristics such as race, age, and sex (Svetkey et al., 1999).

The risk of hypertension was found to decrease with increased consumption of dairy products such as milk and milk products. This, therefore, requires the need to encourage hypertensive patients to consume more dairy products. DASH trial showed that a diet rich in fruit, vegetables, and low-fat dairy products substantially reduced blood pressure (Engberink et al., 2009 and Appel et al., 1997). Several epidemiological (Djoussé et al., 2006; Ruidavets et al., 2006 and Snijder et al., 2007) and prospective (Alonso et al., 2005; Pereira et al., 2002; Wang et al., 2008 and Steffen et al., 2005) studies have reported an inverse relationship between dairy intake and hypertension. The National Heart, Lung, and Blood Institute Family Heart Study found a 36% lower prevalence of hypertension in American adults with a high intake of dairy products, independent of calcium intake (Djoussé et al., 2006). A cross-sectional study among 912 middle-aged French men found that dairy products and dietary calcium combined and independently significantly lowered systolic blood pressure (Ruidavets et al., 2006). Beneficial effects of low fat products have also been reported on childhood blood pressure in the Framingham Children's study (Moore et al., 2005).

From the results obtained, a third of hypertensive patients had other diagnosed NCDs, of which diabetes was the most common (occurring in 83.8% of the patients). There were more patients with diabetes, HIV and cancer in the less than 24 months category. On the other hand, the more than 24 months category had more patients with stroke, ulcers and asthma. The co-existence of hypertension and other NCDs especially diabetes and obesity is associated with a worse health-related quality of life (Banegas et al., 2007). In this study, obesity and diabetes in women and men respectively were the factors most closely and significantly associated with diminished health-related quality of life (Banegas et al., 2007).

LIMITATION OF STUDY 2

The research did not have its own blood pressure measuring machine, as such it depended on the BP machines that each hypertensive clinic was using. This means that different BP machines were used to measure blood pressure. Use of different machines could result in variation of blood pressure readings as not all the blood pressure machines were the same.

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CONCLUSION FROM STUDY 2

Overall, 25.7% of hypertensive patients had mild hypertension, and a higher proportion was found among the more than 24 months category patients. In terms of sex, the highest proportion of women had mild blood pressure while more men had moderate blood pressure. More than half of the hypertensive patients were overweight and obese, with a higher proportion being hypertensive patients in the more than 24 months category. As for sex, more women were obese while more men were overweight. Despite more hypertensive patients being overweight and obese, more than 80% of the patients were not on any weight control program.

A third of hypertensive patients had another NCDs apart from hypertension, of which diabetes was the most common as found in 83.8% of the hypertensive patients who reported to have another NCDs. Relatively more patients (38.6%) in the more than 24 months category had other NCDs than those in the less than 24 months category (28.7%). Overall, there were no significant differences in blood pressure and body mass index between hypertensive patients in the less than 24 months category and more than 24 months category. From the results, there was a

positive correlation between blood pressure and energy intake, total fat intake, potassium intake, calcium intake and BMI.

RECOMMENDATION FROM STUDY 2

In addition to the dietary advice that hypertensive patients get at hypertensive clinic, the clinics should also include measures to control overweight and obesity among hypertensive patients. This could be achieved through establishment of an exercise center within the hospital or in communities where patients could go for exercise. In addition, exercise centers should have exercise instructors to help with different exercises that hypertensive patients could be engaged in depending on other conditions of the patients.

CHAPTER 5

Study 3: Nutrition advice given to hypertensive patients by nurses and clinical officers and patients' perception and interpretation of the advice

This study assessed the type of advice that hypertensive patients get from hypertensive clinics. Nurses and clinical officers usually give advice to hypertensive patients on the day of hypertensive clinic. The advice is meant to help hypertensive patients to manage their condition. The advice was assessed by conducting key informant interviews with nurses and clinical officers.

Study Objectives

1. To document the type of nutrition advice given to hypertensive patients who been have attending hypertensive clinics for less than 24 months or more than 24 months in Malawi.

2. To document challenges that hypertensive patients who have been attending hypertensive clinics for less than 24 months or more 24 months face in implementing the dietary advice that they are given at hypertensive clinic.

Study Research Questions

1. What type of nutrition advice is given to hypertensive patients attending hypertensive clinic in Malawi?

2. What is the perception and interpretation of hypertensive patients towards the nutrition advice given at hypertensive clinic by nurses and clinical officers after diagnosis? (Is it adequate? Does it help? What else can be done/included in the advice?)

METHODS

Study Design

This was a cross sectional study where qualitative and quantitative data were collected from Nurses and Clinical Officers and hypertensive patients respectively. Data collection took place from August to September 2016.

Study Participants and Recruitment

The study interviewed all nurses and clinical officers working in any of the four hypertensive clinics at Mzuzu, Kamuzu, Queen Elizabeth and Zomba Central Hospitals in Malawi. A written informed consent form (Appendix 3) was used to ask for consent of nurses and clinical officers to participate in the study. Twenty nurses and clinical officers were interviewed. All twenty nurses and clinical officers in the hypertensive clinics were targeted because there are few nurses and clinical officers who work in these clinics. At the beginning of the hypertensive clinic, the nurse or clinical officer in-charge informed other nurses and clinical officers about the research using a previously written script (Appendix 5). A nurse or clinical officer in-charge helped to nominate nurses and clinical officers who were actively participating in hypertensive clinic to participate in this study. Only nurses and clinical officers who participate in hypertensive clinic were eligible to participate in this study. Five (5) clinical officers/nurses were interviewed per hypertensive clinic.

In addition to nurses and clinical officers, the study also interviewed two categories of hypertensive patients who have been attending hypertensive clinics in any of the four central hospitals in Malawi. The first category was for hypertensive patients who have been attending hypertensive clinics for less than 24 months while the second category was for hypertensive patients who have been attending hypertensive clinics for more than 24 months. For both

categories, adult males and females more than 18 years were targeted as potential participants. Pregnant women and children less than 18 years old were excluded from this study.

Hypertensive patients were interviewed at the hospital during the day of the clinic. At the beginning of the clinic session, the nurse or clinical officer briefly introduce the research to all hypertensive patients using a written script/note for nurse/clinical officer (Appendix 4). In addition, the nurse or clinical officer allowed the researcher to explain the research to hypertensive patients. This was done to ensure that hypertensive patients clearly understood what the research was all about and that any information that may have been misrepresented by the nurse or clinical officer in the introduction is clarified. After introduction to research was done, hypertensive patients were given an opportunity to ask questions if they have any.

For participants who agreed to participate in the study, the research assistants went through the participant-screening tool (Appendix 1) to determine eligibility of the patient in the study. Once eligibility was determined and the hypertensive patient agreed to participate in the study, the research assistant went through the written informed consent form for hypertension patients (Appendix 2). The form further explained to hypertensive patients about the study and their right to participate or not to participate in the study. Once the patients consented to participate in the study, research assistants signed the consent form on behalf of the respondents so as to conceal the identity of the patient.

Interviewer Training

The researcher conducted all in-depth individual interviews using a semi-structured key informant interview (KII) guide (Appendix 9). To minimize interviewer bias, the semi-structured KII guide content was reviewed by research faculty at NC State University. The research advisors edited the semi-structured interview guide where necessary, providing insights about question

clarity and conciseness, additional probes needed, and appropriateness of language in respect to content and target population. The interview guide was also pretested after training to ensure clarity of questions. Pretesting was done at Nchezi hypertensive support group with a service provider who was similar to the final target population.

Data Collection

Individual in-depth interviews were conducted with nurses and clinical officers using a semi-structured KII guide with open ended questions to collect data on their demographic characteristics, type of advice they give to hypertensive patients, and their knowledge on dietary management of hypertension. In-depth individual interview approach was used instead of focus groups because KIIs provide in-depth one-on-one understanding of individual perspectives without the influence of other stated opinions (Legard et al., 2003, and Rubin and Rubin, 2005). All KIIs were done at the hypertensive clinic after the clinic session because during clinic session, nurses and clinical officers were busy attending to hypertensive patients.

In addition to nurses and clinical officers, hypertensive patients were also asked about their perception and satisfaction of the services they receive at hypertensive clinic through hypertensive questionnaire (Appendix 6). Both open and closed ended questions were used to collect data on hypertensive patient's satisfaction, adequacy, usefulness and the type of nutrition advice given.

During interviews, no recordings were done, as we did not procure recorders due to budget constraints. The interviewer (the researcher) took detailed interview notes and other important field observations. An effort was made to write down all the responses that respondents provided. These notes and field observations were carefully written down on note pads and analyzed later.

Data Analysis

A thematic analysis approach was used to analyze data (Guest et al., 2012). Emerging themes were coded based on collected data and research objectives. Themes were identified through careful reading and re-reading of responses from nurses and clinical officers. Microsoft Word^{TM} was used to organize qualitative data. In Microsoft Word™, all responses for each question were put together for all key informants. At the end, one Word file was developed with all the responses for all the respondents. The data that were collected through the hypertensive questionnaire, were entered and analyzed using Statistical Package for Social Science (SPSS) version 22 (SPSS, I., 2013).

RESULTS

Demographic Characteristics of Nurses and Clinical Officers

A total of 20 nurses and clinical officers were interviewed, of which 13 were females and 7 were males. Out of 20 key informants, the majority (11) were nurses, followed by clinical officers (5). Other professionals included nutritionist, medical doctor and a Southern and Eastern chairperson of diabetic and hypertensive patients (Figure 23).
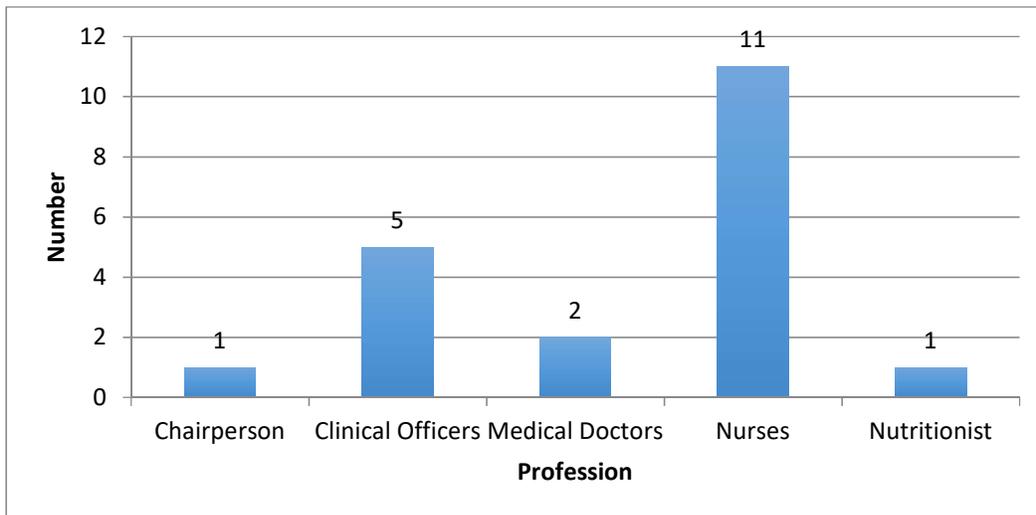
Figure 23: Distribution of professionals of key informants.

The mean age for all nurses and clinical officers was 43.9 years with a minimum and maximum age of 24 and 66 years respectively. The mean number of years that key informants have been working as medical professionals was 9.5 years with a minimum of 1 year and a maximum of 30 years. However, the mean experience of working specifically in hypertensive clinic was 3.9 years with a minimum of 1 year and a maximum of 12 years.

Services Offered at Hypertensive Clinic

From the key informant interviews, the services that are offered at hypertensive clinic include health education talk (including nutrition, exercise, alcohol and smoking advice), blood pressure assessment, weight measurements, medical review and prescription. The advice given is general for both sexes and regardless of the cause of hypertension.

1. Education Talk

A group educational talk is the first thing that is done once hypertensive patients arrive at the clinic. Nurses usually conduct the educational talk. In the talk, hypertensive patients are taught what hypertension is, signs and symptoms of hypertension, causes and effects of hypertension, and foods that should be excluded, included, or limited (nutrition advice) in diets of hypertensive patients. Nurses and clinical officers reported that individual counseling was not possible due to few staff against a large number of hypertensive patients. The type of nutrition advice that is given includes reduce salt, sugar, fat and *nsima* (a thick porridge made from maize flour, comprising of 60% water and 40% maize flour) intakes, and increase consumption of fruits and vegetables. Hypertensive patients are further told to eat grilled or roasted meat rather than boiled or fried in cooking oil. Grilled meat tends to drip off fats during grilling that reduces its fat content. This in turn helps hypertensive patients to reduce fat intake. Key informants did not have specific quantities of salt, sugar, fats, vegetables, and fruits to recommend to hypertensive patients. Key informants did not use any dietary guidelines during the education talk regarding diets for hypertensive patients. As such, the advice that was given to hypertensive patients was general and subjective, as no specific quantities were given. The advice is based on individual knowledge of clinical officer or nurse for hypertension. In some instances, medical doctors and clinical officers reported that there are dietary guidelines in the management of hypertension, but no nurse reported

using any. From the interviews, it was reported that clinical officers and medical doctors rarely do an educational talk as they only focus on reviewing patient information and prescription of drugs. On the other hand, a nurse usually conducted the health talk. Because the advice was general and not specific, most hypertensive patients found it difficult to translate the advice and implement.

Results obtained from hypertensive patients on the types of nutrition advice given at hypertensive clinic correlate with what was reported by key informants. Hypertensive patients reported that they were told to 'reduce the amount of salt'. When hypertensive patients were asked what 'to reduce the amount of salt' means, less than a quarter (20.9%) of patients at least mentioned a figure that they thought related to reduced salt intake, though the figures varied among hypertensive patients (Figure 24).
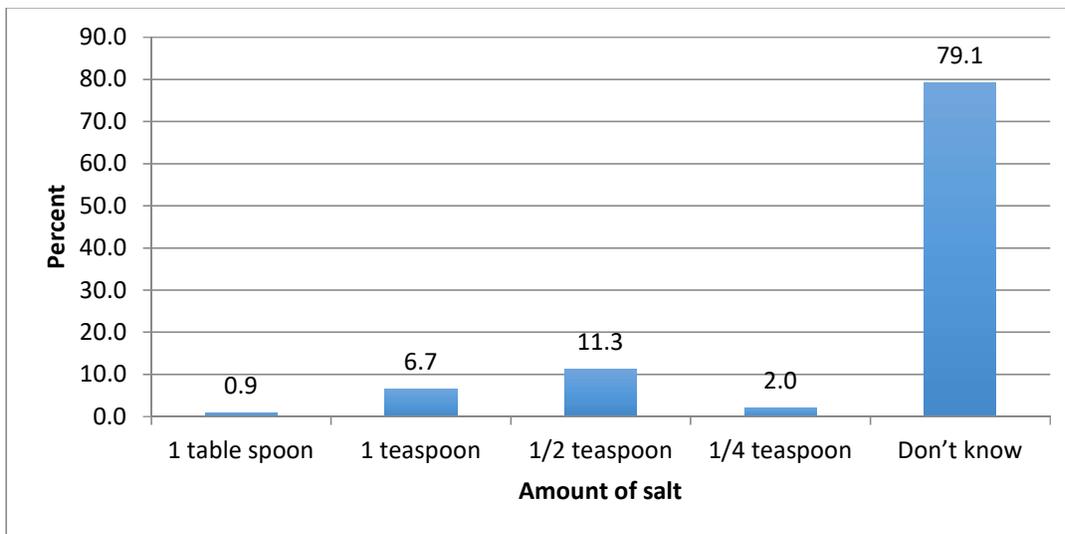
Figure 24: Reported quantities of salt to be consumed per day as reported by hypertensive patients attending hypertensive clinics in Malawi.

From results in Figure 24, the majority (79.1%) of hypertensive patients had no idea of the exact amount of salt to consume per day. Nurses and clinical officers gave similar advice to hypertensive patients regarding fat intake. The advice for fat intake was 'reduce fat intake' and 'no

fat at all'. Just like salt intake, 81.7% of hypertensive patients did not know the exact amount of fat to consume per day (Figure 25).
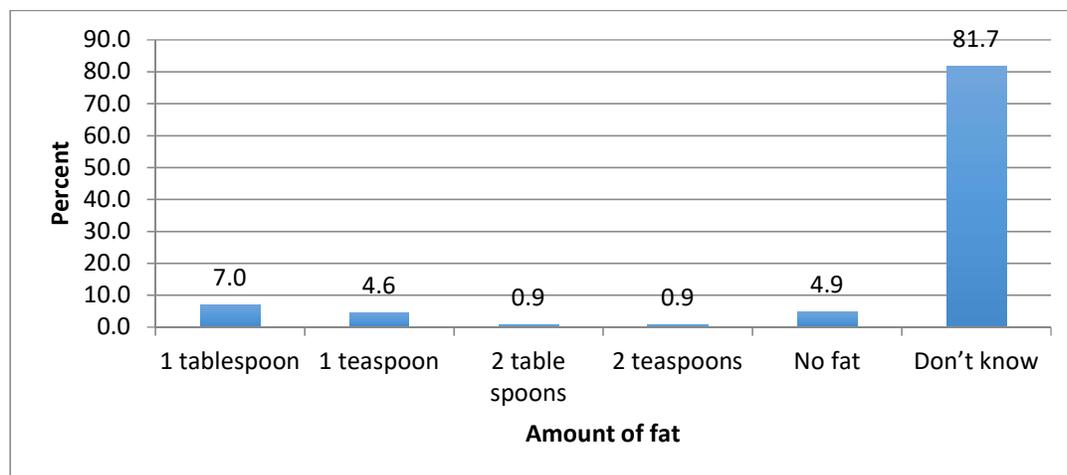
Figure 25: Reported quantities of fat to be consumed per day as reported by hypertensive patients attending hypertensive clinics in Malawi.

In this study, one teaspoon of cooking oil was equal to 3 g, and 1 tablespoon was equal to 10 g. The quantities of fat intake mentioned by hypertensive patients also varied from person to person. If the quantities mentioned are translated into acceptable macronutrient dietary range (for a person consuming 2100 kcal per day), with a recommendation of less 30% of total energy intake coming from fats, then the quantities mentioned in Figure 25 were within the acceptable range. The recommendation is to reduce consumption of total fats to less than 30% of daily total energy intake, saturated fat to less than 10% of total daily energy intake, trans-fats less than 1% of total daily energy intake, and cholesterol less than 200 mg per day.

From key informant interviews, it was reported that hypertensive patients should avoid consuming a lot of sugar. The sugar that was emphasized was sugar added to foods. This is the sugar that was viewed by both hypertensive patients and Nurses and Clinical Officers to be more harmful than other types of sugars. Sugar was also strongly advised against especially for hypertensive patients who were also diabetic.

Apart from the advice on limiting the nutrients discussed above, hypertensive patients were advised to consume more fruits and vegetables, whole grains, drink more than 2 liters of water per day, and reduce consumption of refined products. Almost all nutrition advice that was given was general and no specific quantities were attached to the advice.

Also, nurses and clinical officers reported that they advise hypertensive patients to exercise. From the results obtained from key informants, hypertensive patients are told to exercise though the advice did not specify the intensity and duration of exercise (key components regarding exercise).

Based on key informant interviews, the type of exercise that was recommended included cycling, playing football/netball, being engaged in household chores (day to day activities at home), push-ups, running, stretching and walking. These results agree with what hypertensive patients reported in terms of the type of exercise they are advised to do.

Results from hypertensive patients show that 61.5% were engaged in some type of exercise. However, a majority of hypertensive patients were not adequately exercising. A similar trend was noticed between the two categories of hypertensive patients (63.2% exercising in the less than 24 months category and 59.9% in the more than 24 months category). Even for those that reported to be exercising, the duration was far below the recommended. A majority of hypertensive patients (69.9%) exercised less than 5 hours a week (versus the WHO recommendation of at least 5 hours per week). The common type of exercise that was reported was walking and playing football/netball. These are considered moderate exercise. The proportion of hypertensive patients not meeting the recommended duration of exercise was also high when the category of hypertensive patients was considered (74.3% and 65% in the less than 24 months and more than 24 months categories respectively) (Figure 26).
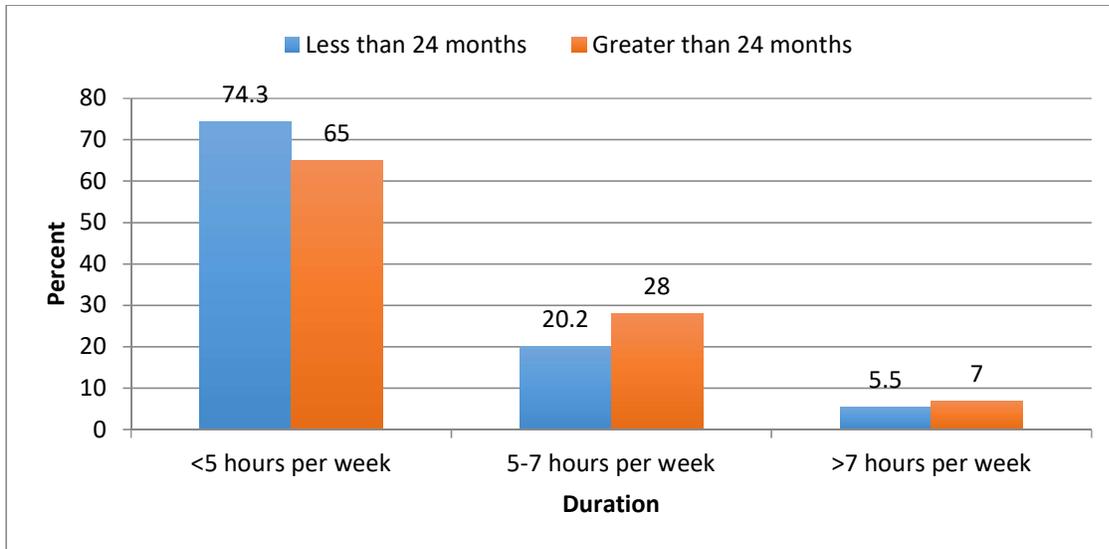
Figure 26: Duration of exercise among hypertensive patients attending hypertensive clinics in Malawi by category of patients.

Alcohol intake and Tobacco Use

Key informants also reported that they advise hypertensive patients against alcohol intake and tobacco use (life style habits). From key informants' results, alcohol consumption among hypertensive patients is completely prohibited (i.e. the advice towards hypertensive patient is no alcohol at all). It is difficult to quantify the quantities of alcohol for each individual hence the no alcohol advice. A similar advice is given regarding tobacco use. Hypertensive patients are advised to completely quit smoking.

Acquisition of Nutrition Knowledge by Nurses and Clinical Officers

Interviews with key informants revealed that the sources of knowledge for dietary management of hypertension was workshops/trainings that some attended a long time ago, school training, reading from books and internet, friends at work and outside their work-place, and in-service training through continuous personal development (CPD). From key informant interviews, workshops/seminars on hypertension are sometimes arranged by government or non-governmental organizations for health workers in hypertensive clinics, but the challenge was that the people who

are sent to these workshops are not the ones that are involved or active in hypertensive clinics. As such, there is no capacity building among health workers in hypertensive clinics. In addition, when people who attend the workshops/seminars come back from such workshops, they do not implement what they learned and nor do they brief (in-house training) those who did not attend. As such, the knowledge gained is kept to themselves.

School training was reported as one of the sources of information related to dietary management of hypertension. Reading from different sources was another source of information. In-service training and CPDs are some of the channels where information on different topics would be disseminated among workmates. Nurses and clinical officers also reported that in most cases there are few nurses and clinical officers allocated to hypertensive clinic as hospital management does not prioritize the clinic.

Nurses and Clinical Officers Self-Assessment of Nutrition Knowledge

Each key informant was asked to rate her/himself in terms of the nutrition knowledge that he/she has regarding dietary management of hypertension. This was based on a scale of 1-5, where 1=Excellent 2=Very good 3=Moderate 4=Poor 5=No knowledge. Base on this scale, 9 out of 20 of the nurses and clinical officers felt that their knowledge was very good. On the other hand, 7 out of 20 nurses and clinical officers felt it was moderate, 3 out of 20 nurses and clinical officers felt it was excellent and 1 out of 20 felt it was poor. There were a number of reasons that key informants reported for their choice on the scale. For those that reported that their knowledge was moderate and poor, some of the reasons were:

- They did not have the specifics for nutrition advice. This relates to nonavailability of dietary guidelines to use in the management of hypertension. As such, they are aware that something could be going wrong somewhere.

- They do not have exact quantities to tell patients since the advice is general and nonspecific.

- New information is appearing every day and they need to continuously keep learning. This includes an explanation that they are still learning from their bosses.

For those that reported that their knowledge was excellent, some of the reasons provided were:

- They get good patient feedback.

- One medical doctor reported that he is a trainer for two regions (in Malawi) on diets for hypertension and diabetes for the World Diabetic Foundation

- Hypertensive patients' blood pressure measurements do respond to the advice given.

- Being able to answer all questions from hypertensive patients.

- Positive feedback from an evaluation exercise that was done in 2013 on the impact of education talk that is given to hypertensive patients.

- Reduction in admission rates to short stays due to high blood pressure among hypertensive patients.

- Positive feedback from other doctors in general wards after seeing reduced cases of uncontrolled high blood pressure.

Source of Information for the Dietary Advice Among Hypertensive Patients

Participants in key informant interviews reported that nurses were the ones that conduct health education talks during hypertensive clinics. In addition, nurses were responsible for managing hypertensive patients and taking measurements such as weight and blood pressure before hypertensive patients went to see the doctor. It is not surprising, therefore, that 74.5% of hypertensive patients reported that the nurse was the source of information for the dietary advice they get. Other sources included clinical officers (probably as patients get their drug prescription),

nutritionist, matron and personal reading (Table 10). Only 0.9% of hypertensive patients reported that they get dietary advice from nutritionist.

Table 10: Sources of information for hypertensive patients attending hypertensive clinics in Malawi.

Source	Frequency	Percent
Nurse	254	74.5
Clinical Officers/Doctors	58	17.0
Nutritionist	3	0.9
Doctor	24	7.0
Matron	1	0.3
Personal Reading	1	0.3

2. Hypertension and Weight Measurements

Key informants also reported they offer hypertension assessment during clinic days. After educational talk, nurses take weight and blood pressure measurements as patients wait on que to be seen by a doctor. Weight and blood pressure were the common measurements that are routinely taken for all hypertensive clinics. Bathroom scales were used to measure weight while blood pressure machine was used for blood pressure. From observations during the study period, the scales used were sometimes faulty and it is doubtful if correct measurements were being taken. In this research we used digital scales to take weight measurements, and noticed that measurements between the two scales were different. It was also noted that in some instances, BP machines had worn out batteries. In one hospital, a set of batteries was being used for three blood pressure machines (had to be used in turns). This was due to long procurement process to procure batteries for the BP machines. Worn out batteries could result into wrong BP measurements, which in turn could result into wrong interpretation of results.

In terms of interpretation of the measurements taken, the current weight was compared to the previous weight of each hypertensive patient. The same applied to BP measurements. Key informants also varied in the way BP measurements are interpreted. Some considered age of the hypertensive patients in their interpretation while others did not. For age dependent interpretation, a hypertensive patient who is more than 45 years old and has a BP reading of more than 150/100 mm Hg is considered to be high. Other key informants reported that any reading (regardless of age) of more than 140/90 mm Hg is considered hypertensive.

From all the clinics (except for Mzuzu Central hospital), body mass index was not used in the assessment of hypertensive patients. This was a disadvantage to the use of weight measurement, as basing on the previous weight measurement does not give the correct advice to the patients. Mzuzu central hospital had developed a BMI chart where they plot weight and heights for individual patients to determine their BMI. The chart is easier and quick to use. If this chart can be adopted by all hypertensive clinics, then it should be easier to assess hypertensive patients using BMI. One of the reasons why BMI was not used was that clinics were not taking heights that can be used to calculate the BMI of patients, some key informants were not familiar with the use of BMI, and some clinics did not have height boards for taking heights. It was also reported that some key informants feel that taking height measurements and calculating BMI is a lot of work since there are few workers and many patients. Because of this, they rush to see all the patients as soon as possible. This could also be an indication of not giving priority to nutrition advice and weight control in the management of hypertension. Key informants (especially of medical background) feel that the important thing in the process of managing hypertension is hypertension drugs. Hypertension drugs are given for free to hypertensive patients.

It was also noted that the assessment of progress was based on comparing the current weight to the previous weight of the patient. Body mass index (BMI) was not used to assess the progress due to lack of height measurements. There is need to encourage all hypertensive clinics to use BMI for assessing patients as this gives a better reflection of the nutritional status of the patient than weight alone. It is also important to have reliable and accurate equipment such as digital scales and blood pressure machines in order to do a proper assessment and accurate interpretation of the results. One of the dangers of using incorrect measurements is that a wrong interpretation can be reached, for example, classifying someone as being hypertensive and prescribing hypertension medication when in fact the person is not hypertensive.

3. Medical Advice

Apart from educational talk and anthropometric assessment, key informants also reported that they offer medical advice. In addition to hypertension drugs, hypertensive patients are given advice related to adherence to drug prescription and proper storage. The dosage for the drugs depends on the type of the drug that the patient is receiving, which depends on the severity of his/her condition. Some drugs have a prescription of once per day and other are for twice per day. Hypertensive patients are further advised to immediately seek medical help for any side effects caused by the drugs. In addition to adherence, they are advised to store the drugs in a cool and dry place.

Adequacy and Usefulness of Advice

Results from hypertensive patients show that the majority of hypertensive patients reported that the advice was adequate and useful, (95.9% and 95.6% respectively). A similar trend was reported in both categories of patients. Patients in the less than 24 months category reported that

the advice was adequate (94.6%) and useful (95.2%), while 97.1% and 95.7% of hypertensive patients reported that the advice was adequate and useful respectively.

There are several reasons that were reported for the adequacy and usefulness of the advice. These included being able to manage and control blood pressure, being able to manage weight, being able to properly select foods to eat based on the condition they have, they are more fit to work and walk independently, being generally healthier than before, and being less worried and stressed. Despite the advice being perceived as adequate and useful, hypertensive patients suggested the following could be included in the advice:

- Specific quantities of the amount foods and nutrients to eat per day should be included in the dietary advice. From the results obtained, it was found that a majority of patients did not have information on the specific quantities of foods and nutrients to eat per day. The advice was too general and not specific such that most patients reported having difficulties in understanding and implementing the advice.

- How they can overcome their food insecurity should be included. Another reason why most hypertensive patients were unable to implement the advice given was that they did not have food or money to buy recommended foods. Hypertension requires modifying eating habits, of which most patient found difficult especially in situations where there is limited food choices. Advice on diversified food production and consumption would help them to easily modify their eating habits while at the same time meeting their daily energy and nutrient requirements.

- Individual counseling should be strongly considered due to individual differences in patients' needs. Patients felt generalized advice sometimes is not applicable to some individuals. Key informants reported that due to large numbers of hypertensive patients

compared to few staff at hypertensive clinic, it was difficult for clinical officers and nurses to conduct one to one sessions (individual counseling).

- There is need to establish exercise centers within the hospital or in communities where patients could go for exercise. Hypertensive patients reported that exercising within communities pose challenges. Most hypertensive patients are not comfortable exercising within communities as individuals due to stigma that they get from community members. Exercise centers would encourage hypertensive patients to exercise as a group as such most hypertensive patients would be motivated to be exercising. In addition to exercise centers, the hospital should have exercise instructors to help with different exercises that are specifically meant for hypertensive patients.

Satisfied that the advice given was adequate and useful, 96.2% of hypertensive patients felt that health workers were knowledgeable of hypertension and the dietary advice given. This judgment was also reported by patients in the less than 24 months category (95.9%) and more than 24 months category (96.5%). The perception might not be a true reflection of health workers' knowledge because patients do not have a standard on which to base their judgement of health workers' knowledge. Their judgment is based on the information that nurses and clinical officers give hypertensive patients. Results from key informants suggest that nurses and clinical officers have 60% of the knowledge they need to effectively manage hypertension.

Following Advice

Overall, 90.6% of hypertensive patients reported that they do follow the advice given. In terms of category, 89.9% of hypertensive patients in the less than 24 months category and 91.2% of hypertensive patients in the more than 24 months category said that they follow the advice.

For those that reported not following the dietary advice, there were a number of reasons that were reported. The reasons reported were similar to challenges that patients faced when implementing the advice given. These are summarized in Table 11.

Table 11: Challenges faced by hypertensive patients attending hypertensive clinics in Malawi when implementing the advice given at hypertensive clinic.

Challenge	Suggested solution
Difficult to change eating habits especially at old age as they are used to eating the foods they are told to avoid	There is need for continued education talk so that patients fully accept to change their eating habits for their own benefit
Difficult to follow the advice as it is too general	There is need to have specific dietary guidelines that should be distributed to both patients and health workers for use.
Lack of resources to implement all the advice given, e.g. money is inadequate to buy recommended foods such as fruits	Establish small scale business for patients to support their needs e.g. transport to the hospital, purchasing recommended foods, purchasing drugs etc.
	Need support to have integrated homestead farming thus backyard gardens and small livestock to increase food available and promote of exercise from working in the garden
Difficult to implement advice given at hypertensive clinic due to lack of support from other household and community members.	There is need for sensitization and awareness campaigns to other family and community members to support hypertensive patients when implementing the advice given at hypertensive clinic

Table 11 (continued).

Stigma from community members especially when hypertensive patients are exercising within the community.	There is need to sensitize family and community members to support the hypertensive patients and recognize the value of exercise Create play/exercise centers in the hospitals or communities where hypertensive patients can be working out as a team because working out alone in communities is accompanied by negative stigma
Long distance to the hospital	Need to open satellite depots/support groups in communities for easy access to services by hypertensive patients
Shortage of drugs in hospitals, so sometimes patients are told to buy drugs on their own from other pharmacies	There is need to lobby for more resources from government and other donors so that hypertensive clinics are adequately stocked with drugs
Lack of equipment for exercise	Create play/exercise centers in the hospitals or communities where hypertensive patients can be working out as a team

Common Causes of Hypertension and the Most Affected Sex as Reported by KIs

From key informant interviews, it was reported that the common cause of hypertension among hypertensive patients who come for hypertensive clinic could be age. As presented in Chapter 4, the mean age of hypertensive patients was 58 years with a minimum age of 18 years and a maximum age of 87 years. Key informants reported that most hypertensive patients that come for hypertensive clinic are above 55 years, an age beyond which physiologically there is an increased risk of developing NCDs. Apart from age, key informants also reported stress, worries,

physical inactivity, HIV, diabetes, overweight, genetics and poor eating habits among hypertensive patients as other contributing factors.

Challenges and Recommendations from Key Informants

- Key informants reported a number of challenges in the course of executing their duties towards hypertensive patients. These include:

- Shortage of staff was one of the challenges that key informants reported. In most cases, hypertensive clinics were understaffed, so it was difficult to conduct one-to-one counseling. It was also reported that hospital management does not prioritize hypertensive clinic, hence they do not allocate more staff to the clinic. Similar sentiments were raised for other staff members who are not committed and interested to work in the hypertensive clinic.

- Lack of dietary guidelines for management of hypertension. Most of the information that was used in hypertensive clinics was for diabetes. Lack of dietary guidelines result in giving general and unspecific advice to hypertensive patients regarding quantities of foods to be consumed.

- Shortage of hypertensive drugs. Key informants also reported that in some cases hospitals run out of stock for hypertensive patients so patients are told to go and buy on their own. Patients who cannot manage to buy drugs stop taking the drugs. This worsens the situation for most hypertensive patients.

- Shortage of measuring equipment and accessories was also another challenge that was reported. In one hospital, they had one BP machine that was used for all the wards. This meant using the machine in turns. In yet another hospital, there was one set of batteries for BP machines that was being used in three BP machines. One of the reasons for not having

batteries was that there is bureaucracy in procurement process hence nurses and clinical officers just give up.

- Overcrowding of patients was also reported as a challenge that is faced in these hypertensive clinics. In all hospitals visited, there were over 100 hypertensive patients and yet there was little space to accommodate them.

- Key informants also reported that some patients do not take seriously appointments for the next visit to hypertensive clinic. This means that hypertensive patients just come any clinic day. Because they travel long distances and because of challenges with transport, they are assisted on the day they come even if they do not have an appointment.

- In addition to hospitals not having enough space for hypertensive patients, it did not also have enough consultation rooms to use during hypertensive clinics. In one hospital visited, three clinical officers were using one room. There was no privacy among patients since three patients would be in the same room. This results into hypertensive patients not being open enough to tell their problems/conditions due to presence of other patients in the room.

- Inadequate hypertension teaching and management materials. Instead, diabetic materials are used.

- Long waiting time for hypertensive patients. Despite patients coming to the clinic as early as 5 AM, doctors and clinical officers start attending to them around 9 or 10 AM. Prior to this starting time, doctors and clinical officers will be attending CPD and ward rounds.

DISCUSSION

Hypertension management in hospitals was mainly done by nurses and clinical officers. Lupafya et al. in 2016, reported that nurses and clinical officers were the health workers most involved in the provision of NCD services in hospitals. On the other hand, nutritionists and other professionals were less involved. Nutritionist positions in hospitals have just been introduced by the government of Malawi to ensure that trained and qualified nutritionists are placed in all hospitals to provide nutrition services to patients. In addition to nutritionists, the government of Malawi through Lilongwe University of Agriculture and Natural Resources has introduced a dietetics program to train dietitians who will also help in management of NCDs alongside other professionals. This has been necessitated by an increase in NCDs (and the already existing high rates of malnutrition) so that as patients come to seek medical help, they could also be assisted with dietary advice and other nutritional services.

Variation of the quantities mentioned by hypertensive patients is an indication that the figures are just guesses. This raises the question of implementation of the advice given if patients do not know and understand what the advice is all about. According to the measurements that were done prior to the study, one teaspoon was equal to 8 g of sodium chloride. The recommended salt intake for hypertensive patients is less than 4 g of sodium chloride per day. This means that though a proportion of hypertensive patients mention the actual quantity, the quantities were incorrect, as there were no quantities of foods given for patients to consume.

Fat is one of the nutrients that was found to be of most concern among hypertensive patients (as reported earlier). This could be attributed to the fact that hypertensive patients are more aware of the contribution of fat towards development of hypertension; hence they are more likely to avoid fats than other nutrients.

Though hypertensive patients reported one teaspoon of sugar per cup as the advice that they are given at hypertensive clinic, this could be a guessed quantity by hypertensive patients, as sugar intake recommendation is based on daily energy intake of an individual. Basing on daily energy intake of 2100 kcal/d for a healthy adult, the amount of energy that is supposed to come from sugar is less than 210 kcal/d. This translates to less than 52 g/d of sugar. Based on the measurements that were done prior to the study, one teaspoon was equal to 8 g, which means the advice from hypertensive clinic could have been to consume less than six teaspoons of sugar/d. However, it should be noted that there could be significant underreporting of sugar consumption among hypertensive patients since they mostly consider sugar added to tea and not total sugar intake from other sources. Johnson in 2000 reported that underreporting is a common problem with dietary surveys (self-reported data) (Johnson, 2005), as such foods high in added sugars may be selectively underreported (Krebs-Smith et al., 2000). Stubbs and Lee, in 2004 also reported that people tend to underreport their energy and that people with higher BMI have a greater degree of underreporting than lean people.

In terms of exercise, WHO recommends 60 minutes a day of moderate-intensity activity for all health benefits unlike the 30-minute recommendation of moderate activity, which is appropriate for cardiovascular/metabolic health (FAO/WHO, 2003). It is therefore recommended that both prehypertensive and hypertensive people should be physically active and maintain a healthy body weight (a BMI of between 18.5 to 24.99 kg/m^2). This recommendation is appropriate especially in cases where there is need to manage obesity. It is recommended that for most hypertensive patients, it is better to start with moderate intensity exercise training and then gradually increase in intensity (Hagberg et al., 1987).

Vigorous exercise increases plasma HDL and apolipoprotein A-I and decreases plasma triacylglycerol, very low-density lipoprotein (VLDL), and atherogenic small, dense LDL concentrations (Williams et al., 1986, 1990, 1992). Physical exercise also helps to prevent weight gain or reduce body weight especially among obese people. According to Paffenbarger et al., (1991), it was reported that collegiate sports play was found to have no effect on hypertension incidence, and this further applied to contemporary walking, stair climbing, or light sports play. This means that patients need to be engaged in vigorous sports as part of their program in order to improve their health and management of hypertension.

Based on the results obtained in this research, though patients reported that they are exercising, the type of exercise and duration are not appropriate to achieve the benefits of exercise in managing hypertension. There is need to design appropriate exercise programs that can significantly contribute to management of hypertension and to encourage those that are not exercising to start doing so.

Several studies have reported a relationship between alcohol consumption and hypertension (Klatsky, 1996). Results from clinical experiments showed that blood pressure falls when one stops drinking and that it rises again within days after resuming drinking. Excessive alcohol consumption is an important and insufficiently recognized cause of hypertension (Saunders et al., 1981). Several epidemiological studies have also shown that alcohol consumption is associated with the development of 5-30% of hypertension cases in the general population. Alcohol consumption among older population may, therefore, increase the odds of developing hypertension (Nakanishi et al., 2002; Ohmori et al., 2002; Thadhani et al., 2002 and Nakamura et al., 2007).

Tobacco use has also been found to increase the risk of developing hypertension hence the need to stop smoking. Paffenbarger et al., in 1991 reported that smoking and hypertension were the highest risk factors for mortality within an individual. The study found that smoking and lack of vigorous recreational exercise were the most hazardous risk factor the development of hypertension. As such, there is need to ensure that hypertensive patients stop smoking all together and increase exercise.

In terms of sources of knowledge of dietary management of hypertension, nurses and clinical officers reported to have learned the information at school. However, most medical curricula have no or little information related to dietary management of hypertension. This is in line with what Lupafya et al. found in 2016 that trainings for nurses and clinical officers are pre-service and in-service trainings (Lupafya et al., 2016). In addition, inadequate technical capacity for management of hypertension was one of the challenges that was reported by health professionals. Because of this, there is need to update curricula in all medical schools so that issues related to NCDs are well covered. This will enhance the skills and knowledge that will be required in the management of NCDs in hospitals. Reading from different sources was also one of the sources of knowledge among nurses and clinical officers. However, in Malawian context, reading poses several challenges as a source of information due to limited access to updated information, as most books are outdated. In addition, internet access for most nurses and clinical officers is a problem due to poor internet connection and inadequate computers.

From the results obtained, it was reported that there was little collaboration among different professionals, such as medical doctors/clinical officers, nurses, and nutritionists within the hospital. Similar findings were also reported by Lupafya et al. in 2016 where only one third of health education officers and nutritionists were found to be routinely involved in services related

to NCD management while 57% were only sometimes involved. In addition, 10% of health education officers and nutritionists were never involved in the management of NCDs (Lupafya et al., 2016). It is noted that medical professionals do not accommodate other professionals within hospital settings. The hospital is usually taken as a treatment facility though other services such as nutrition and nutrition counseling could be done. It is important that all professionals should work as a team in providing services to hypertensive patients to maximize the skills and knowledge of each profession. For example, a medical doctor could deliberately refer hypertensive patients to a nutritionist to get specialized advice or a nurse and a nutritionist could work together in providing health talks to hypertensive patients.

Regardless of the advice that nurses and clinical officers give to hypertensive patients, patients report that they follow the advice. Nurses and clinical officers could, therefore, be a better channel to disseminate nutrition advice to hypertensive patients because of the trust that these hypertensive patients have in nurses and clinical officers. What is needed is to come up with appropriate dietary guidelines that could be used in the management of hypertension.

CONCLUSIONS FROM STUDY 3

The services offered at hypertensive clinic include health education talks (which covers nutrition, exercise, alcohol use, and smoking advice), blood pressure assessment, weight measurements, medical review, and prescription. The type of nutrition advice that is given includes reduce salt, sugar, fat and *nsima* intakes, increase consumption of fruits and vegetables, and eat grilled or roasted meat. There are no specific dietary guidelines used during the education talk.

A majority of hypertensive patients did not know the exact interpretation (no exact quantities were reported) of the nutrition advice that is given. Even for those that reported a quantity, the quantities were incorrect, as they did not match the recommendations. On the other hand, the advice on alcohol and smoking was no alcohol and no smoking. The sources of knowledge among nurses and clinical officers was workshops/trainings, school training, reading from books and internet, friends, and in service training. A majority of nurses and clinical officers felt that their knowledge on dietary management of hypertension was very good.

A majority of hypertensive patients were satisfied with the advice given, as the advice was adequate and useful. However, hypertensive patients need specific quantities of the amount of foods and nutrients to eat per day to be part of the advice, individual counseling to be done, and exercise centers within the hospital or in communities to be established. Some of the challenges that hypertensive patients face in implementing the advice given at hypertensive clinic include difficulty to change eating habits, especially at old age, lack of resources to implement all the advice given, lack of support from other household and community members, lack of equipment for exercise, shortage of drugs in hospitals, long distance to the hospital, and stigma from community members.

Challenges that nurses and clinical officers face in the course of their duty include shortage of staff at hypertensive clinics, lack of dietary guidelines for management of hypertension, shortage of hypertensive drugs, shortage of blood pressure measuring machines and batteries, overcrowding of patients at hypertensive clinics, inadequate infrastructure, and long waiting time for hypertensive patients.

RECOMMENDATIONS FROM STUDY 3

1. Hypertensive clinics should conduct individual counseling in addition to group counseling as NCDs affect individuals differently.

2. There is need to foster a spirit of team work among nurses, medical doctors, nutritionists, clinical officers and other professionals to effectively assist patients with different needs.

3. There is need to update curricula in all medical schools so that issues related to NCDs are well covered and taught to students. This will boost knowledge and skills in the management of different NCDs in hospitals.

4. Hypertensive clinics should use body mass index for assessing patients as this gives a better reflection of the nutritional status of the patient than weight alone. There is need for hypertensive clinics to lobby to hospital management to procure reliable and accurate equipment such as digital scales and blood pressure machines and adequate batteries for accurate assessment and interpretation of results.

5. Hospitals should establish play/exercise centers in hospitals or communities to boost exercise among hypertensive patients. Play centers should further have play center instructors to guide in the type and duration of exercise as desired for different individuals with different needs.

6. Hospitals should decentralize NCD clinics to health centers or form support groups within the hospitals' catchment area where hypertension services could be carried out. This will reduce the overcrowding of hypertensive patients at the central hospital. In addition, hypertensive clinics could split clinic days into two per week to have fewer patients in a day.

7. There is need for more nutritionists/dietitians in all hospitals to ease the pressure that hypertensive clinic staff is facing. This can also assist in one to one counseling that is very important for patients suffering from NDCs.

8. Sensitize family members and community members to support hypertensive patients in implementing the advice given at hypertensive clinic.

9. There is need for capacity building through short courses and on job training for nurses and clinical officers in the management of hypertension.

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APPENDICES

Appendix A:

Pre-screening tool for hypertensive patients attending hypertensive clinics in Malawi.

	IF		IF	
How old are you?	<18 YEARS	DON'T QUALIFY	>18 YEARS	QUALIFY
Are you pregnant (FOR FEMALES ONLY)?	PREGNANT	DON'T QUALIFY	NOT PREGNANT	QUALIFY
			How long have you been on hypertensive clinic?	CATEGORIZE BASED ON LESS THAN 24 MONTHS AND MORE THAN 24 MONTHS

Informed consent for hypertensive patients

North Carolina State University

INFORMED CONSENT FORM for RESEARCH

Dietary practices of hypertensive patients attending hypertensive clinics in Malawi

Edwin Siyame   USAID (BHEARD Program)

My name is_____. My colleagues and I are doing a research on dietary practices of hypertensive patients attending hypertensive clinics in Malawi. You are being asked to take part in a research study. This research is helpful in that it will help us to understand the dietary practices of hypertensive patients. In addition, it will also help us to understand the effectiveness of services being provided at hypertensive clinic. The information you provide will help us to come up with dietary guidelines to manage and treat hypertension. Your participation in this study is voluntary. You have the right to be a part of this study, to choose not to participate or to stop participating at any time without penalty. You are not guaranteed any direct personal benefits for participating in this study.

If you agree to participate in this study, you will be asked to answer questions we have related to the services you receive here at hypertensive clinic, and your diet. We will also take your blood pressure, and measure your height, weight, and mid upper arm circumference.

The information you provide in this study will be kept confidential to the full extent allowed by law. No names will be recorded in this study so that no one can match your identity to the answers that you provide. For participating in this study you will receive $3 US (about

MK1500).   If you withdraw from the study prior to its completion, you will not receive any

compensation. If you have questions at any time about this research, you may contact:

National Health Sciences Research Committee

Ministry of Health, P.O. Box 30377

Lilongwe 3, Malawi. Tel: +265 1 726 422/418, Email: mohdoccentre@gmail.com

If you have understood this research and agree to participate, please tell me so.

Researcher signature indicating verbal consent was obtained: _____ Date:_____

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Appendix C:

Informed consent for nurses and clinical officers

North Carolina State University

INFORMED CONSENT FORM for RESEARCH

Dietary practices of hypertensive patients attending hypertensive clinics in Malawi

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Edwin Siyame   USAID (BHEARD Program)

_____

My name is _____. My colleagues and I are doing a research on dietary practices of hypertensive patients attending hypertensive clinics in Malawi. You are being asked to take part in this research. This research is helpful in that it will help us to understand the dietary practices of hypertensive patients. In addition, it will also help us to understand the effectiveness of services being provided at hypertensive clinic. The information you provide will help us to come up with dietary guidelines to manage and treat hypertension. Your participation in this study is voluntary. You have the right to be a part of this study, to choose not to participate or to stop participating at any time without penalty. You are not guaranteed any direct personal benefits for participating in this study.

If you agree to participate in this study, you will be asked to answer questions we have related to the services you provide here at hypertensive clinic.

The information you provide in this study will be kept confidential to the full extent allowed by law. No names will be recorded in this study so that no one can match your identity to the answers that you provide. For participating in this study you will receive $6 US (about MK3000). If you withdraw from the study prior to its completion, you will not receive any compensation. If you have questions at any time about this research, you may contact:

National Health Sciences Research Committee

Ministry of Health

P.O. Box 30377

Lilongwe 3, Malawi. Tel: +265 1 726 422/418.

Email: mohdoccentre@gmail.com

If you have understood this research and agree to participate, please tell me so.

Researcher signature indicating verbal consent was obtained: _____

Date:_____

Appendix D:

Script for nurse/clinical officer to introduce the research to hypertensive patients

Good morning/afternoon. I would like to inform you that today, our colleagues who are conducting a study on dietary practices of hypertensive patients **that** are attending hypertensive clinic. They are here to ask you some questions related to hypertension and the services you receive from this hypertensive clinic. You are free to choose whether you want participate in their study or not. If you choose to participate in their study OR if you choose not to participate in their study, that will not affect you in any way regarding the services you get from this clinic. We will not know if you participate or not.

We think this research is important. The information you provide the researchers will help us to improve delivery of health information and management and treatment of hypertension. The research also has the potential to help improve the care of other people suffering from hypertension across Malawi.

So feel free to participate or not. They will give you more information as you interact with them.

Appendix E:

Script for nurse/clinical officer in-charge to introduce the research to nurses and clinical officers

Good morning/afternoon. I would like to inform you that today we are privileged to have our colleagues who are conducting a study on dietary practices of hypertensive patients attending hypertensive clinics. They are here to ask you some questions related to the services we provide at this clinic. Feel free to participate in their study and be assured that it is your right to choose to participate or not. If you choose not to participate in their study, that will not affect your relationship with your employer or colleagues at this clinic. We will not know if you participate or not.

We believe that the research is very important in that the information you provide will help us on how to improve delivery of health information, and management and treatment of hypertension. The research also has the potential to reach out to other people suffering from hypertension across Malawi.

So feel free to participate. They will give you more information as you interact with them.

Appendix F:

Questionnaire for dietary practices of hypertensive patients attending hypertensive clinics

in Malawi.

	A. DEMOGRAPHIC **CHARACTERISTICS** OF THE RESPONDENT
A1	Day/Month/Year of Interview /____ /____ / 2016 A2. Hospital Name………
A3	SERIAL NUMBER………….. A4. Sex [___] 1=M 2=F A5. Age [___]yrs
A6	Location of residence………Name of interviewer_____

A7	Marital Status of respondent [___]
	
	      Currently Married – monogamous……….1
	
	      Currently Married – polygamous………...2
	
	      Widowed……………………….……………3
	
	      Divorced…………………………….. ……..4
	
	      Single………………………………………..5
	
	      Separated……………………………..……6
	
	      Others (Specify)…………………………….7

A8	Education level of respondent [___]
	
	      Adult literacy…………1 Tertiary………………..4
	
	      Primary …………………2 University …….………5
	
	      Secondary………………3 Don't know...………….6
	
	      Other (Specify)_____7

A9	Main occupation of respondent [___]
	
	      Farmer……………………1
	
	      Employed………………..2
	
	      Business…………………..3
	
	      None…………………………4
	
	      Others (Specify)…………………………5

B. HYPERTENSION	
B1	How long have you been on **hypertensive** clinic? [____] years/months (Circle appropriate unit)

B2	How were you as being hypertensive? [____]
	
	        1=Ward referral
	
	        2=Self-referral
	
	        3=Other health facility referral
	
	        4=Other means (specify)…………………………..

B3	Did you ever feel/think you had hypertension before your diagnosis? [____] 1=Yes 2=No

B4	If yes, what signs/symptoms made you suspect that you had hypertension [____][____][____] [____] (May mention diabetes signs as HTN does not have specific symptoms)
	
	        1=Excessive thirsty
	
	        2=Frequent urination
	
	        3=Blurred vision
	
	        4=Tiredness
	
	        5=Dizziness
	
	        6=Others
	(Specify)………………………………………………………

B5	How/where did you learn about these signs [____] (Choose one main source)
	
	        1=From Health workers (Hospital)
	
	        2= Radio/TV
	
	        3=Reading books/magazines/leaflets
	
	        4=Friends/Relatives
	
	        5=Others (Specify)……………………..

B6	Do you have any family member with **hypertension?** [____] 1=Yes 2=No

B7	What do you think are the causes of **hypertension**? [____]/[____]/[____]/[____]
	
	        1=Food (Salt, Sugar, Fats etc)
	
	        2=Inactivity
	
	        3=Other NCDs (Diabetes, obesity etc)

	4=Bewitched
	5=Don't know
	6=Others (Specify)…………………………………
B8	How did you know about these causes (Source of information)? [___]
	1=From Health workers (Hospital)
	2= Radio
	3=Reading books/magazines/leaflets
	4=Friends/Relatives
	5=Others (Specify)……………………..

C. NUTRITION ADVICE	
C1	How often do you come to hypertensive clinic? [_____]
C2	What services do you get when you come to the hypertensive clinic?
	1=Education talk
	2=Nutrition advice
	3=Medical advice
	4=Hypertensive assessment
	5=Others (Specify)_____
C3	If you do get nutritional advice, specify the kind of advice that you are given?
	1=Reduce salt intake
	2=Reduce fat intake
	3=Reduce consumption of refined products
	4=Increase consumption of fruit and vegetable
	5=Increase consumption of legumes
	6=Reduce consumption of fatty meats
	7=Others (Specify)…………………………………….
C4	**How do you interpret/understand the advice given? (SHOULD BE SPECIFIC ON AMOUNT/QUANTITIES OF THE ADVICE GIVEN ABOVE) THIS SHOULD BE EXACTLY AS THEY ARE TOLD AT HYPERTENSIVE CLINIC…NOT WHAT THEY SPECULATE.**
	1=Reduce salt intake
	2=Reduce fat intake

	3=Reduce consumption of refined products
	4=Increase consumption of fruit and vegetable
	5=Increase consumption of legumes
	6=Reduce consumption of fatty meats
C5	Are you given any advice related to physical activity? [_____] 1=Yes 2=No
C6	If yes, what kind of advice? (BE SPECIFIC)_____
C7	Who gives you most of the advice? [_____] 1=Nurse 2=Clinical Officer 3=Others (Specify)…………….
C8	Do you find the advice adequate?
C9	Is it effective? [_____] 1=Yes 2=No
C10	Explain…………………………………………………….
C11	Do you find anything missing from the advice you get from the clinic? [_____] 1=Yes 2=No
C12	If yes, Explain?..
C13	Do you think the health worker is well knowledgeable about hypertension and diet? [__]1=Yes 2=No
C14	Do you adhere to the nutritional advice given? [_____] 1=Yes 2=No
C15	If no, explain……………………………………………
C16	Do you face any challenges in implementing the nutritional advice given at the clinic? [_____] 1=Yes 2=No
C17	If yes, mention them 1=Lack of support by family members 2=Lack of money to buy food that is recommended 3=Stigma from other community members 4=Others (Specify)…………………………………..
C18	How can the challenges mentioned above be solved? (Specify for each problem mentioned)...
D. MEDICAL ADVICE (only if indicated that they receive medical advice)	
D1	What kind of medical advice do you get from the clinic about your hypertension?....................

D2	Who gives you this advice? [_____] 1=Nurse 2=Clinical Officer 3=Others (Specify)……………
D3	Does the advice given help you? [_____] 1=Yes 2=No
D4	Explain…………………………………………….
D5	Is the advice adequate? [_____] 1=Yes 2=No
D6	Explain……………………………………………………………..
D7	What else would you wish to be included in medical advice?
D8	Do you face any challenges in implementing the advice given at the clinic? [_____] 1=Yes 2=No
D9	If yes, mention them 1=Lack of support by family members 2=Lack of money to buy food that is recommended to take alongside the drugs 3=Stigma from other community members 4=Nurses/Clinical officers don't pay attention to us 4=Others (Specify)………………………………..
E. OTHER NON COMMUNICABLE DISEASES	
E1	Apart from hypertension, have you been diagnosed with any other NCDs ? [_____] 1=Yes 2=No
E2	If yes, mention? 1=Diabetes 2=Stroke 3=Others (Specify)…………………………………..
E3	When were you diagnosed with the condition mentioned above? [_____]
E4	Are you satisfied with the overall services you get at this clinic? [_____] 1=Yes 2=No

F. ANTHROPOMETRY		
Weight (Kg) [____.____]	Height (cm) [____.____]	MUAC (cm) [_____.____]
BP (mm Hg) 1 [____/_____] BP 2 [____/____] BP3 [_____/____] Average [_____/____]		

THANK THE RESPONDENT FOR PARTICIPATING IN THIS STUDY!!

Appendix G:

24-hour dietary recall questionnaire for dietary practices of hypertensive patients

attending hypertensive clinics in Malawi.

Date of Interview   /___ /___ / 2016   Serial number ….. Sex [___]   1=M 2=F

Age [___]yrs

Hospital Name ……… Location of residence ……….Day of the week_____

Follow these steps:

1) Quick list 2) Forgotten foods 3) Time and occasion 4) Detail cycle 5) Final Probe

Would you tell me any food or drink that you ate or drunk in the past 24 hours?

Food/Drink (Quickly list all foods)	Time and occasion	Amount	Compared to usual intake 1=much more than usual 2=usual 3=much less than usual	Details (Method of preparation- baked, fried, boiled, canned etc. and brand names)	Added salt 1=during preparation 2=At table

Does this day represent your typical eating habit? [_____] 1=Yes   2=No

If no, explain_____

Are you currently on a diet to lose weight or some other health-related reason? [_____]

1=Yes 2=No

Appendix H:

Food frequency questionnaire for dietary practices of hypertensive patients attending

hypertensive clinics in Malawi.

How often do you eat the following foods in a year?

	FOOD GROUP	FREQUENCY 1=Never or Less than once per month 2=1-3 times per month 3=Once per week 4=2-4 times per week 5=5-6 times per week 6=Once per day 7=2-3 times day 8=4-5 times per day 9=6 or more times per day
1	**Cereals and grain:** Rice, pasta, bread / cake and / or donuts, sorghum, millet, maize, etc.	|___|
2	**Roots and tubers:** potato, yam, cassava, sweet potato, and / or other tubers	|___|
3	**Legumes / nuts :** beans, cowpeas, peanuts, lentils, groundnuts, soya, pigeon pea and / or other nuts	|___|
4	**Vegetables**	|___|
5	**Fruits**	|___|
6	**Meat**	|___|
7	**Fish**	
8	**Eggs**	
9	**Oil / fat / butter**	|___|
10	**Sugar, or sweet**	|___|
11	**Spices** (Curry, ginger, Royco, garlic)	|___|
12	**Salt**	
13	**Tobacco use**	|___|

14	Alcoholic beverage	

15. Did your diet change after being diagnosed with hypertension? **(Comparing before diagnosis and after diagnosis**) [_____] 1=Yes   2=No

16. Explain if no change or change

17. Has your diet changed since you started attending hypertensive clinic? (Comparing all the time he/she has been on hypertensive clinic) [_____] 1=Yes   2=No

18. Explain if no change or change

19. Do you do exercise?[_____] 1=Yes   2=No

20. What type of exercise do you do?

21. How often per week (Minutes/day and number of days per week)?

Appendix I:

Interview guide for nurses and clinical officers

1	Day/Month/Year of Interview /____ /____ / 2016 2. Hospital Name………
3	SERIAL NUMBER…………………….. 4. Sex…… 5. Age………..
6	Profession [_____] 1=Nurse 2=Clinical Officer
7	Qualification _____
8	Years of Experience [_____] Years
9	For how long have you been involved in hypertensive clinic? [_____]
10	How do you identify hypertensive patients?
11	What kind of services do you offer to hypertensive patients?

12. What parameters/measurements do you take when hypertensive patients come?

	Parameter	Equipment used	Interpretation

13. Do you give any nutrition advice? (If Yes, fill the table below)

	Advice	Food/Drink/general	Explanation

14. If no, why?

15	Do you have any nutrition guidelines that you use in this clinic when advising hypertensive patients?
16	How did you acquire the nutrition advice you give?
17	On a scale of 1-5, how would you rate your knowledge on nutrition when advising hypertensive patients? 1=Excellent 2=Very good 3=Moderate 4=Poor 5=No knowledge
18	Explain your choice above?
19	What are the common causes of hypertension among your patients?
20	Do you give different nutrition advice for different causes?
21	How common is it for one patient to have multiple NCDs?
22	Which sexes are most affected? Why?
23	Do you give different nutrition advice to different sexes or ages?
24	Which areas (urban or rural) are most affected (where most hypertensive patients come from)?
25	What do you think are the contributing factors for the differences in prevalence?
26	What challenges do you face in dealing with hypertension patients?
27	What recommendations would you make to address the challenges above?