

**FACTORS ASSOCIATED WITH HYPERTENSION AMONG  
EMPLOYEES IN ARUSHA CITY, TANZANIA**

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## **ABSTRACT**

Tanzania is one of developing countries with a higher prevalence of hypertension than many other developing countries. Healthcare workers, teachers and bankers are occupation groups exposed to hypertension due to the nature of their work. There is currently limited published data on the burden of hypertension among this group in Tanzania. A descriptive cross-sectional study was therefore conducted and collection of the data was done from August 2019 to February 2020 to identify the predicting factors for hypertension among teachers, bankers and healthcare workers in Arusha city council. A total of 305 working adults aged 18–60 years were involved in the study. A modified World Health Organization (WHO) STEPwise approach to chronic disease risk factor surveillance questionnaire collected information about socio-demographic characteristics, lifestyle behaviors, dietary practices, physical activity level, anthropometric measurements and biochemical measurements. The data collected were calculated and ranked by using WHO guidelines. The overall hypertension prevalence among working adults was 23.8%. Age (Adjusted Odds Ratio [AOR=34.98, 95% CI: 1.30-94.03]), alcohol consumption (AOR=6.55, 95% CI: 1.22-35.28), low salary (AOR=6.44, 95% CI: 1.12-37.18) and high Low-Density Lipoprotein cholesterol (LDL-C) (AOR=5.93, 95% CI: 1.24-28.45), were significantly associated with hypertension. These findings can be used by local policymakers, education, financial and health sectors as baseline information when planning strategies for management and prevention of hypertension and other Non-Communicable Diseases (NCDs) at workplace, by designing workplace wellness programs to mitigate the associated factors.

## DECLARATION

I, Dalahile Zubery do hereby declare to the Senate of Nelson Mandela African Institution of Science and Technology that this dissertation is my original work and that it has neither been submitted nor being concurrently submitted for degree award in any other institution.

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## CERTIFICATION

The undersigned certify that they have read the dissertation titled "*Factors Associated with Hypertension among Employees in Arusha City, Tanzania*" and recommend for examination in fulfilment of the requirements for the degree of Master's in Life Sciences of the Nelson Mandela African Institution of Science and Technology.

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## **DEDICATION**

This work is dedicated to my parents.

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## **LIST OF ABBREVIATION AND SYMBOLS**

AOR	Adjusted Odds Ratio
BMI	Body Mass Index
BP	Blood Pressure
CI	Confidence Interval
COR	Crude Odds Ratio
CVDs	Cardiovascular diseases
DBP	Diastolic Blood Pressure
HDL-C	High-Density Lipoprotein Cholesterol
JNC VII	Seventh Report of the Joint National Committee on Prevention Detection, Evaluation and Treatment of High Blood Pressure.
KNCHREC	Northern Tanzania Health Research Ethics Committee
LDL-C	Low-Density Lipoprotein cholesterol
MET	Metabolic Equivalent
MmHg	Millimeters of Mercury
Mmol/L	Millimole per Liter
NCDs	Non-Communicable Diseases
OR	Odds Ratio
RBG	Random Blood Glucose
RPM	Revolutions per Minute
S.D	Standard Deviation
SBP	Systolic Blood Pressure
SPSS	Statistical Programme for Social Science
TG	Triglycerides
TC	Total Cholesterol
WC	Waist Circumference
WHO	World Health Organization

## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background of the Problem

Cardiovascular diseases (CVDs) are the leading cause of death among all non-communicable diseases (NCDs), causing about 44% of all NCDs deaths and 31% of all global deaths (World Health Organization [WHO], 2018). Hypertension is the major risk factor for CVDs, like heart attack, stroke and heart failure (Mozaffarian *et al.*, 2014; Ogah *et al.*, 2012). Globally, 22% of adults have hypertension (WHO, 2018). There is an increase in the number of hypertensive adults from 594 million in 1975 to 1.13 billion in 2015 (Zhou *et al.*, 2017). The highest hypertension prevalence (27%) has been reported in the African region and the lowest prevalence (18%) is found in America (WHO, 2018). In a review of hypertension prevalence in developing countries, it was reported a higher hypertension prevalence in Tanzania than in many other developing countries (Ibrahim & Damasceno, 2012).

Hypertension prevalence in Tanzania has risen from 2% to 10% in 1960s to 13% to 79% in 2016 for rural and urban populations (Isungula & Meda, 2017). The higher hypertension prevalence in Tanzania is attributed to tobacco smoking, excessive use of alcohol, unhealthy eating habits and physical inactivity (Mayige *et al.*, 2011). A sedentary lifestyle is one of predicting factors for hypertension (Henson *et al.*, 2013) ascribed by rapid unplanned urbanization, which influences the adaptation of sedentary occupations (Brownson *et al.*, 2005). Occupation is the predicting factor for hypertension due to its association with socio-economic status and lifestyle factors such as physical inactivity and sedentary lifestyle (Allman Farinelli *et al.*, 2010; Henson *et al.*, 2013).

Healthcare workers, teachers and bankers are occupation groups identified to be exposed to the risk of hypertension (Mohammedirfan *et al.*, 2011; Shivaramakrishna *et al.*, 2010; Sovova *et al.*, 2014). The nature of their work makes them spend long hours at work doing sedentary activities also the socio-economic status can influence the adaptation of less physical activities. Determining the factors that may predict hypertension among employees in this study was important due to the following reasons: Firstly, protection of available workforce productivity from chronic illnesses; secondly, healthcare workers play a great role in taking care of patients and promoting a healthy lifestyle for patients; thirdly, teachers are role models to students and

may influence the adaption of healthy lifestyle by students and their parents; and lastly, bankers have a great role in building and maintaining the financial sector in the country.

Despite that, there is limited documentation on the predictors of hypertension among adults in Tanzania, and Arusha specifically. Therefore, the current study aimed to identify the factors associated with hypertension among healthcare workers, teachers and bankers in Arusha City Council for designing workplace intervention for management and prevention of hypertension and other NCDs at workplace.

## **1.2 Statement of the Problem**

While the prevalence of hypertension in adults among developed countries has declined in the last few decades, it has been stable or increasing in many developing countries (WHO, 2018). Although there is limited published data on the predictors of hypertension among working adults in Tanzania, the 2012 WHO Stepwise survey reported that 26% of the adult population is hypertensive, with 68% of the population never screened for blood pressure (WHO, 2012). In Tanzania, the prevention and management of NCDs at workplace through workplace programs for physical activity and healthy eating habit is still a challenge.

Workplace health programs have been identified by WHO as the most cost-effective ways for management and prevention of hypertension in countries where the provisions of health care for chronic diseases are still limited (Bosu, 2016; WHO, 2010). To implement workplace health programs, World Health Organization (WHO) recommended identifying the factors associated with hypertension as an important step in providing baseline information in planning for prevention and management of hypertension and other NCDs (WHO, 2013).

Since there is limited information to inform policymakers on the predicting factor for hypertension among working adults, the study aimed to identify the predicting factor for hypertension among healthcare workers, teachers and bankers to generate baseline information in designing workplace intervention for the prevention and management of hypertension and other NCDs at workplace.

## **1.3 Rationale of the Study**

The higher prevalence of hypertension have been reported in Tanzania than in many other developing countries. Despite that, there is limited information on the burden of hypertension



among working adults. Therefore this study aimed to determine the factors associated with hypertension among healthcare workers, teachers and bankers. This will enable the identification of predictors of hypertension among working adults and help to design workplace intervention for the prevention and management of hypertension at workplace.

## **1.4 Objectives**

### **1.4.1 Main Objective**

To determine the factors associated with hypertension among healthcare workers, teachers and bankers aged 18-60 years old in Arusha City Council.

### **1.4.2 Specific Objectives**

- (i) To determine the prevalence of hypertension among healthcare workers, teachers and bankers aged 18-60 years old in Arusha City Council.
- (ii) To assess the behavioral factors associated with hypertension among healthcare workers, teachers and bankers aged 18-60 years old in Arusha City Council.
- (iii) To determine the biochemical factors associated with hypertension such as blood glucose and serum lipid profile among healthcare workers, teachers and bankers aged 18-60 years old in Arusha City Council.

## **1.5 Research Questions**

- (i) What is the prevalence of hypertension among healthcare workers, teachers and bankers aged 18-60 years old in Arusha City Council?
- (ii) What are the behavioral factors for hypertension among healthcare workers, teachers and bankers aged 18-60 years old in Arusha City Council?
- (iii) What are biochemical factors associated with hypertension among healthcare workers, teachers and bankers aged 18-60 years old in Arusha City Council?

## **1.6 Significance of the Study**

The findings from the current study fill the knowledge gap on the factors associated with hypertension among working adults in Arusha and generate baseline information about the

factors associated with hypertension among healthcare workers, teachers and bankers. It informs the policy makers to develop workplace intervention strategies to mitigate the risk factors for hypertension and related NCDs but also indirect community intervention through patients, students and customers.

### **1.7 Delineation of the Study**

The current study was descriptive cross-sectional which is limited on exploring the causal relationship between the risk factors and hypertension since data were collected at once. Furthermore, the study participants were working professionals from urban residents hence, generalizing the result to all working adults is not appropriate especially for those who are working in rural areas. In addition, majority of the study respondents were female in comparison with other studies due to a large proportion of females than males in the study population. Another limitation encountered was on blood sample collection for biochemical assay tests. Random blood samples were collected among study respondents. This may cause misclassification of the biochemical assay, especially on triglyceride levels as it remains high for several hours after a meal. Moreover, the best way to assess dietary intake of salt is by measuring the urinary electrolyte but in this study, the assessment was based on a questionnaire only. Also, the one month recall of foods consumed on assessment of dietary intake may be subjected to recall bias that may result to misreporting or over-reporting.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Hypertension or Raised Blood Pressure**

Hypertension is a condition in which the blood vessels have persistently raised pressure (WHO, 2013). The measurement of blood pressure is done in millimeters of mercury (mmHg) and recorded as systolic blood pressure, the highest pressure in blood vessels when the heart beats and diastolic blood pressure, the lowest blood pressure in blood vessels between heartbeats (WHO, 2013). The normal blood pressure for adults is systolic blood pressure less than 120 mmHg and diastolic blood pressure less than 80 mmHg and raised blood pressure is categorized as systolic blood pressure equal to or above 140 mmHg and diastolic blood pressure equal to or above 90 mmHg. Normal blood pressure is required for the overall health and wellbeing of vital organs such as heart, kidneys and brain (Momin *et al.*, 2012; WHO, 2013). Hypertension is associated with cardiovascular disease, hardening of the arteries, kidney disease, stroke, and eye damage (WHO, 2009).

#### **2.2 Prevalence of Hypertension**

Globally, the hypertension prevalence among adults is 22%, whereby one in five women and one in four men had hypertension (WHO, 2018). In sub-Saharan Africa, the overall prevalence of hypertension ranges from 30.0% to 31.1% among adults indicating a major health threat to the community (Ataklte *et al.*, 2014; Nduka *et al.*, 2015). The hypertension prevalence varies from country to country as follows; Kenya (24.5%), Namibia (46.0%), Ethiopia (35.2%), and Tanzania (25.9%) (Alwan, 2011; Craig *et al.*, 2018; Kagaruki & Mayige, 2016; Mohamed *et al.*, 2018). The variation in hypertension prevalence between countries may be caused by a difference in the level of urbanization, cultural habits, dietary practices and ethnicity (Ogah & Rayner, 2013). Despite, the increased hypertension prevalence in developing countries, including Tanzania, there is limited documentation about the hypertension prevalence among working adults.

#### **2.3 Occupation and Hypertension**

Occupation is another factor associated with hypertension (Allman Farinelli *et al.*, 2010; Henson *et al.*, 2013). Healthcare workers, teachers and bankers are recognized as a high-risk

group exposed to hypertension and other cardiovascular diseases (Awosan *et al.*, 2017; Mohammedirfan *et al.*, 2011; Shivaramakrishna *et al.*, 2010; Sovova *et al.*, 2014). This is caused by sedentary nature of their work that makes them less physically active (Ogungbenle *et al.*, 2017). Besides, urbanization has fueled changes in lifestyle, whereby people have reduced physical activity and changes in dietary habits (Contento, 2010). Although different studies have shown that, healthcare workers (Osei-Yeboah *et al.*, 2018; Sovova *et al.*, 2014), teachers (Fikadu & Lemma, 2016; Wijayathunge & Hettiaratchi, 2017), and bankers (Ismail *et al.*, 2013; Kumar & Sundaram, 2014; Manjula *et al.*, 2016) are high-risk group exposed to hypertension, this occupation group is neglected during research studies in Tanzania.

## **2.4 Factors Associated with Hypertension**

### **2.4.1 Non-modifiable Risk Factors for Hypertension**

Non-modifiable risk factors associated with hypertension include sex, family history, age and genetics (Ibekwe, 2015). Increased age is associated with hypertension for both females and males. Studies have shown that, as the age of the person increases, the chance for increased blood pressure becomes high (Craig *et al.*, 2018; Kunutsor & Powles, 2009; Mohamed *et al.*, 2018). Other studies done in Africa including individuals aged 15 years and above had similar findings (Dzudie *et al.*, 2012; Walker *et al.*, 2000).

High risk of hypertension is mostly found in males compared to females (Asfaw *et al.*, 2018; Ekwunife *et al.*, 2010; Ibrahim *et al.*, 2008) but after menopause, the risk of hypertension in term of age become the same. World Health Organization (WHO) Stepwise survey conducted in African countries between 2003-2009 has found a high hypertension prevalence in males than females in the majority of the countries although in some countries the findings were vice-versa (Van de Vijver *et al.*, 2014). The association between genetics and hypertension depends on the family history of hypertension. He *et al.* (2011) studied genes relating to hypertension and found 20 different genes which affected sodium handling in the kidney hence affecting the blood pressure of the affected individual.

### **2.4.2 Modifiable Risk Factors for Hypertension**

The behavioral factors associated with hypertension include unhealthy eating habits, overweight and obesity, physical inactivity, excessive use of alcohol and tobacco smoking which result in metabolic syndrome such as hyperlipidemia, diabetes and hypertension (WHO,

2013). Unhealthy eating is associated with too much consumption of trans-fats and saturated fat, high dietary intake of salt and low consumption of vegetables and fruits (WHO, 2012). The association between unhealthy eating habit and hypertension have been observed in different studies (Njelekela *et al.*, 2003; Nurwanti *et al.*, 2018; Onyango *et al.*, 2017; Popkin, 2006).

Overweight and obesity are other factors associated with hypertension in the population. Excess body weight increases the demand for nutrients and oxygen to the tissues, the increase in blood volume that flow through blood vessels increase the pressure on the arteries which can result in hypertension (Bouchi *et al.*, 2016). For adults aged 18 years and above the estimate shows that among three adults one of them is overweight and more than one in ten are obese, whereby women have excess body weight compared to men (WHO, 2016).

Physical inactivity is the contributing factor for hypertension. The WHO has reported that 28% of adults have inadequate physical activity according to the recommendation while men are active by 32% compared to females 23% (WHO, 2018). Findings show that physical inactivity contributes to the high risk of hypertension and other heart diseases due to increased heart rate that hardens the contraction of the heart and increases pressure to the arteries also, physical inactivity is associated with excessive weight gain (Hayes *et al.*, 2002; Huai *et al.*, 2013; Ketkar *et al.*, 2015, Werneck *et al.*, 2018).

Another factor associated with hypertension is excessive alcohol consumption which results in disabilities and premature deaths among different populations in the world (WHO, 2008). Excessive alcohol users are more exposed to hypertension compared to non-alcohol users (Kotwani *et al.*, 2013; Mohamed *et al.*, 2018; Wamala *et al.*, 2009; Williams *et al.*, 2013). There is more than one mechanism that links excessive alcohol consumption and hypertension such as baroreceptors sensitivity, the effect on the level of calcium and cortisol. For example, baroreceptors help the body to regulate blood pressure but excessive use of alcohol prevents the detection of the body's baroreceptors to detect the need of stretching the blood vessels to increase the diameter of the blood vessels resulting in raised blood pressure (Husain *et al.*, 2014). The use of tobacco which includes smoking and smokeless tobacco is also associated with onset of hypertension caused by the release of tobacco chemicals that damage the arteries walls and cause narrowing of the arteries which end up with raised blood pressure (Burns, 2003; Stein *et al.*, 2008).

### **2.4.3 The Biochemical Factors Associated with Hypertension**

Diabetes and hyperlipidemia are metabolic syndromes associated with hypertension. Diabetes is characterized by the failure of the pancreas to produce insulin hormone or the pancreas having a reduced ability to produce insulin in the body (Association, 2005). Diabetes and hypertension may influence each other. This is because insulin resistance cause sugar builds up in the blood that increases the volume of the blood and raises the blood pressure. Also, diabetes can damage the small blood vessels resulting in stiffening of blood vessels which results to hypertension (Kabakov *et al.*, 2006). The association between diabetes and hypertension have been reported in different studies (Lloydm Sherlock *et al.*, 2014; Mayige *et al.*, 2011; Mosha *et al.*, 2017).

The raised lipid profile is associated with the formation of atherosclerosis that hardens and narrows the arteries and increases the chance of developing hypertension (Arora *et al.*, 2007; Chamba *et al.*, 2017). Raised lipid profile has been reported in several general population studies in Africa (Vorster, 2002). However, raised lipid profile is increasing in developing countries like Tanzania. A study done by Kagaruki and Mayige (2016) for example, has reported elevated serum Total Cholesterol prevalence of 4.4% and 25.8% prevalence of elevated Triglycerides (TG) among adults in Tanzania. Determining the raised blood glucose and abnormal lipid profile levels among working adults fills the knowledge gap on the relationship between lipid profile and hypertension among working adults.

## CHAPTER THREE

### MATERIALS AND METHODS

#### 3.1 Study Design

The study was a descriptive cross-sectional that measure the outcome (hypertension) and exposure at one point in time.

#### 3.2 Study Area

The study was conducted in Arusha City Council, Arusha Region. It is a third urbanized region in Tanzania due to an urban population of 31.3% than the national average of urban population 23.1% (Worrall *et al.*, 2017). Arusha City is found near the foot of Mount Meru. As per the National Census of 2012, the city has a total population of 416 442 of which 160 091 are employees (The United Republic of Tanzania [URT], 2016). By comparing with other districts in the region, Arusha city has a high number of employees. The Southern part of the region is bordered by Singinda and Manyara regions, the Northern part is bordered by Kenya, the Eastern part is bordered by Kilimanjaro region and the Western part is Simiyu region. The region is a global tourist destination having national parks such as Lake Manyara National Park, Arusha National park and Ngorongoro Conservation Area (URT, 2015).

#### 3.3 Study Population

The study involved healthcare workers, primary and secondary teachers and bankers aged between 18-60 years working in the Arusha City Council. The study included both males and females from government and non-government institutions excluding part-time workers and pregnant women.

#### 3.4 Sample Size Determination

The sample size was estimated by using the Fischer formula (Fischer *et al.*, 1991).

$$n = \frac{Z^2 pq}{d^2}$$

Where; n = sample size, p = the prevalence of hypertension, d is precision of estimate =5%, Z = standard value of 95% CI =1.96 and q= 1-p.

The minimal sample size estimated was 380 participants; the Prevalence of hypertension was 45%, from a study conducted at Arusha City council by Katalambula *et al.* (2017).

### **3.5 Sampling Procedure**

A multistage sampling technique was used in this study. At the first stage, clusters were formed purposively for Healthcare institutions, Educational institutions (primary and secondary schools) and Financial Institutions (Banks). In the second stage, out of 25 wards, 3 wards (Levolosi, Sekei, and Themi) were selected purposively due to an adequate representative number of health centers, schools and banks. In the third stage, randomly selection of health centers, schools and banks from 3 wards were as follows: out of 21 health centers 8 were selected, for schools out of 22 schools 10 were selected and for banks, out of 18 banks 8 were selected by using ballot method and lastly, a representative sample was obtained by using probability proportional to the size and the sample from healthcare workers was 51, teachers 176 and bankers 153. From each site, the eligible number of participants from health center was at least 8 healthcare workers, for schools and banks at least 13 participants from each and at this stage the participation was voluntary.

### **3.6 Data Collection Tools**

Participant enrollment and collection of data was done from August 2019 to February 2020. The pre-tested modified WHO STEP-wise survey questionnaire including the Global Physical Activity Questionnaire translated from English to Swahili for easy administration collected data on behavioral factors, which included socio-demographic data, as well as information on alcohol consumption, tobacco use, dietary intake, anthropometric measurement, biochemical measurement, physical activity level and history of chronic diseases (Appendix 1). The dietary habit of the study participants was collected by using the Food Frequency Questionnaire (Appendix 2) which was validated by Jordan *et al.* (2013).

### **3.7 Data Collection Methods**

#### **3.7.1 Determination of Prevalence of Hypertension**

Blood pressure was measured by using a digital sphygmomanometer (CITIZEN®) in a seated position. Three measurements were done in the right upper arm after 5 minutes rest interval and the average of it was used in data analysis. The classification of blood pressure based on



the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC VII) as follows: Normotensives were classified as systolic blood pressure (SBP) < 120 mmHg and diastolic blood pressure (DBP) < 80 mmHg, prehypertension (SBP 120–129 mmHg or DBP 80–89 mmHg), hypertension stage 1 (SBP 140–159 mmHg or DBP 90–99 mmHg), and hypertension stage 2 (SBP  $\geq$  160 mmHg or DBP  $\geq$  100 mmHg) (Chobanian *et al.*, 2003). The prevalence of hypertension was determined using the WHO formula (WHO, 2006).

### **3.7.2 Assessment of Behavioral Factors for Hypertension**

#### **(i) Assessment of Tobacco Use and Alcohol Consumption**

The use of tobacco was assessed by previous and current smoking status, the duration of smoking, daily frequency of tobacco use, exposure to second-hand smoking and the use of smokeless tobacco. The assessment of alcohol consumption was done by recalling if the study participant was a lifetime abstainer, 12-month abstainer and past 30-day drinker. Also, the frequency of alcohol use, type of alcohol consumed frequently and consumption of alcohol with food was documented.

#### **(ii) Assessment of Dietary Intake**

The assessment of dietary intake included the number of days on the consumption of fruit and vegetable in a week, the serving portion, type of meals eaten at work per week, type of fat and oils used frequently in meal preparation at home. Salt consumption assessment was done by asking the study respondents about the frequency of salt used during food preparation at home, the use of table salt, perception of the amount of salt consumed and its association with health problems, also the health benefit of minimizing salt intake and the strategies undertaken to control salt consumption. The Food Frequency Questionnaire (Appendix 2) was used to assess the frequency of consumption of food groups in a month to determine the dietary practices of the participants.

#### **(iii) Anthropometric Measurements**

Anthropometric measurements were taken by a qualified healthcare provider. A portable SHORR<sup>TM</sup> stadiometer (Shorr Productions, Olney, MA, USA), was used to measure the height of the study participants. The respondents removed shoes and stand still with their back against

the wall and heels put together in a V-shape while looking forward and the measurement was taken nearest to 0.5 cm. SECA<sup>TM</sup> digital weighing scale (Seca GmbH, Hamburg, and Germany) was used to measure body weight. The participants were asked to remove their footwear and heavy accessories and measurement were taken nearest 0.1 kg. Then, the Body Mass Index (BMI) was calculated using the WHO formula ( $\text{kg/m}^2$ ) and the results were ranked as follows:  $\leq 18.4 \text{ kg/m}^2$  as underweight, 18.5-24.9  $\text{kg/m}^2$  as normal weight, 25.0-29.9  $\text{kg/m}^2$  as overweight, and  $\geq 30 \text{ kg/m}^2$  as obese (WHO, 2016). Waist circumference was measured midway between the last rib bone and iliac bone by using a measuring tape and the measurement was taken nearest to 0.5 cm. The results were ranked as follows:  $>80 \text{ cm}$  for females and  $>94 \text{ cm}$  for males had increased risk of metabolic complication and  $>88 \text{ cm}$  for females and  $>102 \text{ cm}$  for males had substantially increased risk of metabolic complication. The measurements lined with the standard method of anthropometric measurement (WHO, 2005, 2014).

#### **(iv) Assessment of Physical Activity Level and stress**

The physical activity level was assessed by using the Global Physical Activity Questionnaire by considering the intensity, frequency and duration of physical activity in different areas specifically during transport, at work and in recreational areas. The collected data included the number of days in a week, time spent doing physical activity in hours and minutes during transport, at work and recreational area for at least 10 minutes or more continuously in a day (Armstrong & Bull, 2006). To determine the Metabolic Equivalent (MET) which measure the energy expenditure of physical activity, the intensity, frequency and duration of physical activities performed in a week were used and physical activity level was classified by following a standard classification as high physical activity level, moderate physical activity level and low physical activity level (Armstrong & Bull, 2006) and sedentary work was classified as a job that needs a person to sit for 6 hours out of 8 hours at work. For stress, the participants were asked about feeling stressed at work, perception of the salary, working for long hours, unrealistic time pressure and respect at work.

### **3.7.3 The Biochemical Factors Associated with Hypertension**

#### **(i) Determination of Blood Glucose and Lipid Profile**

A standardized Glucometer machine (GlucoPlus<sup>TM</sup> Inc. Quebec, Canada) was used to measure Random Blood Glucose (RBG) by using the capillary finger-prick method. Diabetes was

determined by having random plasma glucose of  $\geq 11.1$  mmol/L or the use of diabetic drugs. A random sub-sample of half of the participants was selected for additional measurement of serum lipid profile. The size of this sub-sample (153 participants) was determined based on the availability of resources. A qualified healthcare provider collected blood samples from participants. The Vacutainer needle collected blood from the median basilic vein of the participant and stored in a red top Vacutainer® blood collection tube and left to clot for 45 minutes. Then, centrifugation was done at a spin rate of 1100-1300 rpm for 10 minutes. Afterwards, serum was pipetted from the clotted blood and stored in a 2 ml Eppendorf tube. All serum samples were frozen at -20 °C until analysis. Serum lipid profiles included; Total cholesterol (TC), Triglyceride (TG), High-Density Lipoprotein Cholesterol (HDL-C) and Low-Density Lipoprotein Cholesterol (LDL-C). All biochemistry assays were carried out at Mount Meru Regional Hospital laboratory using fully automated Chemistry auto analyzer XL-180 (Vital Scientific, B.V. Kanaalweg 24, and Netherlands). The identification of serum lipid profile was ranked according to the WHO cut-off point (WHO, 2005).

### **3.8 Statistical Analysis**

The collected data were entered in Microsoft Excel™ (2016) and exported to Statistical Package for Social Science Version 20.0 software (SPSS Inc., Chicago, IL, USA) for analysis. Descriptive statistics analyzed social-demographic characteristics and frequency and percentage were used to analyze categorical data. For continuous data mean and standard deviation were used. On the assessment of the difference between groups, a chi-squared test was used for categorical variables and a t-test for continuous variables. To test the normality assumption of variable distribution the Kolmogorov–Smirnov test was used. Binary logistic regression analysis was done to determine the factors that were associated with hypertension. The independent variables were social demographic characteristics, behavioral risk factors which included; dietary habits, dietary salt intake, Body Mass Index, stress, physical activity level, alcohol consumption and tobacco smoking while the dependent variable was hypertension. To test the goodness fit of the model Hosmer-Lemeshow statistic was used and the results reported in odds ratios (OR) at 95% confidence intervals and  $p < 0.05$  was statistically significant.

### **3.9 Ethical Considerations**

The study was conducted according to the Declaration of Helsinki. Ethical clearance certificate number KNCHREC 0014 was obtained from Northern Tanzania Health Research Ethics Committee (KNCHREC). Written permission to conduct research was also sought from Arusha City Council and administrators of the selected banks, schools and health facilities. Respondents signed written informed consent after being briefed about the study. To ensure confidentiality data collection was done individually in a special prepared room in their working area and codes known only by researchers were used instead of names in identifying participants to maintain anonymity.

## **CHAPTER FOUR**

### **RESULTS AND DISCUSSION**

#### **4.1 Results**

##### **4.1.1 Socio-demographic Characteristics of the Study Participants**

A total of 305 study participants were included in this study. However, 19 were excluded from statistical analysis due to the incompleteness of data. The final sample size was 286 respondents from three occupations: healthcare workers (61; 21.3%), teachers (131; 45.8%), and bankers (94; 32.9%). The majority of the respondents (204; 71.3%) were female. Nearly half of the respondents (121; 42.3%) were aged 30–39 years; 141 (49.3%) of the study participants had attended college education and (182; 63.6%) were married or cohabiting. Nearly half 122 (42.7%) of the study respondents worked for more than seven years in the current institution and in term of estimated monthly income per month, 22 (7.7%) were earning less than 250 000 (Table 1).

**Table 1: Socio-demographic characteristics of respondents stratified by blood pressure status**

Variable	Total n (%)	Normotension n (%)	Pre- hypertension n (%)	Hypertension n (%)	P- value
Profession					
Healthcare workers	61 (21.3)	33 (54.1)	17 (27.9)	11 (18.0)	0.082
Teachers	131 (45.8)	69 (52.7)	37 (28.2)	25 (19.1)	
Bankers	94 (32.9)	42 (44.7)	20 (21.3)	32 (34.0)	
Age					
18-29 Years	75 (26.2)	44 (58.7)	17 (22.7)	14 (18.7)	0.029
30-39 Years	121 (42.3)	65 (53.7)	34 (28.1)	22 (18.2)	
40-49 Years	49 (17.1)	19 (38.8)	15 (30.6)	15 (30.66)	
50-60 Years	41 (14.3)	16 (39.0)	8 (19.5)	17 (41.5)	
Gender					
Male	82 (28.7)	37 (45.1)	23 (28.0)	22 (26.8)	0.526
Female	204 (71.3)	107 (52.5)	51 (25.0)	46 (22.5)	
Education level					
College	141 (49.3)	76 (53.9)	37 (26.2)	28 (19.9)	0.637
University graduate degree	122 (42.7)	57 (46.7)	31 (25.4)	34 (27.9)	
Postgraduate degree	23 (8.0)	11 (47.8)	6 (26.1)	6 (26.1)	
Marital status					
Single	104 (33.2)	57 (60.0)	20 (21.1)	18 (18.9)	0.028
Married/Cohabiting	182 (63.6)	84 (46.2)	51 (28.0)	47 (25.8)	
Years with the current institution					
Less than a year	24 (8.4)	13 (54.2)	4 (16.7)	7 (29.2)	0.194
1-3 years	58 (20.3)	36 (62.1)	14 (24.1)	8 (13.8)	
4-6 years	82 (28.7)	42 (51.2)	18 (22.0)	22 (26.8)	
7 years and above	122 (42.7)	53 (43.4)	38 (31.1)	31 (25.4)	
The estimated income per month					
Less than 250 000	22 (7.7)	12 (54.5)	4 (18.2)	6 (27.3)	0.299
250 000-500 000	79 (27.6)	47 (59.5)	18 (22.8)	14 (17.7)	
500 000-750 000	83 (29.0)	41 (49.4)	25 (30.1)	17 (20.5)	
750 000-1 000 000	64 (22.4)	26 (40.6)	20 (31.3)	18 (28.1)	
More than 1 000 000	38 (3.3)	18 (47.4)	7 (18.4)	13 (34.2)	

## 4.2 Prevalence of Hypertension

The overall mean ( $\pm$ SD) Systolic Blood Pressure (SBP) of the study participants was 124.4 $\pm$ 19.2 mmHg and Diastolic Blood Pressure (DBP) was 79.0 $\pm$ 12.8 mmHg (Table 4). About half (144; 50.3%) of the study participants had normal blood pressure, 24 (8.4%) had

hypertension stage 1 and 14 (4.8%) had hypertension stage 2 (Table 2). For those who had hypertension, 42 (61.8%) were aware of their condition and 25 (59.5%) were using antihypertensive medication. Furthermore, 14 (28.6%) of hypertensive working adults had a family history of hypertension.

**Table 2: Prevalence of hypertension**

Variable	N	Percent (%)
Normal (SBP < 120 and DBP < 80)	144	50.3
Pre-hypertension (SBP 120–139 or DBP 80–89)	74	25.9
Hypertension		
Isolated Systolic hypertension (SBP $\geq$ 140 mmHg and DBP $\geq$ 90 mmHg)	18	6.3
Isolated Diastolic hypertension (SBP $\geq$ 140 mmHg and DBP < 90 mmHg)	12	4.2
Stage 1 hypertension (SBP 140–159 or DBP 90–99)	24	8.4
Stage 2 hypertension (SBP $\geq$ 160 or DBP $\geq$ 100)	14	4.9

### 4.3 Behavioral Risk Factors for Hypertension

#### 4.3.1 Tobacco Use, Alcohol Consumption and Dietary Practices

None of the respondents was using tobacco. The overall prevalence of alcohol consumption was 61 (21.3%). More than half of the study participants 180 (62.9%) add table salt during eating. Furthermore, those consuming adequate fruits and vegetables per week were 123 (43.0%) and 144 (50.3%) respectively (Table 3).

#### 4.3.2 Physical Activities, Stress Level and Anthropometric Measurement

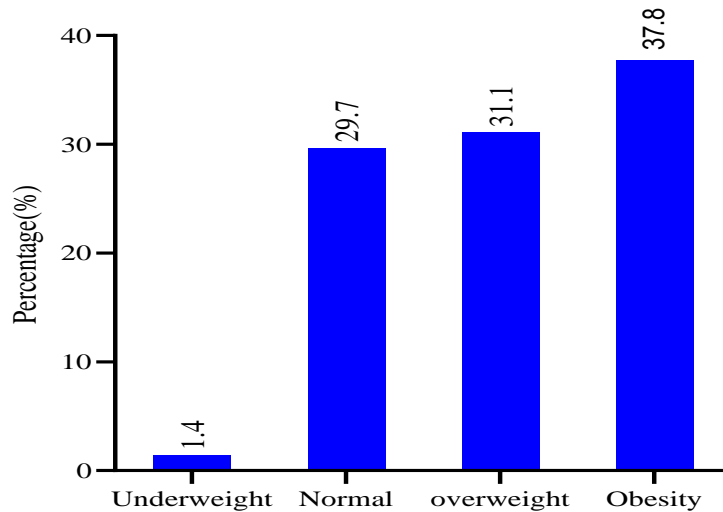
The majority of the study participants 236 (82.5%) were sedentary workers and a low level of physical activity was prevalent in the study population to about 127 (44.4%). About 115 (40.2%) of the respondents were feeling stressed at work and on the perception of salary meet the daily basic need, majority of them 234 (81.8%) reported that the salary does not meet the daily basic need (Table 3). The overall mean BMI (BMI  $\pm$  SD) was  $28.4 \pm 5.9$  kg/m<sup>2</sup>, and normotension and hypertension participants were  $28.7 \pm 5.8$  kg/m<sup>2</sup> and  $31.6 \pm 5.5$  kg/m<sup>2</sup> respectively. About 89 (31.1%) of the study respondents were overweight and 108 (37.8%) were obese (Fig. 1). The overall mean waist circumference of the study participant was  $92.0 \pm 12.9$  cm and 195 (68.2%) of the participants had abdominal obesity (Table 4).

**Table 3: Lifestyle factors of respondents stratified by blood pressure status**

Variable	Total n (%)	Normotension n (%)	Pre-hypertension n (%)	Hypertension n (%)	P-value
Alcohol consumption					
Lifetime abstainers	165 (57.7)	82 (49.7)	51 (30.9)	32 (19.4)	0.009
Past drinkers	60 (21.0)	36 (60.0)	12 (20.0)	12 (20.0)	
Current drinkers	61 (21.3)	26 (42.6)	11 (18.0)	24 (39.3)	
Exposure to second-hand smoke					
No	210 (73.4)	105 (50.0)	58 (27.6)	47 (22.4)	0.450
Yes	76 (26.6)	39 (51.3)	16 (21.1)	21 (27.6)	
Type of oil or fat used at home					
Sunflower oil	204 (71.3)	100 (49.0)	56 (27.5)	48 (23.5)	0.729
Palm oil	60 (21.0)	31 (51.7)	15 (46.7)	14 (23.3)	
No specific cooking oil	22 (7.7)	13 (59.1)	3 (13.6)	6 (27.3)	
Kind of meals eaten at work					
Breakfast	27 (9.4)	13 (48.1)	7 (25.9)	7 (25.9)	0.896
Lunch	114 (39.9)	56 (49.1)	31 (27.2)	27 (23.7)	
Breakfast and lunch	132 (46.2)	69 (52.3)	34 (25.8)	29 (22.0)	
Breakfast, lunch and dinner	13 (4.5)	6 (46.2)	2 (15.4)	5 (38.5)	
Use of table salt					
Yes	180 (62.9)	98 (54.4)	41 (22.8)	41 (22.8)	0.164
No	106 (37.1)	46 (43.4)	33 (31.1)	27 (25.5)	
Consumption of fruits					
≥ 5 days in a week	123 (43.0)	57 (46.3)	31 (25.2)	35 (28.5)	0.258
< 5 days in a week	163 (57.0)	87 (53.4)	43 (26.4)	33 (20.2)	
Consumption of vegetables					
≥ 5 days in a week	144 (50.3)	75 (52.1)	33 (22.9)	36 (25.0)	0.513
< 5 days in a week	142 (49.7)	69 (48.6)	41 (28.9)	32 (22.5)	
Mode of transport to and from work					
Walking	56 (19.6)	33 (58.9)	12 (21.4)	11 (19.6)	0.382
Car and walking	12 (4.2)	4 (33.3)	6 (50.0)	2 (16.7)	
Car and motorcycle	32 (11.2)	15 (46.9)	7 (21.9)	10 (31.3)	
Car	186 (65.0)	92 (49.5)	49 (26.3)	45 (24.2)	



<b>Variable</b>	<b>Total n (%)</b>	<b>Normotension n (%)</b>	<b>Pre-hypertension n (%)</b>	<b>Hypertension n (%)</b>	<b>P-value</b>
Sedentary work					
Yes	236 (82.5)	118 (50.0)	60 (25.4)	58 (24.6)	0.778
No	50 (17.5)	26 (52.0)	14 (28.0)	10 (20.0)	
Level of physical activity					
High physical activity	34 (11.9)	19 (55.9)	10 (29.4)	5 (14.7)	0.756
Moderate physical activity	125 (43.7)	61 (48.8)	33 (26.4)	31 (24.8)	
Low physical activity	127 (44.4)	64 (50.4)	31 (24.4)	32 (25.2)	
Stress at work					
Yes	115 (40.2)	64 (55.7)	23 (20.0)	28 (24.3)	0.160
No	171 (59.8)	80 (46.8)	51 (29.8)	40 (23.4)	
Working for long hours					
Yes	181 (63.3)	91 (50.3)	43 (23.8)	47 (26.0)	0.397
No	105 (36.7)	53 (50.5)	31 (29.5)	21 (20.0)	
The salary meets the basic need					
Yes	52 (18.2)	23 (44.2)	14 (26.9)	15 (28.8)	0.552
No	234 (81.8)	121 (51.7)	60 (25.6)	53 (22.6)	



**Figure 1: The prevalence of underweight, normal weight, overweight and obesity among working adults**

#### **4.3.3 Biochemical Factors Associated with Hypertension**

The overall mean blood glucose level of the study respondents was  $6.1 \pm 2.4$  (mmol/L). There was a significant difference in the mean level of blood glucose among normotension  $5.8 \pm 1.8$  (mmol/L) and hypertension individuals  $7.0 \pm 3.4$  (mmol/L) ( $p=0.0001$ ). About 13 (4.5%) of the respondent had raised blood glucose and 11 (84.6%) were using insulin or oral anti-hyperglycemic agent. Those who were aware that they are diabetic were also hypertensive. For serum lipid profile, the mean raised Total Cholesterol (TC) was  $5.2 \pm 1.5$  mmol/L, Triglyceride (TG)  $1.8 \pm 1.7$  mmol/L, raised Low-Density Lipoprotein cholesterol (LDL-C)  $2.4 \pm 0.8$  mmol/L and low High-Density Lipoprotein cholesterol (HDL-C) was  $1.2 \pm 0.3$  mmol/L. Significantly higher triglyceride (TG) levels were observed among hypertensive compared to normotensive individuals (Table 4).

**Table 4: Anthropometric measurement and biochemical factors stratified by blood pressure status**

Variable	Total Mean±SD	Normotension Mean±SD	Hypertension Mean±SD	P-value
Height (cm)	161.8±7.4	161.6±7.7	162.2±6.3	0.573
Weight (kg)	76.9±15.4	74.9±15.3	82.9±2.3	0.343
BMI	28.4 ±5.9	28.7 ± 5.8	31.6±5.5	0.530
WC (cm)	29.4±5.8	91.6±11.7	101.5±11.4	0.467
SBP (mmHg)	124.4±19.2	116.4±11.6	146.7±19.2	0.024
DBP (mmHg)	79.0±12.8	73.9±8.9	92.5±10.7	0.356
Blood glucose (mmol/L)	6.1±2.4	5.8±1.8	7.0±3.4	0.0001
Total cholesterol (mmol/L)	5.2±1.5	5.8±1.8	5.8±1.7	0.060
Triglyceride (mmol/L)	1.8±1.7	1.7±1.1	2.4±2.9	0.0001
Low-Density Lipoprotein(LDL-C)	2.4±0.8	2.2±0.8	2.7±0.9	0.593
High-Density Lipoprotein(HDL-C)	1.2±0.3	1.2±0.3	1.3±0.4	0.538

#### 4.4 Factors Associated with Hypertension

The results from univariate logistic regression analysis showed age, marital status, alcohol consumption, BMI, abdominal obesity, raised blood glucose, Total Cholesterol (TC) and Low-Density Lipoprotein cholesterol (LDL-C) were predicting factors for hypertension. However, when all the predicting factors were used in multivariable logistic regression analysis, only age, alcohol consumption, low salary and raised Low-Density Lipoprotein cholesterol (LDL-C) were predicting factors for hypertension. In the adjusted odds ratio, the odds of being hypertensive increase as age increases. The odds of working adults aged 30-39 years, 40-49 years and 50-60 years were (AOR=0.86, 95% CI: 0.06-12.57), (AOR=11.07, 95% CI:0.51-24.21) and (AOR=34.98, 95% CI: 1.30-94.03) respectively (Table 5). The results also showed that working adults who consumed alcohol had 6.55 increased odds of being hypertensive (AOR=6.55, 95% CI: 1.22-35.28) compared to non-alcohol users. The odds of study participants who responded that salary does not meet the daily basic needs was 6.44 higher than those who responded salary meets the daily basic need (AOR=6.44, 95% CI: 1.12-37.18 (Table 6). Furthermore, raised Low-Density Lipoprotein cholesterol (LDL-C) was a predicting factor for hypertension. The odds of being hypertensive was 5.93 higher (AOR=5.93, 95% CI: 1.24-28.45) compared to those having normal Low-Density Lipoprotein cholesterol (LDL-C) (Table 7).

**Table 5: Socio-demographic factors associated with hypertension**

Variable	COR (95%CI)	P-value	AOR (95%CI)	P-value
Profession				
Health workers	1		1	
Teachers	1.26 (0.49-3.25)	0.633	1.31 (0.15-11.75)	0.808
Bankers	2.07 (0.76-5.69)	0.156	3.72 (0.26-53.32)	0.334
Age group				
18-29	1		1	
30-39	1.30 (0.41-4.11)	0.660	0.86 (0.06-12.57)	0.912
40-49	5.92 (1.72-20.35)	0.005	11.07 (0.51-24.21)	0.126
50-60	8.27 (2.41-28.42)	0.001	34.98 (1.30-94.03)	0.034
Gender				
Male	1		1	
Female	0.91 (0.39-2.11)	0.827	1.16 (0.13-10.40)	0.894
Education level				
Postgraduate degree	1		1	
University graduate	4.51 (0.27-7.71)	0.662	1.33 (0.07-25.117)	0.851
degree	1.08 (0.21-5.60)	0.930	0.85 (0.04-18.35)	0.918
College				
Marital status				
Single	1		1	
Married/Cohabiting	2.76 (1.17-6.54)	0.021	0.95 (0.14-6.60)	0.959
Years with institution				
Less than a year	1		1	
1-3 years	0.28 (0.40-1.92)	0.195	0.05 (0.002-1.38)	0.076
4-6 years	1.20 (0.29-5.07)	0.800	0.25 (0.01-5.48)	0.382
7 years and above	1.63 (0.41-6.54)	0.493	0.1 (0.004-2.47)	0.161
The estimated income per month				
Less than 250 000	1		1	
250 000-500 000	0.71 (0.12-4.12)	0.703	0.31 (0.01-6.42)	0.450
500 000-750 000	1.69 (0.32-8.96)	0.539	4.39 (0.37-51.49)	0.239
750 000-1 000 000	2.63 (0.50-13.92)	0.257	3.53 (0.25-50.32)	0.353
More than 1 000 000	2.25 (0.35-14.61)	0.396	2.24 (0.09-55.43)	0.622

COR crude odds ratio

AOR adjusted odds ratio

CI confidence intervals

**Table 6: Lifestyle factors associated with hypertension**

Variable	COR (95%CI)	P-value	AOR (95%CI)	P-value
Alcohol consumption				
No	1		1	
Yes	2.59(1.17-5.73)	0.019	6.55(1.22-35.28)	0.029
Exposure to second-hand smoke				
No	1	0.629	1	
Yes	1.21(0.56-2.64)		2.02(0.35-11.61)	0.433
Type of oil or fat used at home				
Sunflower oil	1		1	
Palm oil	0.90 (0.36-2.23)	0.820	2.67 (0.42-16.83)	0.296
No specific oil	1.46 (0.41-5.25)	0.559	1.36 (0.13-14.28)	0.799
Kind of meals eaten at work				
Breakfast	1		1	
Lunch	1.14 (0.33-3.97)	0.834	1.37 (0.19-10.20)	0.757
Breakfast and Lunch	1.40 (0.41-4.83)	0.594	1.55 (0.17-14.47)	0.699
Breakfast, Lunch and Dinner	0.70 (0.06-7.85)	0.772	11.85 (0.23-599.12)	0.217
The use of table salt				
No	1		1	
Yes	1.95 (0.88-4.30)	0.098	4.89 (0.87-27.42)	0.071
Consumption of fruits				
≥ 5 days per week	1		1	
< 5 days per week	0.57 (0.27-1.19)	0.134	0.81 (0.20-3.38)	0.776
Consumption of vegetables				
≥ 5 days per week	1		1	
< 5 days per week	0.94 (0.45-1.94)	0.860	0.81 (0.18-3.68)	0.789
Mode of transport to and from work				
Walking	1		1	
Car and walking	0.60 (0.06-5.93)	0.662	0.55 (0.01-34.82)	0.776
Car and motorcycle	1.50 (0.45-5.03)	0.511	1.13 (0.10-12.61)	0.924
Car	0.99 (0.39-2.50)	0.976	0.30 (0.05-1.77)	0.182
Sedentary work				
No	1		1	
Yes	1.23 (0.49-3.14)	0.661	0.76 (0.10-3.25)	0.556
Level of physical activity				
High activity level	1		1	
Moderate activity level	1.69 (0.21-2.28)	0.545	0.76 (0.09-6.79)	0.804
Low activity level	0.93 (0.29-3.00)	0.904	0.37 (0.04-3.21)	0.364
Stress at work				
No	1		1	
Yes	0.85 (0.40-1.77)	0.656	0.63 (0.15-2.66)	0.524
Working for long hours				
No	1		1	
Yes	0.98 (0.47-2.08)	0.964	0.79 (0.06-9.11)	0.747
The salary meets the basic need				
Yes	1		1	
No	1.28 (0.51-3.21)	0.603	6.44 (1.12-37.18)	0.037
Family history of hypertension				
No	1		1	
Yes	1.07 (0.49-2.32)	0.865	0.42 (0.12-1.52)	0.186

COR crude odds ratio

AOR adjusted odds ratio

CI confidence intervals

**Table 7: Anthropometric and biochemical factors associated with hypertension**

Variable	COR (95%CI)	P-value	AOR (95%CI)	P-value
Total cholesterol (TC)				
Normal	1		1	
Raised	2.35 (1.10-5.03)	0.028	2.92 (0.49-17.39)	0.239
Low-Density Lipoprotein(LDL-C)				
Normal	1		1	
Raised	3.40 (1.56-7.40)	0.002	5.93 (1.24-28.45)	0.026
High-Density Lipoprotein(HDL-C)				
Normal	1		1	
Low	0.593 (0.28-1.25)	0.168	0.45 (0.12-1.77)	0.256
Triglyceride (TG)				
Normal	1		1	
Raised	1.56 (0.75-3.27)	0.235	0.63 (0.11-3.60)	0.604
Blood glucose (mmol/L )				
Normal	1		1	
Raised	5.39 (1.23-23.74)	0.026	3.63 (0.11-3.60)	0.366
Body Mass Index				
Normal	1		1	
Overweight	3.25 (0.85-12.43)	0.085	0.71 (0.06-9.11)	0.792
Obesity	5.35 (1.47-19.44)	0.011	2.64 (0.25-28.28)	0.422
Adnominal obesity				
Normal	1		1	
Abdominal obesity	3.46 (1.14-10.52)	0.029	2.19 (0.13-37.48)	0.589

COR crude odds ratio

AOR adjusted odds ratio

CI confidence intervals

## 4.5 Discussion

The study aimed to identify the predicting factors for hypertension among healthcare workers, teachers and bankers in Arusha city council. Results from this study may have important inferences on strategies for management and prevention of hypertension and other NCDs at workplace. The overall hypertension prevalence among working adults in Arusha City Council was 23.8%, consistent with the Tanzanian national prevalence of hypertension 26% (Kagaruki & Mayige, 2016). Similar findings have been reported in several general population studies conducted in Tanzania 28.0%, Ethiopia 21.0%, Kenya 24.5% and Ghana 28.1% (Dosoo *et al.*, 2019; Fikadu & Lemma, 2016; Galson *et al.*, 2017; Mohamed *et al.*, 2018). However, the prevalence was lower compared with several general population studies done in Tanzania 45%, Zimbabwe 38.4% Turkey 44.0% and South Africa 52% (Erem *et al.*, 2009; Katalambula *et al.*, 2017; Marwiro, 2012; Monakali *et al.*, 2018). The disparities in hypertension prevalence among studies are due to the features of the study population. The current study included healthcare workers, teachers and bankers only while most of the comparative studies were general population studies and there are limited comparable studies of factors associated with

hypertension among working adults. For example, the study done by Katalambula *et al.* (2017) was a population-based descriptive study with a limited number of working adults while the one in Zimbabwe was based on employees working in the city council without specifying the selected departments (Marwiro, 2012).

The current study revealed, an insignificant association between occupation and hypertension. However, there are limited studies to compare three population groups on the association between occupation and hypertension. A study done in Ethiopia, among teachers and bankers reported similar findings in the comparison with two population groups (Fikadu & Lemma, 2016). The current study identified a high prevalence of hypertension among bankers 47.1% compared to teachers 36.8% and healthcare workers 16.2%. This finding was different from a study done in Ethiopia, which reported a high hypertension prevalence among teachers 21.8% than bankers 19.13% (Fikadu & Lemma, 2016). However, the author did not mention the reason for higher hypertension prevalence among teachers than bankers. The higher prevalence of hypertension among bankers in the current study could be caused by sedentary nature of their work as they spend most of the time sitting compared to other occupations and they also have low physical activities that can influence excessive weight gain.

On the other hand, age was a predicting factor for hypertension. The odds of hypertension increased as age increased. Similar findings have been reported in Ghana, India, Nigeria and Bangladesh (Addo *et al.*, 2008; Barua *et al.*, 2018; Kishore *et al.*, 2016; Ulasi *et al.*, 2010). Besides, Dosoo *et al.* (2019) identified an increase in hypertension prevalence with age and the participants who were aged  $\geq 60$  had higher odds of being hypertensive than other age groups. It has been evident that age is the main non-modifiable risk factor associated with hypertension ascribed by stiffening of the arteries due to the results of the ageing process which predispose the elderly to the risk of developing hypertension (Ferreira *et al.*, 2012; Sun, 2015).

Furthermore, alcohol consumption was a predicting factor for hypertension. These findings are comparable with the studies done in Northern Tanzania, Rural India, urban Varanasi India, Ethiopia and Kenya they reported that hypertension was significantly associated with excessive alcohol consumption (Galson *et al.*, 2017; Kiber *et al.*, 2019; Kishore *et al.*, 2016; Mohamed *et al.*, 2018; Singh *et al.*, 2017). In addition, the result of this study is consistent with two different studies done in Kilimanjaro, Tanzania by Galson *et al.* (2017) and Mitsunaga *et al.* (2008) who reported that alcohol consumption was an important risk factor for hypertension in northern regions of Tanzania due to cultural practices of home-brewing. Cultural practices

which allow the use of local traditional alcohol drinks could be the reason for excessive alcohol consumption in the study population and influenced the development of hypertension as explained by Husain *et al.* (2014). Hence Cultural practices should be considered when implementing a workplace wellness program at workplace especially in the northern regions of Tanzania.

On the assessment of stress as a predicting factor for hypertension, the working adults who reported that salary does not meet the daily basic needs were more likely to be hypertensive than those who reported salary meets the daily basic needs. These results concur with studies done in Japan, Bangladesh and the United State to assess household income and its association with hypertension among employees. They reported that household income is associated with development of hypertension due to financial stress for fulfilling their basic needs (Barua *et al.*, 2018; Leigh & Du, 2012; Yanagiya *et al.*, 2020). Furthermore, Leigh and Du (2012) found that doubling the wages decrease the risk of hypertension from 30% to 25% for young working adults and 35% to 30% for women. In addition, a study done in Arusha region among pastoralists in Monduli District reported that having no income was associated with hypertension in this pastoralist community due to financial stress to meet the daily basic need (Khamis *et al.*, 2020). However, the current findings were different from other studies done in Ethiopia, China and South Africa which reported that high income is linked with the development of hypertension especially in developing countries by influencing the adaptation of unhealthy lifestyle such as the purchase of calorie-dense foods and adaptation of sedentary lifestyle as underlying causes of hypertension, however, in developed countries high income is protective due to adaptation of healthy lifestyle (Cois & Ehrlich, 2014; Fikadu & Lemma, 2016; Yu *et al.*, 2000). Inadequate salary to meet the daily basic needs among the study population might be the reason for financial stress for the fulfilment of daily basic needs and expose these working adults to the development of hypertension.

Nonetheless, the findings from this study showed that study subjects who had raised Low-Density Lipoprotein cholesterol (LDL-C) had increased odds of being hypertensive than those who had normal Low-Density Lipoprotein cholesterol (LDL-C). This result concurs with that of Akpa *et al.* (2006) and Osuji *et al.* (2012) that, Low-Density Lipoprotein (LDL) was higher among those who had hypertension than normotensive study participants. The odds of being hypertensive in this study was higher than the study done in Bangladesh and Mongolia (Bayart *et al.*, 2018; Choudhury *et al.*, 2014).



The raised Low-Density Lipoprotein Cholesterol (LDL-C) among the study participants might be attributed to sedentary nature of their work that makes them less physically active and it is known that doing physical activity can lower the level of Low-Density Lipoprotein Cholesterol (Szapary *et al.*, 2003). Another contributing factor on raised Low-Density Lipoprotein in this study population could be the dietary habit since majority of them reported to consume fried foods at workplace however the consumption of fried food was not significantly associated with hypertension.

The metabolic syndrome such as raised blood sugar, raised cholesterol, abdominal obesity, overweight and obesity were assessed in the current study however only raised Low-Density Lipoprotein was significantly associated with hypertension. Raised blood glucose was associated with hypertension in bivariate analysis but statistically insignificant in multivariate analysis. Also, BMI and abdominal obesity were insignificantly associated with hypertension beside been evidenced in several studies as factors associated with hypertension (Bayray *et al.*, 2018; Gebrihet *et al.*, 2017; Kayima *et al.*, 2015).

## **CHAPTER FIVE**

### **CONCLUSION AND RECOMMENDATIONS**

#### **5.1 Conclusion**

In the current study age, alcohol consumption, low salary and raised Low-Density Lipoprotein cholesterol (LDL-C) were the factors associated with hypertension. The prevalence of hypertension, overweight and obesity was high among working adults and the higher prevalence was among bankers compared with other occupations. The finding shows an emerging problem in the working population, especially among bankers as they are exposed to sedentary activities compared to other occupations. Hence this findings inform the policymakers, education, financial and health sectors to design workplace wellness programs that focus on the provision of education about the adaptation of healthy lifestyles especially on physical activities and healthy eating habits to reduce the exposure to risk factors for hypertension and other NCDs at their workplace.

#### **5.2 Recommendations**

- (i) The policymakers, health sector, financial institutions and education sector should use these findings as baseline information in planning strategies for management and prevention of hypertension and other NCDs at workplace by designing workplace wellness programs like providing education about the adaptation of healthy eating habits and ensuring the accessibility of healthy foods at workplace, weight management programs and stress management program.
- (ii) Further research is recommended on the assessment of salt intake by measuring urinary electrolytes to get the accurate dietary intake of salt instead of depending on the questionnaire only since the majority of respondents were using table salt, and excess salt intake is associated with hypertension.
- (iii) Further research is recommended on the assessment of dietary practices and their association with hypertension since the current study did not find the association between the dietary practices and hypertension as the current study did not collect the quantity of foods consumed. The further linkage between hypertension, other studied

modifiable factors and NCDs should be assessed in the study area as possible causal factors for NCDs.

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## APPENDICES

### Appendix 1: Structured questionnaire for the assessment of risk factors for hypertension and assessment of work-related stress

#### (a) Structured questionnaire for the assessment of risk factors for hypertension

Questionnaire ID.....

INSTRUCTIONS: Please would you put (√) in an appropriate box according to the answer selected.

<b>STEP I. DEMOGRAPHIC INFORMATION</b>			
<b>Demographic information</b>			
	Question	Response	
1.	Sex	Male <input type="checkbox"/> Female <input type="checkbox"/>	
2.	How old are you?	_____ years old	
3.	What is the highest level of education you have completed?	<input type="checkbox"/> Up to primary school <input type="checkbox"/> Secondary level <input type="checkbox"/> College/University completed <input type="checkbox"/> Post graduate degree	
4.	Job profession	.....	
5.	What is your marital status?	<input type="checkbox"/> Married/Cohabiting <input type="checkbox"/> Single <input type="checkbox"/> Separated/Divorced <input type="checkbox"/> Widowed	
6.	Which of the following best describes your main work status over the past 12 months?	<input type="checkbox"/> Government employee <input type="checkbox"/> Non-government employee	

7.	How long have you been working with the current institution?	<input type="checkbox"/> Less than a year <input type="checkbox"/> 1-3 years <input type="checkbox"/> 4-6 years <input type="checkbox"/> 7 years and above	
8.	How many people older than 18 years, including yourself, live in your household?	Number .....	
9.	What is your estimated monthly income? (In Tanzanian shillings)	<input type="checkbox"/> ≤ 250 000 <input type="checkbox"/> > 250 000 to < 500 000 <input type="checkbox"/> 500 000 to < 750 000 <input type="checkbox"/> 750 000 to < 1 000 000 <input type="checkbox"/> > 1 000 000	
<b>STEP I. BEHAVIORAL MEASUREMENTS</b>			
<p>I am going to ask you some questions about various health behaviours. This includes things like smoking, drinking alcohol, eating fruits and vegetables and physical activity</p> <p><b>Tobacco use</b></p>			
10.	Do you currently smoke any tobacco products, such as cigarettes, cigars or pipes daily?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<b>If no go to question number 13</b>
11.	How old were you when you first started smoking daily?	_____ years old	
12.	On average, how many of the following do you smoke each day?	Number <input type="checkbox"/> <input type="checkbox"/> Manufactured cigarette <input type="checkbox"/> Hand-rolled cigarettes <input type="checkbox"/> Pipes full of tobacco <input type="checkbox"/> Cigars (cheroots)	



13.	In the past, did you ever smoke tobacco daily?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<b>If no go to question number 15</b>
14.	How long ago did you stop tobacco smoking daily?	<input type="checkbox"/> Years ago <input type="checkbox"/> Months ago <input type="checkbox"/> Weeks ago	
15.	Do you currently use smokeless tobacco products daily?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
16.	In the past, did you ever smoke daily?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
17.	During the past 30 days, on how many days did someone smoke when you were present either at home or around your workplace?	<b>Number of days</b>  Home <input type="checkbox"/> Working place <input type="checkbox"/>	
<b>Alcohol consumption</b>			
	Question	Response	
18.	Have you ever consumed an alcoholic drink such as beer, wine, spirits and homebrewed wine?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<b>If no go to question number 23</b>
19.	In the past 12 months have you consumed an alcoholic drink?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
20.	Have you consumed an alcoholic drink within the past 30 days?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
21.	During the past 30 days, when you drank alcohol, on average, how many standard alcoholic	Number <input type="text"/>	

	drinks did you have during one drinking occasion?		
22.	During the past 30 days, when you consumed an alcoholic drink, how often was it with meals? Please do not count snacks.	<input type="checkbox"/> Usually with meals <input type="checkbox"/> Sometimes with meal <input type="checkbox"/> Rarely with meals <input type="checkbox"/> Never with meals	
<b>Diet</b>  The next questions ask about the fruits and vegetables that you usually eat. I have a nutrition card here that shows you some examples of local fruits and vegetables. Each picture represents the size of a serving.			
	Question	Response	
23.	In a typical week, on how many days do you eat fruit and vegetables?	<p style="text-align: right;"><b>Number of days</b></p> Fruits <input type="checkbox"/> <input type="checkbox"/> Vegetables <input type="checkbox"/> <input type="checkbox"/>	
24.	How many servings of fruits and vegetables do you eat on one of those days?	<p style="text-align: right;"><b>Number of servings</b></p> Fruits <input type="checkbox"/> <input type="checkbox"/> Vegetables <input type="checkbox"/> <input type="checkbox"/>	
25.	What type of oil or fat is most often used for meal preparation in your household?	<input type="checkbox"/> Safi <input type="checkbox"/> Korie <input type="checkbox"/> Sunola <input type="checkbox"/> Sunflower <input type="checkbox"/> Olive oil <input type="checkbox"/> Margarine Others (specify) .....	

26.	On average, how many meals per week do you eat that were not prepared at home?	<p style="text-align: center;"><b>Number of meals</b></p> <p>Breakfast            <input type="checkbox"/>    <input type="checkbox"/></p> <p>Lunch                <input type="checkbox"/>    <input type="checkbox"/></p> <p>Dinner               <input type="checkbox"/>    <input type="checkbox"/></p>	
<b>Dietary salt</b>			
	Question	Response	
27.	How often is salt, salty seasoning and sauces added in cooking or during food preparation at home?	<input type="checkbox"/> Always <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never	
28.	How often do you add salt or salty sauce such as ketchup or soya sauce to your food before you eat it or while eating?	<input type="checkbox"/> Always <input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never	
29.	Do you always use table salt while eating	<input type="checkbox"/> Yes <input type="checkbox"/> No	
30.	What kind of salt do you use for cooking or meal preparation in your household?	<input type="checkbox"/> Iodized <input type="checkbox"/> Non-iodized <input type="checkbox"/> Don't know	
31.	How often do you eat processed food (the foods that have been	<input type="checkbox"/> Always	

	altered from their natural state, such as packaged snacks, canned food, fast-food (e.g. pickles, marinates, sheep's cheese, salami, sausages, ham and other meat products, salted nuts/biscuits, cakes, Crips))	<input type="checkbox"/> Often <input type="checkbox"/> Sometimes <input type="checkbox"/> Rarely <input type="checkbox"/> Never <input type="checkbox"/> Too much	
32.	How much salt is recommended by WHO per day	<input type="checkbox"/> 10g <input type="checkbox"/> 5g <input type="checkbox"/> 15g <input type="checkbox"/> Don't know	
33.	How much salt or salty sauce do you think you consume?	<input type="checkbox"/> Right amount <input type="checkbox"/> Too little <input type="checkbox"/> Don't know	
34.	Do you think reducing the amount of salt you add to the food is important?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> I don't know	
35.	Do you think that too much salt or salty sauce in your diet could Cause a health problem?	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> I don't know	
36.	If yes in above what sort of health problem do you think can be caused by a high salt diet? Put a tick to all that apply	<input type="checkbox"/> High blood pressure <input type="checkbox"/> Osteoporosis <input type="checkbox"/> Stomach cancer <input type="checkbox"/> Kidney stones <input type="checkbox"/> Heart attack/ failure <input type="checkbox"/> Stroke	

		<input type="checkbox"/> Asthma <input type="checkbox"/> Don't know <input type="checkbox"/> Other (specify) .....	
37.	Do you do have regular strategies to control your salt intake?	<input type="checkbox"/> Yes <input type="checkbox"/> No <b>If yes indicate</b> .....	

### Physical activities at Work

Vigorous-intensity activity are the activities that causes large increases of heart rate like lifting heavy loads, manual construction work, while moderate-intensity activity causes small increases of heart rate such as brisk walking, carrying light loads, and light activities are the activities that that does not increase the heart beat or heart rate like sitting in the office.

	Question	Response	
38.	Does your work involve either of the following activity at least 10 minutes continuously?	<input type="checkbox"/> Vigorous-intensity activity <input type="checkbox"/> Moderate-intensity activity <input type="checkbox"/> Light activity	
39.	How many days do you do the activity selected above as part of your work in a week?	Number of days <input type="checkbox"/>	
40.	How much time do you spend doing the activities at work on a typical day?	Number of <b>Hours</b> <input type="checkbox"/> : <b>Minutes</b> <input type="checkbox"/>	

### Travel to and from places

The usual way to travel to and from places include travel for example to work, for shopping, to market and the place of worship.

	Question	Response	
--	----------	----------	--

41.	Which means of transport do you use continuously from home to working place?	<input type="checkbox"/> Bicycle (pedal cycle) <input type="checkbox"/> Walking <input type="checkbox"/> Car <input type="checkbox"/> Motorcycle	
42.	In a typical week, how many days and time do you spend walking or bicycle to get to and from places?	Number of <b>Day</b> <input type="checkbox"/> <b>Hours</b> <input type="checkbox"/> <b>Minutes</b> <input type="checkbox"/>	
<b>Recreational activities</b>  This asks you about sports, fitness and recreational activities (leisure) excluding work and transport activities that you have already mentioned			
	Question	Response	
43.	Do you do vigorous-intensity sports or recreational activities that cause large increases in breathing or heart rate such as running or football, for at least 10 minutes continuously?	<input type="checkbox"/> Yes <input type="checkbox"/> No	
44.	In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational activities?	Number of days <input type="checkbox"/>	
45.	How much time do you spend doing  vigorous-intensity sports, fitness or  Recreational activities on a typical day?	Number of  Hours <input type="checkbox"/> : Minutes <input type="checkbox"/>	
46.	Do you do moderate-intensity sports or recreational activities that cause a	<input type="checkbox"/> Yes <input type="checkbox"/> No	

	<p>a small increase in breathing or heart rate, such as brisk walking, cycling,</p> <p>Swimming, volleyball for at least 10 minutes continuously?</p>		
47.	In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational activities?	Number of days [   ]	
48.	<p>How much time do you spend doing</p> <p>Moderate-intensity sports, fitness or recreational (leisure) activities on a typical day?</p>	<p>Number of</p> <p>Hours [   ] : Minutes [   ]</p>	
49.	How much time do you usually spend sitting or reclining for example watching Television, listening to the music, reading books or newspaper without including the time spent sleeping.	<p>Number of</p> <p><b>Hours</b> [   ] : <b>Minutes</b> [   ]</p>	
<b>History of Hypertension, Diabetes and Blood cholesterol</b>			
	Question	Response	
50.	Have you ever had your blood pressure blood cholesterol and blood glucose measured by a doctor or other health worker?	<p>Hypertension    Diabetes    Blood cholesterol</p> <p>Yes [   ]            [   ]            [   ]</p> <p>No [   ]            [   ]            [   ]</p>	
51.	Have you ever been told by a doctor or other health worker that you have hypertension or diabetes?	<p>Hypertension    Diabetes    Blood cholesterol</p> <p>Yes [   ]            [   ]            [   ]</p> <p>No [   ]            [   ]            [   ]</p>	
52.	Are you currently taking any drugs (medication) in the past	Hypertension    Diabetes    Blood cholesterol	

	two weeks for hypertension, blood cholesterol or diabetes?	Yes [ ] [ ] [ ] No [ ] [ ] [ ]	
53.	Are you currently taking any herbal or traditional remedy for hypertension or diabetes?	Hypertension    Diabetes    Blood cholesterol Yes [ ] [ ] [ ] No [ ] [ ] [ ]	
54.	In your family do you have any history of people suffering from diabetes or hypertension or both	Diabetes [ ] Hypertension [ ] Both of them [ ]	
<b>STEP II: PHYSICAL MEASUREMENT</b>			
<b>Height and weight</b>			
	Question	Response	
55.	Height	<b>In centimeter (cm)</b> _____	
56.	Weight	<b>In kilogram (kg)</b> _____	
<b>Waist circumference</b>			
57.	Waist circumference	<b>In Centimeter (cm)</b> _____	
<b>Blood pressure measurement</b>			
58.	Reading 1	Systolic (mmHg) _____ Diastolic (mmHg) _____	
	Reading 2	Systolic (mmHg) _____ Diastolic (mmHg) _____	
	Reading 3	Systolic (mmHg) _____	



		Diastolic (mmHg)_____	
<b>Blood measurement</b>			
<b>Blood glucose</b>			
59.	Fasting blood glucose	_____ mmol/l	
<b>Blood cholesterol</b>			
60.	Total cholesterol	_____ mmol/l	
	Low-Density Lipoprotein(LDL-C)	_____ mmol/l	
	High-Density Lipoprotein(HDL-C)	_____ mmol/l	
	Triglyceride	_____ mmol/l	

**(b) Assessment of work-related stress**

ASSESSMENT OF WORK RELATED STRESS						
61.	I have unachievable deadlines	Never	Seldom	Sometimes	Often	Always
		[ ]	[ ]	[ ]	[ ]	[ ]
62.	I have to work very intensively	Never	Seldom	Sometimes	Often	Always
		[ ]	[ ]	[ ]	[ ]	[ ]
63.	I have to neglect some tasks because I have too much to do	Never	Seldom	Sometimes	Often	Always
		[ ]	[ ]	[ ]	[ ]	[ ]
64.	I am unable to take sufficient breaks	Never	Seldom	Sometimes	Often	Always
		[ ]	[ ]	[ ]	[ ]	[ ]
65.	I am pressured to work long hours	Never	Seldom	Sometimes	Often	Always
		[ ]	[ ]	[ ]	[ ]	[ ]
66.	I have to work very fast	Never	Seldom	Sometimes	Often	Always
		[ ]	[ ]	[ ]	[ ]	[ ]
67.	I have unrealistic time pressures	Never	Seldom	Sometimes	Often	Always
		[ ]	[ ]	[ ]	[ ]	[ ]
68.	I can decide when to take a break	Never	Seldom	Sometimes	Often	Always
		[ ]	[ ]	[ ]	[ ]	[ ]
69.	I have a say in my work speed	Never	Seldom	Sometimes	Often	Always
		[ ]	[ ]	[ ]	[ ]	[ ]
70.	I have a choice in deciding how I do my work	Never	Seldom	Sometimes	Often	Always
		[ ]	[ ]	[ ]	[ ]	[ ]
71.	My working time can be flexible	Never	Seldom	Sometimes	Often	Always
		[ ]	[ ]	[ ]	[ ]	[ ]
72.	If work gets difficult, my colleagues will help me	Never	Seldom	Sometimes	Often	Always
		[ ]	[ ]	[ ]	[ ]	[ ]
73.	I am given supportive feedback on the work I do	Never	Seldom	Sometimes	Often	Always
		[ ]	[ ]	[ ]	[ ]	[ ]
74.	I get the help and support I need from colleagues	Never	Seldom	Sometimes	Often	Always
		[ ]	[ ]	[ ]	[ ]	[ ]
75.	I receive the respect at work I deserve from my colleagues	Never	Seldom	Sometimes	Often	Always
		[ ]	[ ]	[ ]	[ ]	[ ]

76.	I can talk to my line manager about something that has upset or annoyed me about work	Never <input type="checkbox"/>	Seldom <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
77.	My colleagues are willing to listen to my work-related problems	Never <input type="checkbox"/>	Seldom <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
78.	I am supported through emotionally demanding work	Never <input type="checkbox"/>	Seldom <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
79.	My line manager encourages me at work	Never <input type="checkbox"/>	Seldom <input type="checkbox"/>	Sometimes <input type="checkbox"/>	Often <input type="checkbox"/>	Always <input type="checkbox"/>
80.	Is the salary enough to meet the daily basic need?	<input type="checkbox"/> Yes <input type="checkbox"/> No				
81.	Do you experience an unplanned shift	<input type="checkbox"/> Yes <input type="checkbox"/> No				
82.	Do you experience long working hours	<input type="checkbox"/> Yes <input type="checkbox"/> No				
83.	Poor working condition e.g. excessive noise, temperature extremes, dust etc	<input type="checkbox"/> Yes <input type="checkbox"/> No				
84.	Long-distance from home to work	<input type="checkbox"/> Yes <input type="checkbox"/> No				
85.	Do you feel stressed at work	<input type="checkbox"/> Yes <input type="checkbox"/> No				
86.	What is your level of stress	Very low <input type="checkbox"/> Low <input type="checkbox"/> Moderate <input type="checkbox"/> High <input type="checkbox"/> Very high <input type="checkbox"/>				










## Appendix 2: Assessment of dietary practices







Food item	Frequency					
	Never	Rarely (≤ than once a month)	Everyday	1-2 per week	3-4 per week	1-3 per month
<b>Cereals and cereal products</b>						
Maize on cob						
Mix of beans and other cereals						
Porridge						
Rice						
Breakfast cereals						
Stiff porridge						
Spaghetti						
<b>Banana, Roots and tubers</b>						
Cooked Banana						
Fried Banana						
Cassava						
Sweet potato						
Arrowroot						
Potatoes						
French fries						
Banana stew						
Crips						
<b>Meat, fish and animal product</b>						
Beef						
Mutton						
Organ meat						
Pork						
Chicken						
Sausage						
Egg						
Fish						
Sardines						
Milk						
Yoghurt						
<b>Legumes and nuts</b>						
Beans						
Green peas						
Bambara nuts						
Groundnuts						
Cashew nuts						

<b>Fruits</b>						
Cucumber						
Banana						
Orange						
Watermelon						
Avocado						
Pineapple						
Baobab						
Mango						
<b>Vegetables</b>						
Cabbage						
Amaranth leaves						
Spinach						
Cowpea leaves						
Pumpkin leaves						
African eggplant						
African nightshade						
Carrot						
Tomato						
<b>Fats and oil</b>						
Vegetable fat						
Mayonnaise						
Lard						
Peanut butter						
<b>Other foods</b>						
Pizza						
Burger						
Water						
Carbonated soft drink						
Alcoholic drink						
Coffee						
Black tea						
Milk tea						

## Appendix 3: Showcard

### (Diet) Serving Sizes of Fruits and Vegetables

VEGETABLES ARE CONSIDERED TO BE:	1 SERVING (STANDARD)	EXAMPLES
Raw green leafy vegetables	 <b>1 cup</b>	Spinach, salad, etc.  
Other vegetables, cooked or chopped raw	<b>½ Cup</b>	Tomatoes, carrots, pumpkin, cabbage, fresh beans, onion, Etc    
<b>FRUIT</b>		
Cucumber (Matango)	<b>1 medium-size piece</b>	
Banana (Ndizi)	<b>1 medium-size piece or 2 small bananas(ndizi kisukari)</b>	

Orange (Chungwa)	<b>1 medium-size piece</b>	
Mango (Embe)	<b>1 medium-size piece</b>	
Watermelon (Tikiti maji)	<b>¼ Kipande cha tikiti maji (134g)</b>	
Avocado (Parachichi)	<b>1 small size (parachichi dogo) (110 g)</b>	
Pawpaw (Papai)	<b>¼ piece (¼ kipande) (120g)</b>	
Pineapple (Nanasi)	<b>¼ piece</b>	
Fruit juice	<b>½ cup</b>	<b>Juice from fruit.</b>

## Appendix 4: Informed consent form

### THE NELSON MANDELA AFRICAN INSTITUTION OF SCIENCE AND TECHNOLOGY (NM-AIST)



### CONSENT FORM

#### TITLE: DETERMINATION OF FACTORS ASSOCIATED WITH HYPERTENSION AMONG EMPLOYEES IN ARUSHA CITY COUNCIL, TANZANIA.

**This Informed Consent Form has two parts:**

- Part I: Information sheet
- Part II: Certificate of Consent (for signatures if you agree to take part)

#### PART I: INFORMATION SHEET

**Introduction:** I am Dalahile Zubery, a master student from the Nelson Mandela African Institution of Science and Technology (NM-AIST). I am currently involved in conducting research on the Determination of Factors Associated with Hypertension among Employees in Arusha City Council. Please listen carefully and ask any questions you may have before agreeing to take part in the study.

**What the study is about:** The purpose of this study is to assess the factors associated with hypertension among employees in Arusha City Council, Tanzania.

**Purpose of the research:** Hypertension is affecting the majority of the people in the country and it has become among the ten diseases that contribute to death in the country. There is a need for identifying the risk factors associated with hypertension and make strategies to mitigate the risk factors.

**Participant Selection:** You are being invited to take part in this research because you are the employee falling in the category group that demonstrated to be at risk of the disease. If you become affected with the disease it may result in loss of manpower due to repeated absenteeism



at workplaces which can result in early retirement but there is also loss of income through providing care for the management of the disease.

**What we will ask you to do:** If you agree to be in this study, I will conduct a survey with you. The survey will include questions about your lifestyle behaviours, dietary habit, and measurement on body weight, height and waist circumference but also a collection of (5ml) of a blood sample for analysis of blood glucose, total blood cholesterol, high-density lipoprotein, low-density lipoprotein, and triglyceride the survey will take about 90 minutes to complete.

**Risks:** There is the risk that you may find some of the questions about your household to be sensitive. You may refuse to answer any particular question and may stop the interview at any time.

**Benefits:** The immediate benefits to you for taking part in this survey is that you will be able to know your health status and get free medical advice based on the screening result but the longer-term benefit will aim at developing workplace intervention strategies to mitigate the risk factors for hypertension and related NCDs.

**Compensation:** There is no compensation for taking part in this study.

**Confidentiality:** Your answers will be confidential. The records of this study will be kept private. In any sort of report, we make public we will not include any information that will make it possible to identify you. Research records will be kept in a locked file; only the researchers will have access to the records.

**Taking part is voluntary:** Taking part in this study is completely voluntary. You may skip any questions that you do not want to answer. If you decide not to take part or to skip some of the questions, it will not affect your current or future relationship with Nelson Mandela African Institute of Science and Technology, or the District Council. If you decide to take part, you are free to withdraw at any time.

## **PART II: CERTIFICATE OF CONSENT**

I have read the foregoing information or it has been read to me and has understood. My questions have been answered to my satisfaction. I agree to participate in this study.

Name of participant \_\_\_\_\_

Signature of participant \_\_\_\_\_ Date \_\_\_\_\_






I confirm that the participant was allowed to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Name of researcher \_\_\_\_\_

Signature of researcher \_\_\_\_\_ Date \_\_\_\_\_

**Thank you very much for your participation in this study.**

## Appendix 5: KNCHREC ethical clearance

		
<p><b>Kibong'oto Infectious Diseases Hospital- Nelson Mandela African Institution of Science and Technology- Centre for Educational Development in Health, Arusha (KIDH-NM-AIST-CEDHA) -KNCHREC</b></p>		
<p><b>RESEARCH ETHICAL CLEARANCE CERTIFICATE</b></p>		
<b>Research Proposal No: KNCHREC 0014</b>		<b>14<sup>TH</sup> MARCH 2019</b>
<b>Study Title:</b>	<b>Assessment of Risk Factors Associated with Hypertension among Employees in Arusha City</b>	
<b>Study Area:</b>	<b>THE NELSON MANDELA AFRICAN INSTITUTION OF SCIENCE AND TECHNOLOGY</b>	
<b>PI Name:</b>	<b>Dalahile Zubery</b>	
<b>Co-Invigilator:</b>		
<b>Institutions:</b>	<b>School of Life Science and Bio-Engineering (LISBE) of the Nelson Mandela African Institution of Science and Technology</b>	
<b>The Proposal has been approved by KNCHREC on 14<sup>th</sup> March 2019</b>		
<ol style="list-style-type: none"><li>1. Subject to this approval you will be required to submit your progress report to the KNCHREC, National Institute of Research and Ministry of Health Community Development Gender Elderly and Children</li><li>2. Publication of your findings is subject to presentation to the KNCREC and NIMR Approval.</li><li>3. Copies of final publication should be made available to KNCHREC, National Institute of Research and Ministry of Health Community Development Gender Elderly and Children</li></ol>		
<b>Duration of Study Renewal:</b> Subject to Renewal within ONE YEAR		
<b>Span From:</b> 14 <sup>th</sup> March 2019 to 13 <sup>TH</sup> March 2020.		
 ..... <b>Mr. Simon Njeya</b> <b>Secretary</b> <b>KNCHREC</b>	 <b>Chairperson</b> <b>KNCHREC</b>	

## Poster Presentation



### FACTORS ASSOCIATED WITH HYPERTENSION AMONG EMPLOYEES IN ARUSHA CITY, TANZANIA

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#### Abstract

Healthcare workers, teachers and bankers are occupation groups exposed to hypertension due to the nature of their work. A descriptive cross-sectional study was conducted to identify the predicting factors for hypertension among teachers, bankers and healthcare workers in Arusha city council. The prevalence of hypertension among working adults was 23.8%. Age, alcohol consumption, low salary and high Low-Density Lipoprotein cholesterol (LDL-C), were significantly associated with hypertension.

#### Background

Hypertension is the major risk factor for CVDs, like heart attack, stroke and heart failure. In a review of hypertension prevalence in developing countries, a higher hypertension prevalence was reported in Tanzania than in many other developing countries. Despite that, there is limited documentation on the predictors of hypertension among working adults in Tanzania. Therefore, the current study aimed to identify the factors associated with hypertension among healthcare workers, teachers and bankers in Arusha City Council.

#### Results

The overall hypertension prevalence among working adults was 23.8%. Age (AOR=34.98, 95% CI: 1.30-94.03), alcohol consumption (AOR=6.55, 95% CI: 1.22-35.28), low salary (AOR=6.44, 95% CI: 1.12-37.18) and high Low-Density Lipoprotein cholesterol (LDL-C) (AOR=5.93, 95% CI: 1.24-28.45), were significantly factors associated with hypertension.

#### Conclusion

The current study found high prevalence of hypertension, overweight and obesity among working adults and the higher prevalence was among bankers compared with other occupations. The finding shows an emerging problem in the working population, especially among bankers compared to other occupations. Hence this findings inform the policymakers, education, financial and health sectors to design workplace wellness program specifically on healthy lifestyle to mitigate this factors.

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