Body Mass Index, Waist to Hip Ratio and the Prevalence of Hypertension Among University Lecturers in Tanzania.

A case study of University of Dar Es Salaam

JOHN, Chalukulu Bilinzozi

NORGES IDRETTSHØGSKOLE

Supervisor: Professor Lars Bo Andersen

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Department of Sport Medicine
THE NORWEGIAN SCHOOL OF SPORT SCIENCES AND PHYSICAL EDUCATION (NUSPE)

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Abstract

Background: Hypertension caused by overweight is now becoming a major public health problem in Tanzania as interventions occur mainly at the secondary and tertiary levels rather than at the primary prevention level. This study aimed at examining the relationship between different anthropometric indicators and the prevalence of hypertension in university lecturers in Tanzania.

Method: A cross-sectional study of 95 male adult lecturers randomly sampled from the University of Dar Es Salaam, Tanzania, were undertaken to study their body mass index (BMI), waist to hip ratio (WHR) and the prevalence of hypertension. A questionnaire concerning demographic characteristics, medical histories, and social lifestyles associated with hypertension was filled in by a face to face interview. Anthropometric measurements were taken after the interview. Cross-tabulations, correlation and linear regression analysis were used to assess the relationships of BMI and WHR on the variance of systolic blood pressure (SBP) and diastolic blood pressure (DBP). Subjects were considered to be hypertensives if they demonstrated a SBP at or above 140mmHg and DBP at or above 90mmHg or self reported use of antihypertensive drugs. The Permission to conduct the study was sought and received from the Research and Publications Unit, University of Dar Es Salaam.

Results: The mean age, BMI and WHR of the subjects were 40.3 years (S.D. 9.7), 26.3kgm^{-2} (S.D. 3.46), and 0.9 (S.D. 0.066) and mean SBP and DBP were 130.1 (S.D.18.03) and 79.5 (12.9) respectively. Age controlled multiple regression analyses demonstrated that BMI did not have a significant effect on any BP variable. However, WHR showed a significant relationship with SBP (r =0.52), and DBP (r = 044) $p<0.0001$. Subjects above WHR cut off point had 13.2mmHg ($p<0.01$) higher SBP and 6.3mmHg ($p<0.05$) higher DBP compared to those below cut off point. The overall prevalence rate of hypertension was 25.5%. Results of the partial correlation coefficient controlled for age, indicated a significant positive correlation between SBP and DBP ($r=0.74$, $p<0.0001$). When all confounding factors were considered, age remained to be strong and non modifiable factor ($p<0.05$, β =0.352) of BP. Participation in physical activity was associated with lower SBP by an average of 1.79 ($p=0.05$, β= - 0.02) and WHR.

Conclusion: Both BMI and WHR are modifiable, but WHR was strongly associated with BP. Subjects with high central adiposity distribution are potential candidates of increased risk of hypertension and therefore, preventing or controlling an increase in WHR may have definite health benefits in the body particularly with advancing age. Changes in lifestyle especially participation in physical activity is of paramount importance in maintenance of the acceptable WHR.

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List of Acronyms

BP	Blood Pressure
SBP	Systolic Blood Pressure
DBP	Diastolic Blood Pressure
BMI	Body Mass Index
WHR	Waist to HipRatio
UDSM	University of Dar Es Salaam
NHANES	The Third National Health and Nutrition Examination Survey
AMMP	Adult Morbidity and Mortality Project
CVD	Cardiovascular Diseases
WHO	World Health Organization
HKMU	Hubert Kairuki Memorial University
IMTU	International Medical and Technological University
BHS	British Hypertension Society
YLL	Years of Life Lost
DALYs	Disability Adjusted Life Years

Chapter 1

INTRODUCTION

1.1 Background to the study

This introductory chapter discusses background to the study, short history and location of the University of Dar Es Salaam, problem formulation, purpose, objectives, research questions, hypothesis and significance of the study, and briefly defines key concepts.

1.1.1 Tanzania today

Due to the on-going globalization process, so many changes have occurred in Tanzania. The most notable changes are in education, food production, alcohol, smoking, drug abuse, urbanization, industrialization, reduced physical activity and body energy expenditure.(1) Health indicators show that the country is experiencing heavy burden of both communicable and non-communicable diseases, including hypertension.(2) Before the 1960s, Tanzanians used to consume organic food - unprocessed food from milling machines or factories.(1) Today, people have changed their traditional food habits and dietary patterns.(3) Urbanization has made them walk less, consume popular cheap snacks, sugary drinks and salted nuts.(4) They are now moving from a rural to an urban lifestyle, bringing with it "advances or diseases of civilization" such as increased hypertension.(5, 6)

1.1.2 University of Dar Es Salaam

Dar Es Salaam *("Haven of peace")* formerly known as Mzizima *("healthy city")* is the largest city in Tanzania, located on a bay of the Indian Ocean. The city has a population estimated at around 3millions, and is the country's richest city and an important economic centre (Dodoma is the political capital). It is the educational centre of the country and home to various higher learning institutions such as the University of Dar Es Salaam (First University to be established in Tanzania), the Open University of Tanzania, the Hubert Kairuki Memorial University (HKMU) as well as the International Medical and Technological University (IMTU) among others.

Dar Es Salaam University comprises of four campuses namely; Mlimani, Mkwawa University College of Education, Dar Es Salaam University College of Education and Institute of Journalism. University of Dar Es Salaam was first established in 1961 as a College of the University of London and was made a Constituent College of the University of East Africa in 1963. In August 1970, it became a national University, The University of Dar Es Salaam. Like other universities all over the world, it was meant to be an institution where people are trained at the highest level for clear and independent thinking, analysis and problem solving.(7)

The presence of the university in the city of Dar Es Salaam subjects lecturers to effects of urbanization,(8) which put them at risk of developing hypertension. For example, 58% of the staffs of a large organization located in Dar Es Salaam were reported to be overweight and had almost no idea of their own body weight.(1) Could it be the same for University of Dar Es salaam lecturers? We do not know.

A lecturer's duties can usually be grouped into four categories: teaching, research, administration and character building/personal development of students.(9) In addition, from my personal experience, Tanzanian lecturers spend most of their time either in the library reading, preparing teaching materials, writing papers, in the laboratory conducting experiments or doing research as well as participating in several funded projects. As members of the society lecturers also participate in the cultural demands of the society such as burial rites, ceremonies, planning weddings, family and social group meetings that are mandatory for societal acceptance. All these tasks place additional demands on lecturers' personal time aside from their professional/occupational responsibilities. The nature of their work and tight schedules limit them from participating in regular physical activities making them prone to hypertension and the related diseases.

1.2 Problem formulation

Blood pressure (BP) is a strong, consistent, continuous, independent, and etiologically relevant risk factor for cardiovascular and renal disease.(10) Environmental factors (physical inactivity, toxins, diet and psychosocial factors), genetic factors and the interactions among these factors are the main cause of elevated BP.(11) By nature hypertension disease is a problematic in Tanzanian society as interventions occur mainly at the secondary and tertiary levels rather than at the primary prevention level. As it is reported majority of people with hypertension have no symptoms, this has made preventive health behaviors difficult to encourage.(12) Consequently, there is high prevalence of hypertension in Tanzania particularly urban areas with low levels of detection, treatment and control.(13) In addition, the problem of overweight, obesity and other metabolic syndrome which seem to be increasing especially among the urban elite and business community emulate unhealthy poor lifestyles and food habits. It is this gap that this study seeks to address.

1.3 Purpose of the study

Despite important advances in understanding of benefits of a physically active lifestyle, hypertension pathophysiology and the availability of effective treatment strategies among physicians and in the general population, still the incidence of hypertension has not decreased.(14, 15) Obesity is said to be a strong risk factor for various diseases including hypertension, diabetes, coronary heart disease, gall bladder disease and certain types of cancer.(16) Body Mass Index (BMI) and Waist Hip Ratio WHR) are anthropometric indices used for assessing the body weight, amount and distribution of body fat.(17) The anthropometric measures and associated indices have been used for years in an attempt to identify those with a high level of obesity and who may be at risk of developing chronic health conditions.(18, 19) They are said to be good indices with high validity (19) when it comes to predicting hypertension.(20)

Cross-sectional studies indicate a direct association between BMI, WHR and hypertension, across various levels of BMI.(19-22) With higher BMI and WHR cardiovascular disease risk factors, such as hypertension tend to be elevated.(23) In addition epidemiological and clinical research represent high priorities in hypertension research in developing countries.(24) The present study was therefore undertaken to examine the relationship between different anthropometric indicators and prevalence of hypertension among university lecturers in Tanzania, conscientize the community, and contribute information to the culture-congruent preventive and health modification strategies.

1.4 Objectives of the study

The objectives of this study are to:

i. Use the anthropometric measurements to describe the body weight and adiposity patterns of the university lecturers.

ii. Compare the relationship between BMI, WHR, and BP in university lecturers.

iii. Examine the association between age, level of education, lifestyle, and the BP.

1.5 Research Question

This study will be guided by the following questions:

i. How many lecturers have excessive body weight, high central adiposity and high BP?

ii. How is the participation of lecturers in physical activity?

iii. Which index predicts the prevalence of hypertension best?

iv. What is the self perceived awareness of the university lecturers on hypertension?

1.6 Research Hypothesis

Hornby defines hypothesis as "(an) idea or suggestion that is based on known facts and is used as a basis for reasoning or further investigation".(25) This research is built upon six hypotheses:

i. There is no significant correlation between BMI and BP in university lecturers.

ii. There is no significant correlation between WHR and BP in university lecturers.

iii. There is no significant correlation between participation in physical activity and BP in university lecturers.

iv. There is no statistical difference in anthropometrical characteristics between normotensive and hypertensive lecturers.

v. There is no significant correlation between demographic characteristics (age, level of education) and BP in university lecturers.

vi. There is no significant relationship between hypertension awareness and prevalence hypertension disease in university lecturers.

1.7 Significance of the study

Most of the developing countries lack reliable statistics related to the prevalence, incidence and mortality of hypertension.(24) However, high-quality research can still be carried out in spite of the limited resources. It is therefore envisaged that results of this study will add to the literature on prevalence of hypertension and related diseases, especially among the elite in Tanzania. The findings are expected to reinforce preventive programs and measures for detecting lecturers at risk of developing hypertension, help those at risk and those already victims of the disease to become more aware of the disease and the precautionary measures to prevent its progression. The findings will also be useful to the national health units monitoring the wellness of the citizens as well as to future researchers.

1.8 Definitions of key concepts

1.8.1 Hypertension

As the heart contracts, blood is pumped out of the heart into blood vessels known as arteries. At the top of the wave of the heart contraction, the **systolic** blood pressure (SBP) is measured. BP exerted by the heart when it is resting between beats is referred to as **diastolic** blood pressure (DBP). Hypertension (also known as High BP) as applied in this study refers to a systolic blood pressure (SBP) at or above 140mmHg and diastolic blood pressure (DBP) at or above 90mmHg.(26) BP is described as a continuous variable as it is commonly reported in this manner, with mean and standard deviation values.

1.8.2 Lecturer

Lecturer is a term of academic rank. As far as this study is concerned, lecturer is a person who leads research groups and supervises university students as well as lecture courses at university level.

1.8.3 Overweight and Obesity

One is said to be overweight if he or she has an excess body weight compared to set standards, whereas obesity is an individual with excessive amount of body fat.(27) that causes body disturbances which in turn contribute to the risks of hypertension.(28) and other metabolic syndrome. Adults are defined as being obese if they have a BMI of 30 or greater, and as being overweight if they have a BMI of 25 but less than 30.

1.8.4 Physical activity

Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure above basal (i.e. resting) level.(29)

1.8.5 Risk factor

Risk factor according to Webster's New World Medical Dictionary refers to something that increases a person's chances of developing a disease or an aspect of personal habits or an environmental exposure that is associated with an increased probability of occurrence of a disease.(30) However it should also be understood that though risk factors are associated with a disease they do not necessarily cause the disease.(31) Risk factors can be categorized into; modifiable and non modifiable risk factor.

1.8.6 Modifiable risk factors

Modifiable risk factors are things that you can control, change, or modify by changing your lifestyle, changing personal habit or taking medications to reduce hypertension risk.(32) Whereas,

1.8.7 Non Modifiable risk factors

Are usually intrinsic to the individual and therefore not easily controlled, changed and modified.

1.8.8 University of Dar Es Salaam

Whenever the word University of Dar Es Salaam appears in this study will refer to the University of Dar Es Salaam, Mlimani campus. The campus is located in the city of Dar Es salaam and constitute of several faculties.

1.8.9 Waist to Hip Ratio (WHR)

Waist-to-hip ratio is a measurement that compares the waist circumference to that of hip circumference. The ratio is obtained by taking the waist circumference measurement divided by the hip circumference measurement.

1.8.10 Body mass index (BMI)

Body mass index also known as Quetelet Index (initially described by Quetelet in 1869) is an anthropometric index for measuring overweight and obesity among adults (27, 33, 34).

1.9 Conclusion

This chapter discussed introduction, background to the study, history and location of the University of Dar Es Salaam, problem formulation, purpose, objectives, research questions, hypothesis and significance of the study, and briefly defined key concepts. The coming chapter covers literature review used for this study.

Chapter 2

LITERATURE REVIEW

2.0 Introduction

The World Health Organization (WHO) shows that hypertension accounts for one in every third deaths worldwide.(35) The high prevalence of hypertension worldwide has contributed to the present pandemic of cardiovascular disease.(3) The disease is considered as a major but modifiable contributory factor in cardiovascular diseases (CVD). It is becoming a chronic condition of concern as it contributes to coronary artery disease, stroke and other vascular complications.(36)

2.1 The prevalence of hypertension in Tanzania

While hypertension prevalence is increasing in economic developing countries making it a greater population burden, prevalence is reported to be stable or decreasing in developed countries.(3) Several surveys conducted demonstrate that the problem is going up due to a very low control among Sub Saharan African countries (5-8) (Table 1 Summarizes studies conducted on hypertension in African countries). Despite the rise of the problem, surveys carried out have contributed a greater understanding of the prevalence and awareness of hypertension.(37-43) When measurements are comparable, these surveys can also be used to address important questions in international epidemiology.(44)

In the context of this study, the Tanzanian society has not been spared from being affected by hypertension. Despite lack of a national survey on hypertension, several surveys have been conducted in various study areas using samples comprised of different age structures and diverse definitions of hypertension.(9) For instance, Edwards and co-workers write;

> *"…Forsyth (45) in the late 1960s found crude hypertension prevalence (diastolic blood pressure > 100 mmHg) of only 1.2 and 4.9% among rural populations living largely from subsidence agriculture in mainland Tanzania and Zanzibar. In 1979 Vaughan (46) found a hypertension prevalence (> 160/ 95 mmHg) of 2% in adults aged 25±64 years in Handeni, another poor rural area. In 1987±89,*

Swai et al.(47) studied hypertension prevalence among adults from three different rural areas in Tanzania. In four villages in the Kilimanjaro area (Shari is situated in this area), crude hypertension prevalence (> 160/95 mmHg) was 10.9% for men and 9.6% for women. In three villages from a less prosperous area, crude prevalence were 3.6 and 5.2% for men and women; and in three villages from the poorest area were 2.3 and 3.6%, respectively. Age-specific mean systolic and diastolic blood pressures and hypertension prevalences in Shari in 1996 were markedly higher than in the Kilimanjaro villages in 1988, particularly among adults aged over 45 years…" (Edwards&co-workers, 2000, pg.149).

Anecdotal evidence shows that hypertension and strokes are responsible for more than 50% of cardiovascular deaths in Tanzania.(48) High prevalence of hypertension is shown to be in urban areas. For instance, 10% hypertension cases were found in Dar Es Salaam, mostly among the high executives.(1) People suffering from hypertension are at high risk of suffering from or experiencing a stroke, to reduce incidence BP needs to be controlled in Tanzania.(21, 22) The Adult Morbidity and Mortality Project (AMMP) (49) reported that, stroke related deaths were common among people aged over 60 years. The project added that the probability of dying from stroke between the ages of 15 and 50 years was over six times higher in an urban area, and between two and four times higher in two rural areas.

Some researchers attribute the prevalence of hypertension in Tanzania to low physical activity and some are not certain, henceforth further studies are needed in the area.(50, 51) Kuga and co-workers for example, show that urban residents in Tanzania are the most susceptible individuals to hypertension and overweight problems due to physical inactivity.(13)

Table 1: Prevalence of Hypertension in Selected Population Studies in Sub-Saharan Africa

First Author (Year of Publication)	Country	Population Type	Age Group	Prevalence of Hypertension* (%) Men	Women
Akinkugbe [52] (1968)	Nigeria	Rural	40–44	15.2	13.1
			45–49	14.4	39.4
			50–54	23.3	33.6
			55–59	20.5	29.0
			60–64	44.6	41.6
			65–69	27.6	39.5
			70+	45.0	39.3
Giles[53] (1994)	Liberia	Rural	40–44	18	25
			45–49	16	36
			50–54	18	34
			55+	20	50
Cooper[51] (1997)	Nigeria	Rural+Urban	25+	14.7†	14.3†
	Cameroon	Rural	25+	14.2†	16.3†
		Urban	25+	22.8†	16.0†
Mbanya[50] (1998)	Cameroon	Rural	25–74	12.7	8.8
		Urban		23.8	18.7
Edwards[54] (2000)	Tanzania	Rural	35–54	40.6	38.8
			55+	54.0	61.0
		Urban	35–54	46.6	52.3
			55+	77.8	69.0
Steyn[55] (2001)	S. Africa	National	15+	25.1†	25.3†
Amoah[56] (2003)	Ghana	Urban	25+	27.6†	29.5†

*Hypertension defined as SBP ≥140 and/or DBP ≥90 mm Hg or being on drug therapy.
†Age-adjusted.

Adapted from Cappuccio, et al., 2004 (57)

2.2 Hypertension, what is it?

When the heart is in the pumping process it contracts generating pressure against the resistance of the blood vessels. BP is the force with which blood pushes against the artery walls as it travels through the body. Hypertension is a medical term for high BP resulting from an abnormally high pressure in the arteries. It is a disorder of mismatch between intravascular volume and vasoconstriction resulting in excessive wall stress that damages the blood vessels and organs. The presence of both modifiable and non modifiable risk factors in a hypertension patient makes the definition of hypertension arbitrary.(58-60) However consensus from several published guidelines including WHO (26) and British Hypertension Society (BHS) (59) refer hypertension to as a systolic pressure at or above 140mmHg and diastolic pressure at or above 90mmHg. Normal BP in adults ranges between 100/60 to 140/90.(61) High BP (Hypertension) can be classified into three grades (see table 2). (61)

2.3 Hypertension – pathophysiology of

No one is certain of the mechanism behind hypertension however; two ways are thought to be the main causes. Hypertension may occur as a result of an underlying disorder of the kidneys or a hormonal disorder.(62) According to this paradigm hypertension is developed from renal system dysfunction especially when the kidney retains too much fluid. If too little fluid is retained, BP decreases. This type of hypertension contributes 2 – 5% of the total hypertension patients and is called secondary hypertension. The remained percentage (95%) have no clear single identifiable cause known and therefore its diagnosis is made after excluding known causes that comprise secondary hypertension. This type of hypertension is referred to as essential, idiopathic or primary hypertension (see figure 1).(63) Essential hypertension is said to be heterogeneous and contributed by several factors; environment, genetic and demographic factors (Table 3).(64, 65)

Table 2: ESH-ESC 2003 classification of hypertension

Category	Systolic (mmHg)	Diastolic (mmHg)
Optimal	<120	<80
Normal	120 – 129	80 – 84
High normal	130 – 139	85 – 89
Grade 1 – Mild hypertension	140 – 159	90 – 99
Grade 2 – Moderate hypertension	160 – 179	100 – 109
Grade 3 – Severe hypertension	>/=180	>/=110
Isolated systolic hypertension	>/=140	<90

(Adapted from Thomas, 2006)

Table 3: Factors contributing to development of essential hypertension

Systemic hemodynamics
Plasma volume
Renin angiotension system
Sympathetic nervous system
Role of the kidney
Dietary factors
Sodium
Calcium
Potassium
Obesity
Alcohol
Heredity
Race

(Adapted from Rose, 1987)

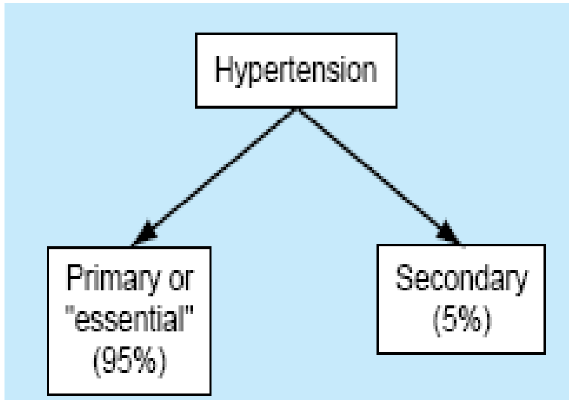

Figure 1: The relative frequency of primary and secondary hypertension

2.4 Effects of blood pressure on the risk of cardiovascular disease

As discussed above hypertension is one of the major modifiable risk factors for CVD. Studies indicate an existence of a continuous relationship between blood pressure (BP) and CVD risk down to at least 115/75mmHg.(66-68) In a cohort study conducted in Japan it was concluded that high-normal BP is a risk factor for the incidence of stroke and myocardial infarction in a general urban population of Japanese men.(13) Many diseases such as stroke (damage to the brain), heart attack, damage to the eyes and kidney are due to the high BP.(69) Hypertension is also one of the major causes of deposition of cholesterol and fat in the coronary arteries leading to atherosclerosis a disease that accounts for one third of deaths in the industrialized world.(70) Kelly and co-workers indicate from their study that the association between hypertension and CVD incidence and mortality is consistent between genders.(68)

MacMahon (71) suggested from his work that there is no clearly defined lower level of BP below which the risk of CVD do not continue to decline. A marginal decrease in high BP has a profound effect in lowering of CVD rates.(72, 73) For instance, it has been estimated that a 3–mm Hg reduction in SBP could lead to an 8% reduction in stroke mortality and a 5% reduction in mortality from coronary heart disease.(74) Prevention is better than cure, it is therefore important to curb hypertension in order to reduce the risk of CVD and premature deaths.(35)

2.5 Overweight, Obesity and Hypertension

Chiang and co-workers (75) define overweight as the ratio of actual weight to average or desirable weight (specific for age, sex, height, and body build). They add that an individual may be overweight on account of musculature or bony structure rather than excess fat, so that overweight and obesity are not necessarily synonymous.

Weight gain in adults has a detrimental impact on physical health and can lead to death.(76) Its side effects in human body can range from psychological effects that impact quality of life (e.g. poor self-esteem, discrimination, depression) to physiological conditions that subject an individual at risk for premature death. (27, 35) A person may develop one or combinations of two or more of the following conditions: hypertension, dyslipidemia (high total cholesterol or high levels of triglycerides), type 2 diabetes, heart disease, stroke, gallbladder disease, osteoarthritis, sleep apnea and respiratory problems, some cancers (such as endometrial, breast, and colon).(77) Most health practitioners believe that the more overweight an individual is, the higher the risk for developing health complications, the converse also appears true *(ibid)*.

Body weight plays a significant role in BP. The relationship between body weight and BP has been documented in several other studies. (42, 43) Weight reduction of as little as 4.5kg can produce a decrease in BP in a large proportion of overweight people with hypertension.(69) In another study it was reported that for each 10 kg increase in weight in western population there was an increase of 2-3 mmHg in SBP and 1-3 mmHg in DBP.(78)

The anatomic distribution of weight is a factor in determining which people are more susceptible to hypertension.(22) Literature reveals through both cross-sectional and longitudinal studies that there is a significant association between relative weight and hypertension.*(ibid)* Chiang and the colleagues (75) assert that there is a frequent of coexistence between overweight and hypertension which suggests a causal relationship between the two conditions. They further add that weight gain constitutes one kind of environmental stress that brings a genetic predisposition toward hypertension into the open. Hypertension is said to be approximately twice more prevalent in the obese than in the non-obese.(79)

Increasing evidence accumulated through both metabolic and epidemiologic studies indicate that where excessive fat is located on the body, one's health is at risk.(80) Body fat distribution has been suggested to be the most indicator of hypertension risk than actual overweight.(69) It is asserted that aberrant fat localization, such as abdominal adiposity, and not total body fat mass, is the most crucial determinant of cardiovascular diseases.(45) In most epidemiological studies, anthropometric measurements have been used to assess the fat distribution and the relationship between the body fat distribution indices and the risk of hypertension.(81) Anthropometric indicators that reflect excess adipose tissue are; BMI, which reflects the proportion of adipose tissue in the total body mass, regardless of localization– and the WHR – which provides a measure especially of visceral fat.(82)

2.5.1 Anthropometric measurements of overweight, obesity and Blood Pressure

2.5.1.1 Body Mass Index (BMI)

Body mass index also known as Quetelet Index (initially described by Quetelet in 1869) is an anthropometric index for measuring overweight and obesity among adults.(27, 33, 34) Keller emphasizes that BMI should be used as a suggestive indicator of risk and not an *"absolute"* tool for medical diagnosis. She further adds that its categories have more correlations with disease risk, the higher BMI the higher the risk for CVD (27) and all cause of mortality in both men and women.(83) There is a relationship between BMI values and morbidity and mortality. BMI values of 20-25 kgm^{-2} represent a range associated with good health for most people, while BMI values below 20 kgm^{-2} and greater than 27 kgm^{-2} can be associated with health problem.(84)

Positive associations between BMI and BP have been documented in several studies.(54-57) While some studies (85) reported a consistent, and modest association between BMI and BP, others suggest a BMI threshold at which level the relationship with BP should begin.(31, 32) In Tanzania, Njelekela and co-workers reported a significant correlation of BMI to SBP and DBP, in both genders,(48) this was also observed in Nigeria by Kadiri and co-workers.(86) However, White and co-workers reported that, for Canadian men, hypertension was more highly correlated with BMI in almost every age group.(22) Tesfaye and co-workers (87) concluded from their study that the relationship between BP and BMI is U or J shaped, an observation which was suggested before, although inconsistently (88). From their study which involved subjects from Vietnam, Indonesia and Ethiopia Tesfaye and co-workers (87) also noticed prevalence of high blood pressures in both underweight and overweight population subsets and the relatively low blood pressures in the normal range BMI range. Despite several early studies report a strong relationship between BMI and BP, the perception is challenged today due to new reports of increased BP and hypertension prevalence rates in lean populations.(87)

Several studies have shown that the relationship between body fat and BMI cutoff points differ between populations, and attribute the differences to body composition based on genetics, ethnic background as well as energy intake and physical activity.(62, 63) Following this difference several countries have developed BMI-for-age charts for their populations and some have gone further into defining cutoff points on these charts to define overweight and obesity.(89) As a result, different BMI-for-age values define overweight and obesity in different populations.(90) Africa has not developed any and still relies on the BMI cutoff points proposed by the WHO (1997) as the universal standard for classification of obesity (see table 4).(91)

The use of BMI as an assessment of adiposity is a non intrusive, reliable and has been validated against measures of body density,(92) however, several limitations; including its inability to distinguish between fat mass and non-fat mass as well as abdominal visceral and subcutaneous fat have been reported.(91)

Table 4: The International Classification of adult underweight, overweight and obesity according to BMI

Classification	BMI(kg/m^2)	
	Principal cut-off points	Additional cut-off points
Underweight	<18.50	<18.50
Severe thinness	<16.00	<16.00
Moderate thinness	16.00 - 16.99	16.00 - 16.99
Mild thinness	17.00 - 18.49	17.00 - 18.49
Normal range	18.50 - 24.99	18.50 - 22.99
		23.00 - 24.99
Overweight	≥25.00	≥25.00
Pre-obese	25.00 - 29.99	25.00 - 27.49
		27.50 - 29.99
Obese	≥30.00	≥30.00
Obese class I	30.00 - 34-99	30.00 - 32.49
		32.50 - 34.99
Obese class II	35.00 - 39.99	35.00 - 37.49
		37.50 - 39.99
Obese class III	≥40.00	≥40.00

Adapted from The WHO Global Database on Body Mass Index (BMI)
(http://www.who.int/bmi/index.jsp retrieved on 09.05.2008)

2.5.1.2 Waist to Hip Ratio (WHR)

Central obesity is often referred to as abdominal, upper-body, male-type, android, or visceral obesity vs. female-type or gynoid obesity, where there is preferential fat accumulation in the gluteal and femoral distribution.(93) To differentiate between central or upper body obesity (i.e. fat cell deposits in the abdomen) from lower body obesity with fat cell deposits in the buttocks and legs, WHR is commonly used.(22) WHR has been long recognized as a substantial component in the assessment of cardiovascular disease risk factors due to a positive association between high WHR and hypertension.(69, 94) Its validity as a measure of abdominal obesity has been evaluated in several studies by comparing WHR with abdominal fat measured by computed tomography.(95) The index is capable of predicting the risk of obesity related morbidity and mortality as they account for regional abdominal adiposity.

Evidence exists suggesting that obesity and high BP are disorders that are closely linked, particularly when obesity is characterized by a central fat distribution,(46, 68) a type of fat reported to be more insulin resistant than peripheral fat (69). The abdominal accumulation of body fat, apart from overall level of adiposity, is associated with increased BP, an increased risk of hypertension,(85) and many other metabolic abnormalities that are generally regarded as part of insulin resistance syndrome (IRS).(47)

WHO in 1998 provided a chat which shows general guidelines for acceptable levels for waist - hip ratio (see table 5). Individuals with either higher BMI or central adiposity distribution are potential candidates at increased risk of hypertension and cardiovascular disease.(94)

Table 5: General guidelines for acceptable levels for waist - hip ratio

	acceptable		unacceptable		
	excellent	Good	average	high	extreme
male	< 0.85	0.85 - 0.90	0.90 - 0.95	0.95 - 1.00	> 1.00
female	< 0.75	0.75 - 0.80	0.80 - 0.85	0.85 - 0.90	> 0.90

2.6 Physical activity, physical fitness, exercise and blood pressure

Physical activity refers to bodily movement produced by the contraction of skeletal muscle that increases energy expenditure above the basal (i.e., resting) level.(29, 96) Almost everyone engages in physical activity in order to sustain life, however it is the amount and time we devote to that differentiate us.(29) Physical activity can be performed at a wide range of intensities: walking or other moderate intensity activities such as swimming at a low, moderate or brisk pace; vigorous endurance activities such as jogging, running or walking fast uphill; and participating in activities that increase strength and or flexibility.(97) Involvement in both regular - sustained physical activity and fitness exercises make significant contributions to one's health, sense of well-being, and maintenance of a healthy body weight.(93, 98)

The health outcomes of physical activity has been associated with chronic diseases and health risks such as hypertension, obesity and coronary heart disease.(99) Evidence gathered from literature indicated that physical activity influences BP control and is effective in the prevention of cardiovascular disease.(100, 101) Several clinical trials conducted demonstrate that physical activity reduces BP in hypertensive and normotensive persons, independent of weight loss.(76, 78, 79) In a study conducted in Finland, it was ascertained that the combination of regular physical activity and weight control reduced the risk of hypertension in both sexes regardless the level of obesity (102). For example it has been observed that aerobic exercise training from 3 to 5 times per week for 30 to 60 minutes per session at moderate intensity lowered systolic/diastolic blood pressures by 2.6/1.8mmHg in normotensives and 7.4/5.8mmHg in hypertensives.(72, 73)

As discussed above, evidence supports the view that involvement in appropriate physical activity can have significant health benefits for all sectors of the population (99). Overall, mortality rates from all causes of death are lower in physically active individuals whereas, a sedentary lifestyle increases risk for overweight, obesity and chronic diseases such as hypertension.(103) Today, through intervention studies, physical activity is widely advocated as a non pharmacological intervention that can provide an effective means to lower BP and a useful method for both prevention and treatment of high BP in a variety of populations.(82-84)

2.7 Relationship between hypertension and other risk factors: smoking, alcohol abuse and age.

Epidemiological surveys document several other risk factors associated with BP levels such as alcohol abuse, smoking, age, to mention a few.(104)

2.7.1 Alcohol abuse

Global alcohol consumption has increased in recent decades, with most or all of this increase occurring in developing countries.(105) The relationship between alcohol consumption and its consequences relies on the two main dimensions of alcohol consumption: average volume of consumption and patterns of drinking including mediating mechanisms; biochemical effects, intoxication, and dependence (see Figure 2. for the main paths).(106)

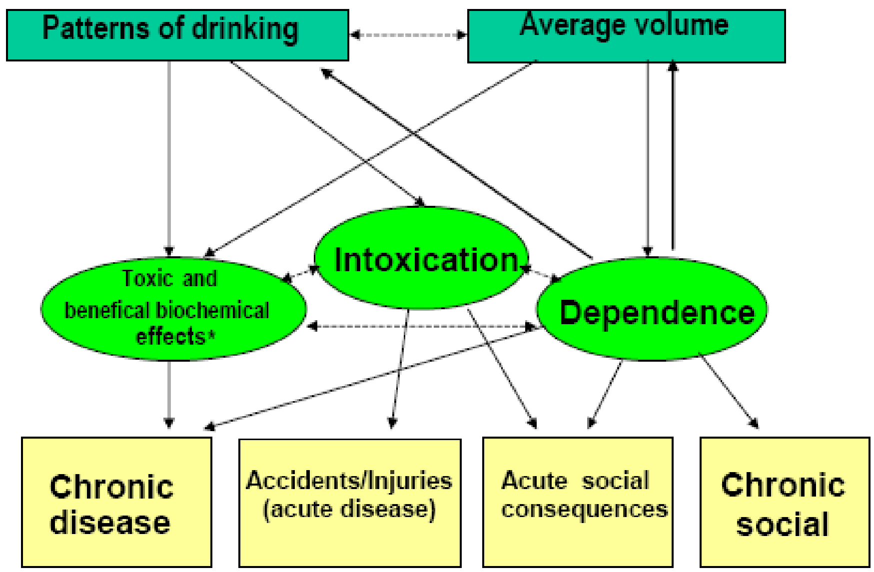

Figure 2: Model of alcohol consumption, mediating variables, and short-term and long-term consequences.

Alcohol use is related to wide range of physical, mental and social harms and its consumption is linked to more than 60 disease conditions in a series of recent meta-analyses.(107) Its use is reported to have both beneficial effects (e.g. biochemical effects - protection against blood clot formation of moderate consumption, which is protective for coronary heart disease),(108) and harmful effects on health (e.g. intoxication - a powerful mediator for acute outcomes, such as car crashes or domestic violence, and can also cause chronic health and social problems). However; on the whole, the health impact of alcohol consumption is negative.(106)

Ezzati, *et al*. (109) and WHO (105) indicate that around 4% of the global disease burden is alcohol related as compared to with that attributed to the effects of tobacco (4.1%) and high BP (4.4%) . In Europe for example; adult per capita alcohol consumption was estimated to be 11.9 liters pure alcohol, almost twice the global average of 6.2 l in 2002.(110) In terms of burden of disease, alcohol-attributable deaths, years of life lost (YLL) and disability adjusted life years (DALYs) were reported to be double or triple those estimated globally.(92)

For most diseases related to alcohol consumption, a dose – response relationship exists with risk of the disease increasing with greater amounts of alcohol intake.(111) It is reported that moderate alcohol consumption is inversely associated with CVD and total death. The relationship between alcohol and hypertension is reported as far back as 1915, when Lian reported alcoholism as a cause of hypertension in French servicemen.(112) Though the mechanism of the relationship remains ambiguous, several mechanisms have been proposed (83, 84) and clinical studies have confirmed the link between the alcohol and hypertension.(113, 114) In addition the relationship between alcohol and hypertension has been shown to be independent of sex, race, education, smoking, salt intake and the type of alcoholic beverage.(97)

Findings from studies show that hypertension and other cardiovascular disorders such as cardiac arrhythmias or heart failure are adversely affected by alcohol.(107) They assert that high levels of alcohol consumption ($\geq$2 drinks per day) are associated with an increased risk of hypertension.(99, 100) Furthermore literature indicate that daily consumption of more than 30g pure alcohol for men (and presumably lower levels for women) causes hypertension.(106) INTERSALT's study which involved 50 centers worldwide reports that, after account was taken of key confounders, men who drank 300-499 ml alcohol/week were found to have systolic/diastolic BP on average 2.7/1.6 mm Hg higher than non-drinkers, and men who drank >=500 ml alcohol/week had pressures of 4.6/3.0 mm Hg higher.(115) Saunders, Porth and Kunert report from their studies that up to half of the alcohol dependent whose blood pressures were over 140/90 mmHg, returned to normal after detoxification in most and remained normal for as long as they stayed abstinent.(116, 117) Other studies conducted of alcohol consumption and discontinuation in hypertensive patients have shown that BP falls within 24 h to 1 week of reducing intake, and rises occurring equally rapidly on restarting.(90-92) These reports affirm the relationship between alcohol and hypertension.

2.7.2 Cigarette Smoking

Cigarette smoking and use of tobacco are reported to exhibit a causal association with increased mortality from several diseases worldwide.(118) Studies show that developing countries have large increases of cigarette smoking especially among males over the last part of the twentieth century.(118, 119) Smoking has shown undoubtedly harmful effects on the heart and blood vessels and is said to be a strong independent risk factor for cardiovascular disease and premature deaths.(120) The role of cigarette smoking in the development of hypertension is not as well elucidated.(121) However, heavy cigarette smoking may lead to noxious effects such as sympathetic nervous overactivity, oxidative stress, and acute vasopressor effects that are associated with increases in markers of inflammation that are linked with hypertension.(122, 123) In addition chronic smoking is said to cause endothelial dysfunction, vascular injury, plaque progression, and increased arterial stiffness that may contribute to the development of hypertension.(122) Despite cross-sectional and cohort studies report an excess of hypertension in smokers, there is less defined relationship between cigarette smoking and incident hypertension.(124)

Since cigarette smoking is a strong independent risk factor for cardiovascular disease, quitting from it is acknowledged to be one of the most effective lifestyle interventions for preventing cardiovascular disease and premature deaths. Although studies confirm that cigarette smoking increases the risk of developing hypertension, there is no current evidence that indicates smoking cessation directly reduces BP in people with hypertension.(100) In addition there is no study that has proposed smoking cessation as a recommendation for the prevention or treatment of hypertension.(125)

2.7.3 Age

As one gets older, blood vessels become less elastic. With age there is a general increase in BP in general population as well as in people with hypertension.(126) The older we get, the greater the risk for developing high BP in both sexes across all world regions.(127) The Third National Health and Nutrition Examination Survey 1988-1991 (NHANES III) (103) showed that average SBP tends to rise in both men and women throughout adult life, with DBP peaking about age 55 (see figure 3).

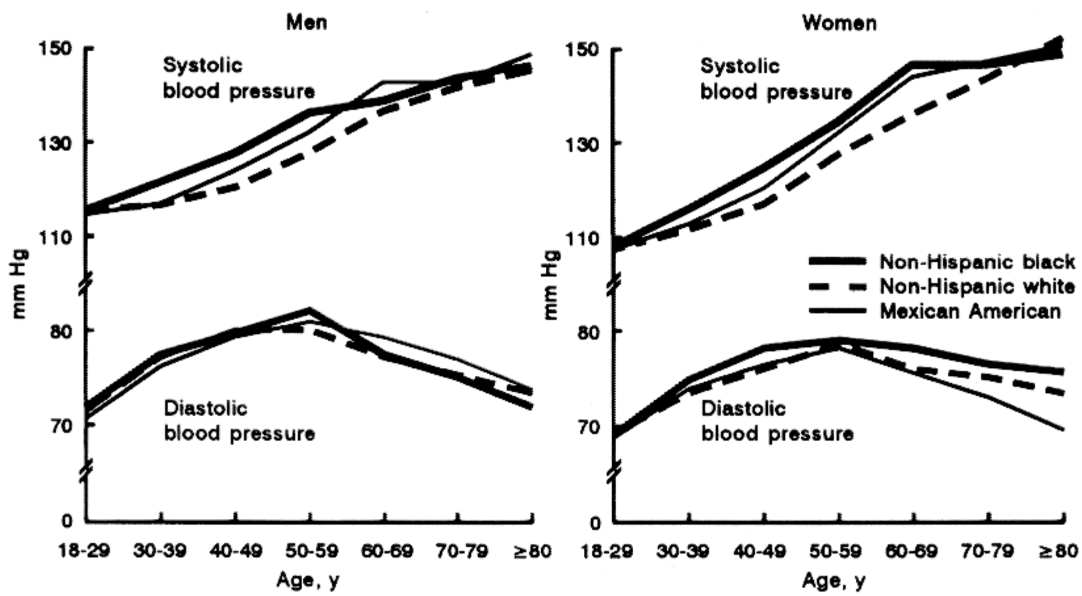

Figure 3: Mean systolic and diastolic blood pressures by age and race/ethnicity for men and women, US population 18 years of age and older. (Adapted from NHANES III)

Several surveys conducted in California (128), Connecticut (129) and Maryland (130) in the United States reported that the prevalence of hypertension (both borderline and definite) was higher in men than in women under the age of 50. After the age of 50 the prevalence rates for men and women were similar. It has also been estimated that among adults >50 years of age, the lifetime risk of developing hypertension approaches 90%.(131) In Tanzania, the prevalence rate of hypertension is reported to be high after the age of 45.(4) Furthermore studies report that elevated readings have also been noted in infants who have a family history of high BP and in teenagers (particularly those who are obese).(132) However, the chance of getting hypertension remains high as one gets older.

In the general population, despite the age and other non modifiable risk factors, dietary and lifestyle modifications that lower BP are widely advocated as part of strategies to prevent, reduce and treat hypertension.

Chapter 3

THEORETICAL FRAMEWORK

3.1 Theoretical framework defined

A theoretical framework is a collection of interrelated concepts which helps a researcher make explicit assumptions and place the research in a discipline or subject (133). It guides the research (ready-made map) in determining what things should be measured, and what statistical relationships to look for. The theoretical underpinning of this study is based on ***the physical activity epidemiological framework.***

3.2 Epidemiology

Epidemiology refers to the study of distribution and determinants of health-related states or events in specified populations, and the application of this study to the control of health problems (134, 135). Epidemiological studies are primarily based on the premise that the cause of a health problem/disease that affects members of a population results in higher rates of occurrence of that problem/disease in those members of the population who are exposed to that cause than in those who are not exposed (136). The rate of the problem in a particular population relates to the frequency of cases. That frequency may be measured in several ways, such as the prevalence (the proportion of the population at a given time that has a case) and the incidence (the number of new cases per person per unit of time).(135, 137, 138)

Caspersen (138) put forward four major traditional uses of epidemiology;

i. to establish the magnitude of a health problem,

ii. to identify the factor(s) that causes the health problem as well as the mode(s) by which the factor is transmitted;

iii. to develop the scientific basis for preventive activities or the allocation of health resources; and

iv. to evaluate the effectiveness of preventive or therapeutic maneuvers.

Epidemiologists have developed several research designs (experimental and observational studies) that have also been used to study disease-related issues in physical activity and health.(138) They take a more distant view and study groups of people at the population level. The community is the epidemiologist's laboratory.

3.3 Physical activity epidemiology

Physical activity epidemiology examines the relationship between physical activity and various health related states from a variety of perspectives.(139) Specifically, physical activity epidemiology makes use of epidemiological research strategies to study physical activity as a health related behavior linked to disease and other outcomes.

Caspersen (138) provides a good summary of what physical activity epidemiology research is;

> *Physical activity epidemiology can be defined as a two part process. First it studies (a) the association of physical activity as a health-related behavior with disease, and other health outcomes; (b) the distribution and determinants of physical activity behavior(s) and (c) the interrelationship of physical activity with other behaviors. Second, it applies that knowledge to the prevention and control of the disease and the promotion of health (Caspersen, 1989 pp 465).*

Physical activity epidemiological research play a greater role in establishing the importance of physical activity to public health.(140) Dishman and co-workers (141) comment that physical activity epidemiological research provides a possibility of describing why physical inactivity is a burden on public health and what can be done about it.

This study therefore has adopted the physical activity epidemiological framework based on literature guide in order to study the prevalence of hypertension among the population of university lecturers in Tanzania.

Chapter 4

RESEARCH DESIGN AND METHODOLOGY

4.0 Introduction

This chapter discusses the research design and methodology including approach, sample and power calculation, inclusion and exclusion criteria, research setting, data collection and analysis. The last section deals with ethical issues.

4.1 Research design

According to Bryman research design provides a framework for the collection and analysis of data (142) its purpose being to achieve greater control of variables important for maintaining validity of a research.(143) The present study employed a descriptive quantitative design using a cross-sectional survey to collect data.

4.1.1 Quantitative research design

Quantitative design is used when there is analysis of numerical data based on numerical measurements of specific aspects of phenomena. During the process data collection is typically done using pre-structured written or online questions that have to be filled in by the respondents.(144) Furthermore the quantitative researcher seeks explanations and predictions that will be generalized to the whole population. The approach facilitates hypothetico-deductive reasoning whereby a researcher starts with something that little is known about so as to further explore the topic.(145, 146) Quantitative design was preferred in this study as it provides an efficient way for investigating health issues in the communities as well as the best method for collecting large amounts of information in social and health research.(147, 148) The design was appropriate as it was able to collect information relating to the prevalence of hypertension in university lecturers.

4.1.2 Cross sectional study

To achieve its goal this study employed a cross sectional survey in studying the population of university lecturers at a given time-point in order to collect a body of quantifiable data then examine to detect the pattern of association (142, 144, 149). However, the researcher understands that it is not easy to assess the reasons for associations shown in cross-sectional studies but what is important is to find out whether the exposure precedes or follows the effect. Cross-sectional studies are mostly used to measure the prevalence of diseases such as hypertension, thus often called prevalence studies.(150)

There are several reasons that made the researcher adopt cross-sectional approach. The approach is applicable when measuring current health status vital for public health planning, understanding disease etiology and for the generation of hypotheses. The approach is relatively easy and inexpensive to conduct, useful for measuring fixed characteristics of individuals as well as when there is a sudden outbreak of disease.(150) It is fairly quick and can estimate prevalence of outcome of interest because sample is usually taken from the whole population.(151) Information obtained from cross-sectional studies is helpful in assessing the health care needs of populations.

My position as a researcher in this study was to observe and measure what was relevant to the study, however maximum care was taken to avoid contaminating the data.

4.2 Sampling method and power calculation

4.2.1 Population

A population is “any group of persons that have at least one common characteristic”.(152) It is a group whereby a researcher wishes to generalize his/her findings. Burns and Grove further describe the population as “all elements or subjects that meet the criteria for inclusion in the study”.(153) On the other hand a subset of the population selected to participate in a study is referred to as a sample.(154) In this study the population consisted of the University of Dar Es Salaam lecturers both junior and senior university lecturers.

4.2.2 Sampling

The sample is that portion of the population that we have observed above and the relation between population and sample is what is called sampling design. Random sampling design also known as probability sampling (142) was employed in this study. The design gives all members of the population a known chance of being selected for inclusion in the sample.(155) Random sampling can be conducted using several techniques, simple random sampling being one of them. Simple random sampling was used in this study as subjects were randomly selected from the population and every single individual had an equal chance of selection.(144, 155) The subjects were visited in their offices or homes and everybody as long as he was a lecturer had the right to participate. This was so done in order to avoid biasness. During the whole process no drop out was noticed.

4.2.3 Sample size

The sample size is important in any study for two reasons; for adequacy in representing a population and for practical considerations of time and cost (156). The sample size for this study was obtained using a using a formula for calculating sample size for a descriptive, cross-sectional study.(157, 158)

$$N = pq/(E/1.96)^2$$

Whereby:

N = minimum representative sample size

p = best estimate of prevalence of hypertension expressed as a fraction of 100 (in this case, 10% = 0.1)

q = 1 – p

E = absolute precision, i.e. value required (in percentage) which in actual terms describes the maximum difference between the population rate and the sample rate that can be tolerated (0.05). i.e. the proportion of error accepted or marginal error

Based on previous study this study estimated a 10% prevalence of hypertension in university lecturers and therefore estimated a representative sample (N) of about 138 subjects, confidence interval 95%.(1)

4.3 Inclusion/Exclusion criteria

Participants included in this study were male lecturers; junior and senior university lecturers from the University of Dar Es Salaam. The study included normal people with or without history of using long term medications. Technicians and non academic staffs were excluded.

4.4 Research setting

Selection of the study site was based on convenience; the researcher who conducted the study has an extensive prior experience living and studying in the specific region chosen. The university chosen was the University of Dar Es Salaam, situated in the city of Dar Es Salaam. The main campus also called Mlimani meaning on the hill is located about 13 kilometers west of Dar Es Salaam city center. The university offers Bachelors, Masters and Doctoral degrees, and several Certification Programs.

4.5 Instrumentation

4.5.1 Questionnaire

Subjects were interviewed using a closed ended structured questionnaire and their anthropometric measurements were taken (see appendix A). The use of a questionnaire offered anonymity and likelihood of obtaining correct information especially when sensitive information were required.(159) The researcher personally administered the questionnaires to the respondents, recorded BP levels and also took anthropometric measurements.

Interview and anthropometric measurements were conducted after obtaining consent from the subjects. The questionnaire asked about: demographic characteristics, such as age (in years), level of education (Bachelor, Masters, PhD, and Professors), marital status (married/single/divorced and co-habitant). It enquired information about diseases requiring long-term medication, satisfaction with current health (five-point Likert). Furthermore subjects were required to provide their social lifestyle information, such as physical activity - the frequency (days per week), duration (in minutes or hours) and type of regular exercise/activities (swimming, cycling, soccer, basketball, tennis, badminton, volleyball, gardening, walking housekeeping and other odd jobs), smoking (never/current/former), drinking (never/current/former) and hypertension awareness.

4.5.2 Anthropometric measurements

The anthropometric measurements were done using BMI and WHR. These measurements provide a crude means of quantifying important variation in body shape, and are easy to obtain for large samples.

4.5.2.1 Body mass index

BMI was used to assess how much an individual's body weight departs from what is normal or desirable for a person of his or her height. BMI is a height-weight system of measurement that applies to both sexes. Literature support the use of BMI as it has been validated against measures of body density.(92)

Height was measured to the nearest 0.05 cm. The protocol below was followed:

a. Subjects stood straight on a flat floor and against flat wall barefooted with their arms hanging by their sides and the back of head, back, buttocks, calves and heels touching the upright.
b. The head was positioned so that the top of the external auditory meatus is level with the inferior margin of the bony orbit.
c. Legs were straight, arms at sides, and shoulders leveled.
d. They were asked to look straight ahead so that the line of sight is parallel with the floor.

Weight was measured using a portable digital scale at 0.1 kg precision. The protocol below was followed:

a. Subjects were asked to be barefooted and heavy clothing, such as sweaters and heavy jackets.(22)
b. They were asked to stand with both feet in the center of the scale.

Figure 4: Measuring body weight

BMI (Weight/Height^2 in kgm^{-2}) was calculated using the given formula and compared to the universal standard for classification of overweight and obesity (see table 4 chapter 2).(91)

$$BMI = \frac{\text{WEIGHT (Kg)}}{\text{HEIGHT SQUARED (m}^2\text{)}}$$

4.5.2.2 Waist to Hip circumference ratio

When taking the measurements subjects were asked to stand with their feet 12±15 cm apart, with their weight equally distributed on each leg. Waist and hip circumference were recorded using a standard tape measure. The tape measure was stretched around the abdomen – at the level midway between the lowest rib margin and iliac crest. Hips were measured at the level of the widest diameter around the buttocks – the widest level over the trochanters in a horizontal plane. The waist and hip circumference were measured to the nearest 0.5 cm, and WHR was calculated by dividing the waist circumference over hip circumference. The results obtained were compared to the standard values as suggested by WHO in the year 1998 (see table 5).

Figure 5: Measuring Waist circumference

4.5.3 Blood pressure

The BP was measured using an automatic BP monitor Bioland 2003 Digital Blood Pressure Monitor (Arm Style), measurement range 0 - 300mmHg, Pulse Rate 40 - 200/minute with accuracy: Blood Pressure +/- 3 mmHg, Pulse +/- 5%. The instrument gives the values for both systolic and diastolic values on its LCD screen (see figure 6).

Figure 6: Bioland 2003 Digital Blood Pressure Monitor (Arm Style)

The measurements were taken while the subject is in the sitting position after a 10-min rest (160) if the subject was found to have been engaging in a physical activity. The right arm was used throughout the study. The instrument was validated using a manual sphygmomanometer. The study relied on average of two or more readings taken at a single visit and when the first two readings differed by 0.5mmHg an addition reading was obtained before the average was calculated.(161)

4.6 Validity and reliability

Data collection instrument in this study was a questionnaire developed by a researcher and was given to a senior and junior supervisor from the Norwegian University of Sport Sciences and Physical Education (NUSPE) to check its clarity and to indicate weaknesses. Following the supervisors' evaluation and recommendations, changes were made where necessary to ensure validity and reliability of the instrument. The instrument used to measure BP was validated everyday in the morning using a manual sphygmomanometer. In addition to avoid errors where the difference between the first and the second reading was 0.5mmHg, a third reading was taken.

4.7 Data analysis

4.7.1 Methods used in data analysis

The data was captured using the Microsoft Excel Package. In analyzing the data, both the descriptive and inferential statistics were computed. The researcher with assistance of a statistician analyzed the data. Data were analyzed both manually and using software.

Microsoft Windows Excel Package and SPSS version 15 were used. All responses pertaining to variables were first classified as either nominal, ordinal or scale data categories. The categories were then transformed into numerical codes and entered into the Microsoft Excel Sheets and then the file was exported to SPSS. Although most of the descriptive statistics were carried out within the SPSS programme, both packages (Microsoft Excel and SPSS) were used to ascertain the frequencies in order to construct tables and figures: prevalence of hypertension, age and level of education distribution, risk factors, and lecturers' awareness about hypertension.

The relationships were examined using cross-tabulations, correlation and linear regression analysis. Multiple linear regression analysis enabled age-adjusted comparisons of systolic and diastolic BP levels to be made between various potential confounding factors – participation in physical activity, BMI, WHR, smoking and alcohol drinking. In addition a supplementary analysis was performed to assess the independent effect of each social lifestyle variable: participation in physical activity, smoking, alcohol consumption on BP.

4.8 Ascertainment of risk of developing hypertension

Subjects were considered to be hypertensives if they demonstrated a SBP at or above 140mmHg and DBP at or above 90mmHg or self reported use of antihypertensive drugs.(162)

4.9 Ethical considerations

Permission to conduct the study was sought and received from the Research and Publications Unit, University of Dar Es Salaam (see appendices B and C). All subjects were asked of their verbal consent before they were enrolled in the study. They were informed of the purpose of the study, advantages of participating and disadvantages of not participating, as well as their rights to withdraw at any stage during the process. Privacy, confidentiality and anonymity were ensured during the process. Questionnaires used had neither names nor identity attached.

This chapter discussed the research design and methodology in detail including sampling method and power calculation, Inclusion/Exclusion criteria, research setting, data collection instruments, validity and reliability as well as ethical issues.

Chapter five will present data analysis and interpretations.

Chapter 5

DATA ANALYSIS AND INTERPRETATION

5.0 Introduction

This chapter discusses the data analysis and interpretation of the results obtained. It describes the socio-demographic characteristics of the participants which include age, marital status, and level of education in relation to the prevalence of hypertension. It also includes descriptive statistics (table 6); cross-tabulations, correlation and linear regression. The population characteristics, anthropometric indicators, SBP and DBP are shown as mean and standard deviation (table 6).

Table 6: Descriptive statistics of the subjects

Variable measured	N	Minimum	Maximum	Mean	Std. Deviation
Age (years)	95	26	62	40.3	9.7
Height (m)	94	1.53	1.86	1.7	.1
Weight (Kg)	94	49.9	115.2	76.4	11.2
Waist (cm)	94	66	116	91.7	10.2
Hip (cm)	94	83	126	102.2	6.8
Systolic blood pressure (mmHg)	94	88	194	130.1	18.03
diastolic blood pressure (mmHg)	94	54	125	79.5	12.92
Body mass index (kg/m2)	94	17.07	34.64	26.3	3.46
Waist hip ratio	94	.76	1.10	0.9	.066
Valid N (listwise)	94				

5.1 Socio-demographic characteristics

A total of 95 questionnaires were distributed and returned with one incomplete filled. Ninety five individuals met the eligibility criteria for inclusion in the study. Data analysis was completed on all 95 participants. The mean age of the participants was 40.33 years

(SD ± 9.66) with the youngest aged 26 and oldest 62. Majority of the subjects were between 30 and 39 years (N=46, 48.4%). Data indicate that majority of the university lecturers are married (N=77, 81.1%) and many hold either Masters or PhD degrees (N=76, 80%). Table 7 provides a summary of the socio-demographic characteristics of the university lecturers.

Table 7: Cross tabulation of select socio-demographic characteristics and diagnosis of hypertension (n = 94)

Variable *(N)*	**Diagnosis**			
	Normotensive	**Hypertensive**	**x^2/p value**	**df/sign**
Age				
25 – 29 (7)	7 (7.4%)	0 (0%)		
30 – 34 (23)	22 (23.4)	1 (1.1%)	18.5	
35 – 39 (23)	18 (19.1%)	5 (5.3%)		df = 7
40 – 44 (9)	6 (6.4%)	3 (3.2%)	p = 0.01	
45 – 49 (11)	5 (5.3%)	6 (6.4%)		
50 – 54 (10)	7 (7.4%)	3 (3.2%)		
55 – 59 (8)	4 (4.3%)	4 (4.3%)		
60 – 64 (3)	1 (1.1%)	2 (2.1%)		
Marital Status				
Single (18)	15 (16%)	2 (2.1%)	2.07**	df = 1
Married (77)	55 (58.5%)	22 (23.4%)		
Level of Education				
Bachelor (19)	15 (16.0%)	4 (4.3%)		
Master (40)	32 (34.0%)	7 (7.4%)	3.5 **	df = 2
PhD (36)	23 (25.5%)	13 (13.8%)		

** p – value is not significant

Through simple linear regression, a strong and positive significant correlation was observed between age and BP (other confounders kept constant). For every increase in age (one year), SBD was noted to be increasing by an average of 1.09mmHg and DBP by 0.71mmHg ($p<0.001$). A higher proportion of subjects over 45 years were diagnosed as hypertensive than were younger subjects. Using cross tabulation analysis a statistically significant relationship was observed between BP (normotensive and hypertensive subjects) and age (table 7).

Even though the BP decreases as the level of education increases and from single to married status, both level of education and marital status showed no significant correlation with BP ($p>0.05$).

5.2 Medical history and current health satisfaction

Six individuals were found to be having diseases that require long term medication out of which four engage in physical activities. The specified diseases self reported were hypertension and diabetes type 2. And as expected these individuals recorded both high SBP 146.83mmHg (SD ± 18.61) and DBP 87.83 (SD ± 10.69). They were overweight BMI of 28.13Kg/m2 (SD ± 1.29), had an unacceptable high WHR of 0.98 (SD ± 0.03) and aged between 45 and 59.

Sevent-three participants are reportedly satisfied with their current health status, 13 neither satisfied nor dissatisfied and 9 were either dissatisfied or very dissatisfied. However, among those who were either satisfied or very satisfied, over half (N=47) were overweight out of which 8 were obese. They also had WHR (0.92 ± 0.05 SD) as well as high DBP (82.34mmHg ± 12.7 SD). Those who were dissatisfied with their health status (N=9), both normal (N=1) and overweight (N=8) demonstrated slightly high SBP (140.11mmHg ± 27.48 SD) and DBP (82.5mmHg ± 16.87 SD) with an unacceptable WHR of 0.93 ± 0.08 SD).

5.3 Social lifestyle information

5.3.1 Participation in physical activity

Data indicated a group of 62 out of 95 sampled subjects participate in physical activities (table 8). In this group, some were neither certain of their physical activity frequency per week nor had paid attention to it. 53 subjects (55.8%) indicated they participate in physical activity with frequency ranging from once to seven times a week. However, a total of 45 individuals reported both frequency and the duration they spent in physical activity. The reported time spent in physical activity varied from 10 to 180 minutes. Data further indicated that majority of those who participate in physical activity are married (N=50, 52.6%) out of which 45 subjects are either master or PhD degree holders.

Participation in physical activities was found to be significantly related to WHR. Subjects who reported participation in physical activity were noted to have lower WHR by an average of 0.024 units (p=0.02) compared to those who did not participate in physical activity.

Partial correlation controlled for age revealed a negative correlation between participation in physical activity and SBP (r= - .266, p=0.05). Further multiple regression analysis controlled for age revealed a significant relationship between those reported participation in PA at least once a week irrespective of the time and SBP (R= -.59, p=0.05). It was also noted that those reported participation in PA had lower SBP on the average of 1.8mmHg (95% CI 0.5 to 1.36) (given the same age). On the other hand no significant relationship was found with DBP (R=0.53, p>0.05).

5.3.2 Cigarette Smoking

Smoking analysis was based on three categories: never, current and former smokers. Analysis from the collected data indicated that most of the lecturers do not smoke (N=93, 97.9%). Results showed that out of the 95 respondents 88 (92.6%) never smoked before, 2 (2.1%) currently smoking and 5 (5.3%) have stopped smoking. Table 8 & 9 summarize the information.

Results of a linear multiple regression controlled for age indicated weak positive correlation between smoking with both systolic and diastolic BP, however, no statistical significant was noted. Cigarette smokers demonstrated to have higher SBP on the average of 12.5mmHg (95% CI -0.85 to 33.4) compared to non smokers (given the same age). On the other hand DBP was seen to be higher by an average of 5.2mmHg (95% CI -10.5 to

20.9) among smokers compared to non smokers.

Table 8: Number of participants according to smoking habit vs. age group

SMOKING HABIT	AGE GROUP (YEARS)								Total
	25 - 29	30 - 34	35 - 39	40 - 44	45 - 49	50 - 54	55 - 59	60 - 64	
Never	8	21	23	7	9	10	7	3	88
Current	0	1	0	1	0	0	0	0	2
Former	0	1	0	1	2	0	1	0	5
Total	8	23	23	9	11	10	8	3	95

Table 9: Social lifestyle characteristics

SOCIAL LIFESTYLE		N	Age (years) Mean ± SD	%age
Participation In Physical Activities				
	Yes	62	40.21 ± 9.29	65.3%
	No	33	40.55 ± 10.47	34.7%
	Total	95	40.33 ± 9.67	100.0%
Smoking				
	Never	88	40.19 ± 9.7	92.6%
	Current	2	35.5 ± 6.36	2.1%
	Former	5	44.6 ± 10.09	5.3%
	Total	95	40.33 ± 9.66	100.0%
Drinking				
	Never	42	37.36 ± 8.13	44.2%
	Current	41	41.44 ± 9.93	43.2%
	Former	12	46.92 ± 10.34	12.6%
	Total	95	40.33 ± 9.66	100.0%

5.3.3 Alcohol drinking

Alcohol drinking was categorized into three groups: never, current and former drinkers. Data show a close tie of the number of subjects between who have never drunk (N=42) and current alcohol consumers (N=41), while 12 subjects have stopped drinking (Table 9&10 provide summaries of the information).

Table 10: Number of participants according to drinking habit vs. age group

	AGE GROUP (YEARS)								Total
	25 - 29	30 - 34	35 - 39	40 - 44	45 - 49	50 - 54	55 - 59	60 - 64	
DRINKING									
Never drink	4	13	13	4	3	4	0	1	42
Current drinker	4	8	9	4	6	3	6	1	41
Former drinker	0	2	1	1	2	3	2	1	12
Total	8	23	23	9	11	10	8	3	95

A linear multiple regression model with both age and alcohol drinking status correlating with SBP showed both age and drinking status to be significant risk factors affecting the SBP. A positive correlation of r=0.19 (p=0.037) was observed between those who reported alcohol drinking and SBP controlled for age. Further analysis showed the relationship between alcohol drinking and SBP was not statistically significant (R=0.58, p>0.05). Alcohol consumers had SBP of 4.83 mmHg (95% CI -1.2 to 10.9) higher than non alcohol drinkers. When DBP was analyzed there was a no significant correlation between the two (r=0.071, p=0.25).

5.4 Hypertension awareness

Table 11 gives a summary of how many lecturers were informed and checked their BP within the past two years as well as reported using hypertension medicine.

Table 11: Hypertension awareness

HYPERTENSION	AWARENESS	N	Age (years) Mean ± SD	%0f total N
Informed that had High Blood Pressure	Yes	16	49.69 ± 10.08	16.8%
	No	79	38.43 ± 8.45	83.2%
	Total	95	40.33 ± 9.66	100.0%
Blood pressure checked within the past two years	Yes	53	42.3 ± 10.03	55.8%
	No	42	37.83 ± 8.67	44.2%
	Total	95	40.33 ± 9.66	100.0%
Take High Blood Pressure medicine	Yes	6	51.17 ± 12.64	6.3%
	No	89	39.6 ± 9.06	93.7%
	Total	95	40.33 ± 9.66	100.0%

It was noted that those who were informed of their BP appeared to be overweight (BMI= 27.6 ± SD 4.02), had average WHR (0.94 ± SD 0.06) and were hypertensive ($p<0.001$). The subjects who had their blood pressures checked within the past two years were overweight (BMI= 26.7 ± SD 3.58), had WHR of 0.91 (± SD 0.07) accompanied with normal BP.

5.5 Anthropometric indices

After being tested for normality, BMI and WHR variables were found to be normally distributed throughout the sample while age, SBP and DBP were not (see table 12). On the other hand table 7 provides descriptive characteristics of the anthropometric indices of the university lecturers.

Table 12: Tests of Normality

	Kolmogorov-Smirnov(a)			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Age (yrs)	.144	94	.000	.928	94	.000
Systolic Blood Pressure (mmHg)	.117	94	.003	.919	94	.000
Diastolic Pressure (mmHg)	.080	94	.169	.961	94	.007
Body Mass Index	.062	94	.200(*)	.989	94	.614
Waist Hip Ratio	.040	94	.200(*)	.989	94	.632

* This is a lower bound of the true significance.
a Lilliefors Significance Correction

5.5.1 Body Mass Index (BMI)

The average BMI for the whole sample was 26.3 (SD±3.46). Out of 94 subjects visited, 11 were found to be obese while the rest were underweight, normal or overweight. Subjects with BMI <30 showed to be normotensive (mean SBP/DBP) of 128.65 ± SD 17.13 / 78.53 ± SD 12.2 mmHg), while those found to be obese were hypertensive (SBP 141.23 ± SD 21.54 mmHg). A significant correlation between BMI and BP: BMI and SBP ($r=0.3$, $p=0.001$), BMI and DBP ($r=0.26$, $p=0.006$) was noted, however, the relationship between the two variables were not statistically significant ($p=0.61$).

5.5.2 Waist to Hip Ratio (WHR)

The subjects were found to have WHR ranging from 0.76 to extreme ratio of 1.10. Out of all subjects 50 had acceptable ratio (<0.9) and the remainder had an unacceptable ratio (>0.9). Individuals with acceptable WHR had normal BP (about 123/75mmHg) while those with unacceptable WHR had raised BP of about 139/85mmHg see table 13 for more the observed trend.

Results revealed a positive partial correlation between WHR and SBP (r =0.52, p<0.0001) and DBP (r = 0.44, p<0.0001). Linear regression models were applied for each SBP and DBP as the dependent variable and WHR as the independent variables controlled for age to determine the relationship between WHR and BP (SBP and DBP). It indicated a positive significant relationship between WHR and SBP (p<0.05) however, no significant relationship as observed with DBP (p=0.17). The results continually demonstrate that WHR above the cut off point was generally associated with SBP more strongly (beta 0.30, p< 0.002) than DBP (beta 0.2, p<0.047). Further analysis indicated that those above WHR cut off point had 13.2mmHg (p<0.01) higher SBP and 6.3mmHg (p<0.05) higher DBP compared to those below cut off point (given the same age).

When a chi-square was performed to see if there was a relationship between BP (normotensive and hypertensive) and WHR (those below and above cut off point), a statistically significant relationship between the two categorical variables was found (chi square with one degree of freedom = 31.02, p<0.0001).

5.6 Blood pressure

Table 6 and 13 provide a good description of BP distribution among the subjects. The subjects had little raised systolic BP (p<0.001, difference = 10.12, 95% CI 6.43 to 13.81) compared to the norm of 120 mmHg, and lower SBP (p<0.001, difference=9.9, 95% CI 6.2 to 13.6). For the diastolic BP, there was very little difference (Mean difference = 0.488, 95% CI 2.16 to 3.13 p = 0.715>0.05) lower than the norm of 80 mmHg.

Out of the 94 subjects, 25.5% individuals were hypertensive (N=24, Mean age 47.17±SD 8.6) while the rest were normotensive (N=70, 74.5%). 3 (3.2%) had normal SBP but high DBP (>90mmHg), 7 had normal DBP but high SBP and 14 (14.9%) had both high SBP and DBP.

Table 13: Descriptive characteristics of the university lecturers

Variable		N	Mean ± SD	% of total N
Body Mass Index				
	Underweight	2	17.2401 ±.25	2.2%
	Normal	27	22.7933 ±1.65	29.0%
	Overweight	53	27.2213 ±1.38	57.0%
	Obese	11	32.2136 ±1.31	11.8%
	Total	93	26.3116 ±3.48	100.0%
Waist To Hip Ratio				
	Excellent Acceptable	22	0.8115 ± 0.02	23.4%
	Good Acceptable	27	0.8741 ± 0.01	28.7%
	Average	25	0.9236 ± 0.02	26.6%
	High Unacceptable	14	0.9668 ± 0.02	14.9%
	Extreme Unacceptable	6	1.0310 ± 0.04	6.4%
	Total	94	0.8964 ± 0.07	100.0%
Systolic Blood Pressure (mmHg)				
	optimal	28	112.71 ± 6.56	29.8%
	Normal BP	45	128.94 ± 5.19	47.9%
	High BP	21	155.84 ± 16.5	22.3%
	Total	94	130.12 ± 18.03	100.0%
Diastolic Blood Pressure (mmHg)				
	Optimal BP	51	70.39 ± 6.17	54.3%
	Normal BP	26	83.89 ± 2.78	27.7%
	High BP	17	100.18 ± 9.4	18.1%
	Total	94	79.51 ± 12.92	100.0%

When linear regression analysis was performed (other confounders kept constant), a positive correlation was realized between BP and age (SBP- r = 0.58, DBP – r = 0.53, p = 0.01). It was also noted that with every increase of one year in age, the systolic BP and Diastolic BP (on the average) increases by 1.094mmHg (95% CI 0.779 to 1.41) and 0.714mmHg (95%CI 0.48 to 0.95), p<0.001. However, when other confounders (participation in physical activity, smoking, drinking, BMI, and WHR) were considered, the increase of SBP and DBP with age dropped to 0.63mmHg and 0.582mmHg. Though age remained to be strong and non modifiable factor (p<0.05, β =0.352) of BP, participation in physical activities was able to reduce SBP by an average of 1.79 (p=0.05, β= - 0.02). Results of the partial correlation coefficient controlled for age, indicated a significant positive correlation between SBP and DBP (r=0.74, p<0.0001).

Chapter 6

DISCUSSION, CONCLUSION, LIMITATIONS, STRENGTHS AND RECOMMENDATIONS

6.0 Introduction

This chapter discusses the findings, concludes the study and presents recommendations for further studies.

6.1 Socio-demographic characteristics and hypertension

Hypertension is not an equal opportunity disorder as it does not affect persons with certain demographic characteristics more than persons without those characteristics. From the present study we found out a graded relationship between age and prevalence of hypertension. As we age, there is a natural tendency for BP to rise due to the reduced elasticity of the arterial system, however, this process does not progress uniformly at all sites of the arterial system.(163) This implies that, the older we get, the greater the risk for developing high BP.

The study further revealed the prevalence of hypertension to be more pronounced in individuals above the age of 45 than those who were young. The same observation was also noted by Bovet who indicated the prevalence rate of hypertension in Tanzania to be higher after the age of 45.(4) The mean SBP (130.12 mmHg) observed in this study was found to be lower than what was reported in the general population of urban Dar Es Salaam (136.3mmHg).(54) However, the mean SBP of this study closely resembles to the mean SBP of all the urban sub Saharan African populations which was demonstrated to be 130.9mmHg.*(ibid)*

Reports from various studies indicate that hypertension decrease is associated with the increase in the level of education.(164, 165) For instance, Izzo and his colleagues (166) reported the hypertension prevalence to be less for subjects having over 12 years of schooling than the opposite for all demographic groups. Such observation was not noted in this study. Despite the number of years lecturers spend in acquiring education, the level of their education was found to have no significant effect on the prevalence of hypertension ($p>0.05$).

The results obtained from this study demonstrated that marital status has no significant effect on BP. In addition, no significant difference in BP was noted between married and single subjects. This is contrary to the observations reported by Lipowicz and coworkers (167) who studied Polish men. They reported that never married men had on average higher SBP and DBP than married men and at a higher risk of hypertension when compared to married men even when adjusted for different demographic, socio-economic and life-style variables.

6.2 Social lifestyle

In multivariate analysis, the associations between participation in physical activity, smoking habits, drinking habits, and BP were analyzed using ANOVA. In the analysis, DBP and DBP were used as dependent variables and categorized participation in physical activity, smoking and drinking habits served as fixed factors among independent variables. Age, BMI, and WHR were used as independent variables.

6.2.1 Participation in physical activities and hypertension

This study noted an inverse relationship between those who reported participation in physical activity irrespective of the time they spent and SBP ($p=0.05$) after adjustment for age. Although small, the association was significant and remained significant even after adjusted for other potential confounders. As could be anticipated, participation in physical activity was associated with lower levels of BP just as previous findings indicated (126) and lower WHR.

Studies have reported that aerobic exercise training from 3 to 5 times per week for 30 to 60 minutes per session at moderate intensity can lower systolic/diastolic blood pressures by 2.6/1.8mmHg in normotensives and 7.4/5.8mmHg in hypertensives.(98, 99) In the same vein, randomized controlled trials showed that the average reductions in SBP/DBP among people with hypertension was about 7/6 mmHg and 3/2 mmHg among normotensive.(168) In this study we observed that participation in physical activity is associated with low SBP irrespective of how long and type of the exercise one engages in. Scientists widely advocate the use of physical activity as the best non pharmacological intervention that can provide an effective means to lower BP in a variety of populations.(108, 109, 169)

6.2.2 Smoking and hypertension

This study shows that majority of the university lecturers do not smoke and no significant correlation was found between smoking and BP. About 2% of the subjects reported to be smoking as compared to 20% reported by Bovet among Dar Es Salaam residents.(2) Although those who reported smoking exhibited higher SBP and DBP, no significant correlation was found between smoking and the BP. The two groups (those reported smoking and non smokers) showed no significant difference in their adjusted SBP and DBP.

Although smoking is being mentioned as one among the risk factors for cardiovascular disorders, no consensus has so far been reached among scientists regarding the association between smoking habits and BP (124, 170). Several studies (171-173) have indicated that no association existed between smoking habit and BP values that blood pressure of smokers was lower than that of non-smokers,(174-177) or that smoking raised blood pressure.(178, 179) As far as this study is concerned, the association between the two is insignificant.

6.2.3 Alcohol and hypertension

Lian in 1915 found out that, there is a relationship between alcohol and hypertension.(112) In our study alcohol drinking as correlated with BP however no significant relationship between the two was observed. This insignificant relationship was noted to be independent of level of education, smoking, and marital status. It is suggested that regular consumption of alcohol raises BP especially during the hours that alcohol is not consumed.(180) The Effect of alcohol on BP starts appearing at the lowest levels of intake and increasing with the amount consumed. Earlier published studies indicated some health benefits of drinking small amounts of alcohol; for instance the work done by Nakanishi and his coworkers has demonstrated that even very low alcohol consumption can be a health risk for many.(181) In the same line, studies indicate that consumption of excessive amounts of alcohol can consequently raise BP to unhealthy levels.(125, 126)

6.3 Anthropometric Indices

6.3.1 Body mass index

Majority of the respondents studied were overweight (57.4%), with average BMI 26.3 kgm^{-2}. Obesity is said to be one of the most important risk factors for hypertension.(13) Previous studies indicate that there is a strong relationship between BMI and blood pressure to the extent that this was considered as an universal finding from the majority of the initial studies.(182) Most of the surveys conducted have shown the correlation between relative weight and hypertension to be significant but low (0.20 to 0.30).(22) Njelekela and co-workers reported a significant correlation of BMI to SBP and DBP, in both genders in Tanzania.(48) However, the perception is challenged due to the current increased reports of blood pressures and hypertension prevalence rates in lean populations.(87) Contrary to the universal findings, this study found no significant correlation between the two variables among the male university lecturers. SBP and DBP were positively correlated with age while BMI was not, thus, BP increased with increasing age; while the BMI did not show any significant effect on BP. Such type of conclusion was also observed by Bose and co-workers in their cross sectional study of 150 adult Bengalee Hindu male in India (mean age 40.7 and BMI 23.2 kgm^{-2}). Through age controlled multiple regression analyses they demonstrated that BMI did not have any significant effect on BP variable.(183)

As documented by several authors body weight plays a significant role in BP and a positive relationship is said to exist between the two.(72, 74) However, this study found an insignificant the relationship between BMI and BP even after analyzing it based on four disaggregates; underweight, normal, overweight and obese. Such type of analysis based on four disaggregates of BMI tend to yield a negative association.(182) We can therefore conclude that there is no correlation between BMI and BP in general, and with hypertension prevalence in particular.

6.3.2 Waist to hip ratio

Despite being one of the most convenient methods for measuring obesity, BMI does not directly indicate the level of adiposity.(184) In this study, when compared to BMI, WHR was found to be strong measure of obesity. This study therefore used WHR alongside BMI as has long been recognized as a substantial component in the assessment of cardiovascular disease risk factors due to its strong positive association with hypertension.(69, 94, 185)

The abdominal accumulation of body fat, apart from overall level of adiposity, is associated with increased blood pressure and increased risk of hypertension.(85, 186) The same finding was also reflected in this study which as indicated in the significant association between WHR and hypertension. It was also revealed that majority of the sampled subjects (78.7%) had their WHR below cut off point (acceptable WHR) and normotensives, contrary; subjects above cut off point were characterized with hypertension. The study further demonstrated that a greater number of the subjects had acceptable level of the abdominal adiposity which puts them at lower risk of developing hypertension.

6.4 Blood pressure and the prevalence of hypertension

44.2% of the sampled University of Dar Es Salaam did not check their blood pressure in the previous two years compared to 30% of the members of the Southampton University community who had not checked their blood pressure for the same period of time.(187) It was also found that majority of the subjects were normotensive (74.5%, mean age 38.17, SBP 123mmHg, DBP 74mmHg), while the rest were hypertensives (25.5%, mean age 47.17, SBP 151mmHg, DBP 96mmHg). Hypertension rates amongst the university lecturers are slightly lower compared to the urban residents of Dar Es Salaam city. For instance, in the year 2000, Edwards and co-workers (54) found the prevalence to be 46.6% among urban residents aging between 35 and 54, and 77.8% among those above 55years. Recently survey conducted in the year 2005 demonstrated the prevalence of hypertension of about 30% among male adults in urban Dar Es Salaam population.(188) Previous studies have also suggested that the high prevalence of hypertension among urban dwellers is due to increasing urbanization and industrialization which has consequently made hypertension and its complications a major health threats in developing countries.(13) The findings of this study support the conclusions made by the previous surveys, as university lecturers live in the city of Dar Es Salaam.

6.5 Conclusion

The purpose of this study was to examine the relationship between different anthropometric indicators and prevalence of hypertension among male university lecturers in Tanzania, conscientize the community, and contribute information to the culture-congruent preventive and health modification strategies. The study made use of the anthropometric indices BMI and WHR, due to simplicity and reproducibility of height, weight, hip and waist circumferences measurements. Also both have long been recognized as important indicators for estimating cardiovascular disease risk factors, in particular their association with hypertension.

As demonstrated by the results we can draw conclusion regarding the relationship between BMI, WHR and the prevalence of hypertension based on findings from this study and other related ones. We found no significant relationship between BMI and BP in general, and with hypertension prevalence in particular. BP was significantly correlated with age and WHR while BMI was not. It was further noted that both BMI and WHR are modifiable, with WHR strongly associated with BP. Therefore attention should be given to maintaining an acceptable WHR below the cut off point. It is also of paramount importance that people reconsider their lifestyle to prevent an increase in WHR. Additionally the study indicates that at any given level of age and BMI, preventing or controlling an increase in WHR may have definite health benefits among the male university lecturers. This benefit becomes more obvious with advancing age.

Participation in physical activity has been shown to be of great importance in maintaining the acceptable WHR. Moreover, a WHR cut-off point of ≥0.95 could be utilized among this population (for men only) for health promotion purposes to prevent and manage hypertension.

6.6 Limitations

The researcher identified the following limitations:

i. The study estimated a minimum sample of 138 subjects, instead it was conducted based on a relatively small sample size (N=95) and therefore limited power to detect true relations/associations in/between several variables.

ii. It is to my understanding that estimation of participation in physical activity based on questionnaire and interview poses a threat to internal validity of the collected data, but nevertheless this was a useful and possibly the best available tool. In addition, this study did not measure the intensity of the exercise and so the evaluation is based upon self report.

iii. Despite the fact that the prevalence of hypertension in epidemiologic studies is likely to be overestimated if it is based on too few readings/visits.(189) this study relied on average of two or more readings taken at a single visit. This was so done due to time and financial constraints, availability and convenience for both subjects and researcher.

iv. The researcher understands that BP is somewhat sensitive to salt intake, however, no adequate measures of salt consumption was taken in this study.

6.7 Strengths

Despite the encountered limitations, this study expresses its strengths by including a wide demographic and socioeconomic diversity within the sample, collection of anthropometric and BP measures done by direct measurement rather than by self-report, control for relevant confounders in the estimates of association between anthropometric indicators and hypertension. In addition, the analytic procedures employed, has ensured comparability of evaluation and in terms of explanatory power of anthropometric indexes in the determination of the prevalence of hypertension among the university lecturers in Tanzania.

6.8 Recommendations

i. Whether the findings of this study apply to women and other university groups with different body habitus, merits further investigation.

ii. The data collected may not represent the entire university population in Tanzania since it was conducted at only one university located in Dar Es Salaam. It might have limited the generalizability of the results and therefore, a wider study is recommended which will cover both genders and majority universities in Tanzania.

APPENDICES

Appendix A: Questionnaire

BODY MASS INDEX, WAIST-TO-HIP RATIO AND THE PREVALENCE HYPERTENSION AMONG UNIVERSITY LECTURERS IN TANZANIA. A Case Study of University of Dar Es Salaam

Questionnaire

Faculty of ……………………………………………………Questionnaire number………

A Demographic characteristics:

1. Age: …………………………..years.
2. Marital status (tick one)

Single	Married	Divorced	Cohabitant

Highest Level of Education (degree) attained (tick one)

Bachelor	Masters	PhD

B Medical history

1. Do you have any disease that requires long term medication?

YES	NO

Specify:………………………………………………………………………………

2. Are you satisfied with your current health status? (Tick one)

1………...	2………	3…………	4…………..	5…………..
Very satisfied	Satisfied	Neither satisfied nor dissatisfied	Dissatisfied	Very dissatisfied

C Social lifestyle information

1. Do you participate in physical activities?

YES	NO

If YES, how many times (frequency)

Per week	How long per day?	
………..	………hours	….…minutes

2. Do you smoke?

Never	Current	Former

3. Do you drink?

Never	Current	Former

D Hypertension awareness

Were you ever told your blood pressure was high?

YES	NO

Have you had your blood pressure checked in the past two years?

YES	NO

E Anthropometric indices

Body Mass Index	Waist Hip Ratio
i. Height ………. …….. cm	i. Waist circumference ………………… cm
ii. Weight …………….. Kg	ii. Hip circumference ………………….. cm
BMI= …………………….	iii. WHR= …………………………………

F Blood Pressure

Systolic …………………….mmHg ii. Diastolic ……………… mmHg

Appendix B: A letter requesting for Field Study Permit

CHALLKULU BILINZOZI JOHN
P.O. BOX 62304,
DAR ES SALAAM, TANZANIA.
10.09.2008

DEPUTY VICE CHANCELLOR (ARC)
UNIVERSITY OF DAR ES SALAAM,
P.O. BOX 35091
DAR ES SALAAM, TANZANIA.

U.F.S.
HEAD OF DEPARTMENT,
PHYSICAL EDUCATION SPORT AND CULTURE,
FACULTY OF EDUCATION
UNIVERSITY OF DAR ES SALAAM.
P.O. BOX
DAR ES SALAAM, TANZANIA.

forwarded for action
please assist.
Ag. Head PESC Dept.
10/09/2008

Sir/Madam

Ref: **FIELD STUDY PERMIT**

The heading above refers.

I am Tanzanian student studying at the Norwegian University of Sport Science and Physical Education (NUSPE also called **Norges Idrettshogskole**) under the collaboration with the Department of Physical Education Sport and Culture, University of Dar Es Salaam. As part of my master programme at NUSPE I am required to write a thesis and I chose to conduct my study in my country, Tanzania. The study is titled: BODY MASS INDEX, WAIST HIP RATIO AND THE RISK OF DEVELOPING HYPERTENSION IN UNIVERSITY LECTURERS IN TANZANIA. CASE STUDY UNIVERSITY OF DAR ES SALAAM. The study will involve using a questionnaire, taking measurements of body height, weight, waist and hip circumference and blood pressure of the lecturers from the University of Dar es Salaam. The study will commence on 15th September, 2008 and end on 30th October, 2008.

I therefore request your office to help me with the study permit before I proceed.

Attached with this letter, please find an introductory letter from NUSPE and research abstract. proposal.

Thanking you in advance for your assistance.

Yours Sincerely

Bilinzozi

John, C.B.

Mob.# 0716 661088

Appendix C: Research Permit Letter

UNIVERSITY OF DAR-ES-SALAAM

OFFICE OF THE VICE-CHANCELLOR

P.O. BOX 35091 ♦ DAR ES SALAAM ♦ TANZANIA

Ref. No: AB3/12(B)

Date: 12th September, 2008

To: The Deputy Vice-Chancellor - Planning, Finance and Administration,
University of Dar es Salaam.

UNIVERSITY STAFF AND STUDENTS RESEARCH CLEARANCE

The purpose of this letter is to introduce to you **Mr. Chalukulu Bilinzozi John** who is a bonafide student of the University of Dar es Salaam and who is at the moment conducting research. Our staff members and students undertake research activities every year especially during the long vacation.

In accordance with a government circular letter Ref.No.MPEC/R/10/1 dated 4th July, 1980 the Vice-Chancellor was empowered to issue research clearances to the staff and students of the University of Dar es Salaam on behalf of the government and the Tanzania Commission for Science and Technology, a successor organization to UTAFITI.

I therefore request you to grant the above-mentioned member of our University community any help that may facilitate him to achieve research objectives. What is required is your permission for him to see and talk to the leaders and members of your institutions in connection with his research.

The title of the research in question is **"Body Mass Index, Waist Hip Ratio and The Risk of developing hypertension in University Lecturers in Tanzania: Case of the University of Dar es Salaam".**

The period for which this permission has been granted is **September, 2008** to **October, 2008** and will cover the following areas/offices: **University of Dar es Salaam.**

Should some of these areas/offices be restricted, you are requested to kindly advise him as to which alternative areas/offices could be visited. In case you may require further information, please contact the Directorate of Research and Publications, Tel. 2410500-8 Ext. 2087 or 2410743.

Prof. Rwekaza S. Mukandala
VICE-CHANCELLOR

VICE CHANCELLOR
UNIVERSITY OF DAR-ES-SALAAM
P.O. BOX 35091
DAR-ES-SALAAM

Direct: +255 22 2410700
Telephone: +255 22 2410500-8 ext. 2001
Telefax: +255 22 2410078

Telegraphic Address: UNIVERSITY OF DAR ES SALAAM
E-mail: [illegible]
Website address: [illegible]

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