

Association Between Physical Activity and Prevention of Hypertension Among Adults in Mbarara City, Western Uganda

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Abstract

In Africa, the involvement in Physical Activity in adults is 20.9% according to WHO (Kirunda et al., 2016). In Uganda, there is limited data on the level of Physical Activity and physical inactivity. However, most NCDs including hypertension in Uganda have been attributed to lack of Physical Activity. Hypertension is rising steadily and results from the countrywide survey indicate that prevalence of hypertension is 26.4% within the population (Guwatudde et al., 2015). Annually 500,000 deaths occur in Uganda due to hypertension (Ministry of health, 2021). This study set out to examine the association between physical activity and prevention of hypertension among people aged 40 years and above in Mbarara city, Uganda. The specific objectives followed:

1. To determine the prevalence of hypertension among people aged 40 years and above in Mbarara city, Uganda.
2. To determine the factors associated with involvement in physical activity among people aged 40 years and above in Mbarara city, Uganda.
3. To assess the relationship between physical activity and prevention of hypertension among people aged 40 years and above in Mbarara city, Uganda

This study used a cross-sectional design and involved quantitative approaches of data collection with a total of 384 respondents. Data were collected using administered questionnaire between June and July 2024. The data collected was analyzed using STATA software version 18.

The study found that the overall prevalence of hypertension was 28.9% (95% CI: 24.4%-33.4%). Females had a higher prevalence of hypertension at 30.5% (95% CI: 24.6%-36.4%) than males at 26.3% (95% CI: 19.3%-33.4%). Hypertension was most prevalent among participants aged 50-59 years at 51.8% (95% CI: 41.1%-62.4%) and among those who were obese at 37.8%. Although there was no statistically significant association between physical activity and hypertension ($p>0.05$), the results showed that physically active participants had lower odds of hypertension (OR=0.622, 95% CI: 0.3741.036) than physically inactive participants. The prevalence of hypertension was lower among physically active participants (26.6%) than among physically inactive participants (36.8%). There is need to formulate and implement interventions aimed at reducing physical inactivity through health education, policy formulation, and provision of facilities in cities where physical activity and exercise can be done. Further interventional studies should assess the effectiveness of physical activity programs in preventing and managing hypertension.

1. Introduction

This chapter comprises of the background to the study, statement of the problem, general objective, specific objectives, significance, and justification of the study, theoretical and conceptual framework, and scope of the study.

1.1 Background to study

Physical activity and its determinants for different populations have become an important topic of research in the last 20 years (Sherbiny & Elserly, 2018). Researchers have now turned their attention towards understanding the mechanisms that facilitate participation in physical activity for better health outcomes (Gunnell et al, 2014). Physical activity (PA) is defined as a bodily musculoskeletal movement which requires energy expenditure. It includes any movement done by the body during playing, traveling, working, jogging, cycling, heavy gardening and doing routine household duties (WHO, 2017). PA plays an active role in the prevention of hypertension and other non-communicable diseases (NCDs), such as coronary heart disease, diabetes mellitus type II, dyslipidaemia, obesity, breast and colon cancers in addition to the prevention of dementia, depression, and premature death (Sherbiny & Elserly, 2018; Diaz & Shimbo, 2013).

Physical inactivity has increased in epidemic proportions all around the globe over the past few decades (Kohl et al., 2012). Among various contributing factors to hypertension-related mortality, physical inactivity alone is estimated to be responsible for an annual average of 5.3 million global deaths and more than 69 million disability adjusted life years (Gamage & Sineviratne, 2021; Lancet, 2012; Hallal et al., 2012; Pedisic et al., 2019). Worldwide, hypertension is estimated to increase to 60% by 2025 (Diaz & Shimbo, 2013). However the World Health Organization (WHO) projects the number of hypertension cases in SSA to increase from an estimated 80 million in 2000 to 150 million in 2025 (Guwatudde et al., 2015)

Hypertension is likely to become a major health system challenge in Africa as it is predicted to become among the leading cause of death in the region by 2030 (Ankita et al., 2021; Diaz & Shimbo, 2013). In Uganda, hypertension is rising steadily and results from the countrywide survey indicate that prevalence of hypertension is 26.4% within the population (Guwatudde et al., 2015). In 2016, the estimated risk of mortality from Non-Communicable Diseases was 22%, primarily due to cardiovascular disease and cancer, along with underlying risk factors of hypertension (Ankita et al., 2021).

With one-quarter of the world's adult population estimated to have hypertension, the primary prevention of hypertension has become a global public health initiative (Diaz & Shimbo, 2013)

Worldwide, 30% of adults do not have a sufficient level of physical activity (Peldisic et al., 2019). Current guidelines recommend increasing physical activity as a means to prevent hypertension. These guidelines stem from a large body of literature demonstrating the protective effects of physical activity and exercise (Diaz & Shimbo, 2013). In Low- and Middle-Income Countries, there is a low level of physical activity at population level. In Africa, the adult occurrence of PA is 20.9% according to World Health Organization (Guthold et al., 2011; Kirunda et al., 2016).

With urbanization, Uganda has undergone a rapid epidemiological transition, with Non Communicable Diseases (NCDs) such as hypertension, diabetes, and cancer (MOH, 2019). The promotion of a physically active lifestyle might help address the increasing burden of NCDs in Uganda (Kirunda et al., 2016; Namusisi et al., 2011; Mondo et al., 2013). However, maintaining individual physical activity levels may be challenging due to unavailability of parks, walking trails, and cycling lanes, especially in urban areas

In Uganda, there is limited data on the occurrence of physical activity and physical inactivity. However, most Non-Communicable Diseases (NCDs) including hypertension in Uganda have been attributed to lack of Physical Activity. According to the Ministry of health (MOH) (2019), lack of PA was responsible for the prevalence 6.0% hypertension.

In Uganda, until recently there had been no study aimed at determining levels of Physical Activity, their adequacy and distribution within its population (Gawatudde, 2016). In 2014, Uganda's Ministry of Health commissioned the first countrywide NCD risk factor survey to provide baseline estimates of the prevalence of the common risk factors for NCDs in the country (Gawatudde, 2016; MOH, 2014). According to this survey, occurrence of Physical Activity (PA) in Uganda was 95.7% and this finding varied greatly from other studies that have assessed PA in other parts of the country. A lower occurrence of PA (49%) was reported in Kasese district (Mondo et al., 2013) and even much lower (29.8%) in South-western Uganda (Murph et al., 2013)

Population estimates of physical activity for specific countries are needed to inform national public health efforts (Wang et al., 2017; Pedisic et al., 2019). Only a few low-income countries have developed policies on physical activity (Pogrmilovic et al., 2018; Peldisic et al., 2019), possibly because of limited national epidemiological data needed to inform policy makers about their public health importance.

There are limited and inconsistent data on population-level occurrence of physical activity in Uganda.

Few studies have examined associations between Physical Activity and prevention of hypertension.

Thus, there is limited information about objectively determined Physical Activity and its correlates in Uganda (Kirunda et al., 2016). The paucity of research on PA and its positive or negative association with hypertension indicates a need for research in Uganda among peri-urban and rural populations. Thus the purpose of this study was to assess the association between Physical Activity and prevention of hypertension among adults aged 40 years and above in Mbarara City, Uganda.

1.2 Problem statement

Hypertension is among the chronic diseases that are on the rise globally and currently it is responsible for 5.3 million global deaths (Gamage & Sineviratne, 2021). Projections over the next few decades indicate the number of hypertension cases increase to 150 million by 2025 sub-Saharan Africa (SSA) (Guwatudde et al., 2015). Being physically inactive has been associated with increased risk of hypertension, and in Uganda it is at a prevalence of 26.4% (Guwatudde et al., 2015) and accounts to about 500,000 deaths each year (Ministry of health, 2021).

In Uganda there has been limited detailed population based data on the levels of Physical Activity (PA) and its risk factors (Guwatudde et al., 2016). In 2014, Uganda's Ministry of Health conducted the first countrywide NCD risk factor survey to provide baseline estimates of the prevalence of the common risk factors for NCDs in the country (Kirunda, 2016; MOH, 2014). According to this survey, occurrence of PA in Uganda was 95.7%. However, these findings varied largely from other few studies carried in other parts of the country which was as low as 49% in Kasese (Mondo et al., 2013) and even much lower (29.8%) in South-western Uganda (Murph et al., 2013). This shows that there is limited and inconsistent data on population-level occurrence of physical activity in Uganda.

This situation compounds the problem to overwhelm the entire country and thus the health of the people especially the elderly is compromised. Despite the solutions like formulating policies, health education, and efforts to increase sensitization on health diets and physical activity, the problem still remains persistent (Guwatudde et al., 2016).

In Mbarara city there has been no study aimed at determining levels of PA, their adequacy, and distribution within its population. This could be possibly because prevalence of hypertension in the general population is not well documented and considered as a major priority. The most recent population based cross sectional survey in Mbarara city indicated that prevalence of obesity was 46% (Twinamasiko et al., 2018). Since most hypertension is asymptomatic in the early stages, many of the affected persons may be unaware and this could delay interventions for prevention such as Physical Activity to be implemented in the general population. This challenge motivated the undertaking of this study to assess the association between Physical Activity and prevention of hypertension in Mbarara city, Uganda.

1.3 General objective

The purpose of this study was to assess the association between physical activity and prevention of hypertension among people aged 40 years and above in Mbarara city.

1.3.1 Specific objective

- i. To determine the prevalence of hypertension among people aged 40 years and above in Mbarara city, Uganda.
- ii. To determine the factors associated with involvement in physical activity among people aged 40 years and above in Mbarara city, Uganda.
- iii. To assess the relationship between physical activity and prevention of hypertension among people aged 40 years and above in Mbarara city, Uganda.

1.4. Research questions

- i. What is the prevalence of hypertension among people aged 40 years and above in Mbarara city?
- ii. What factors are associated with involvement in physical activity among people aged 40 years and above in Mbarara city?
- iii. How is physical activity related to the prevention of hypertension among people aged 40 years and above in Mbarara city?

1.5 Research hypothesis

Null Hypothesis: There is no significant association between physical activity and the prevention of hypertension among people aged 40 years and above in Mbarara city.

Alternative Hypothesis: There is a significant association between physical activity and prevention of hypertension among people aged 40 years and above in Mbarara city.

1.6 Significance of the study

This study aims to investigate the association between physical activity and prevention of hypertension among people aged 40 years and above in Mbarara city. The findings of this research will have significant implications for public health, clinical practice, and individual well-being.

By understanding the relationship between physical activity and hypertension prevention, this study will provide valuable insights for developing targeted interventions to reduce the risk of hypertension among adults.

The study findings will contribute to the growing body of evidence on the importance of physical activity for healthy aging, enabling healthcare providers to recommend evidence-based exercise programs for older adults.

Hypertension is a major risk factor for cardiovascular diseases, stroke, and kidney disease. By identifying the role of physical activity in preventing hypertension, this study may help reduce the healthcare burden associated with these conditions.

The study's results will provide policymakers with evidence to inform physical activity promotion initiatives and hypertension prevention programs, ultimately contributing to improved population health.

By understanding the benefits of physical activity for hypertension prevention, people aged 40 years and above can make informed decisions about their lifestyle choices.

Healthcare professionals will benefit from the study's findings, enabling them to provide evidence based guidance on physical activity for hypertension prevention.

The study's results will inform the development of targeted interventions and programs to promote physical activity and prevent hypertension.

1.7 Justification of the study

Many people live in communities that are not designed for physical activity. With limited studies on Physical Activity (PA), the implementation of policies to promote PA is relatively limited. The result of this laxity leads the population to increased risk of hypertension and other NCDs, thus leading to low quality of life and reduced life expectancy.

While it is true that chronic conditions have a long incubation period and typically do not manifest themselves until later in life, recent evidence has shown that some diseases previously thought to be

diseases of adulthood are becoming more prevalent among youths. For example, type 2 diabetes among youths and other conditions like obesity in children which is likely to result into hypertension (Ball & McCargar, 2013). Without studies on Physical Activity, engaging in regular physical exercises early in life will remain limited and this can lead to poor healthy activity habits later in life, thus increasing the risk of hypertension and reducing the quality of life.

Additionally, quality physical education in Uganda has been encouraged by Ministry of Education but it has not been included on the school program in almost all primary and secondary schools. This is possibly because of failure to recognize the negative impact of physical inactivity as a result of limited evidence based data on Physical Activity. Physical education has the opportunity to provide nearly all children with regular physical activity as well as the skills and knowledge to lead physically active lives.

1.8 Theoretical and conceptual framework

1.8.1 Theoretical framework

Theories of behavior change are essential to understand physical activity and provide an organizing framework for effective intervention. There are several models which have received empirical support for their effectiveness or show promise for intervening with Physical Activity.

The health belief model: The health belief model attempts to predict health-related behavior in terms of certain belief patterns. A person's motivation to undertake health behavior can be divided into three categories: individual perceptions, modifying factors, and likelihood of action. Individual perceptions are factors that affect the perception of illness and with the importance of health to the individual, perceived susceptibility, and perceived severity. Modifying factors include demographic variables, perceived threat, and cues to action. The likelihood of action is the perceived benefits minus the perceived barriers of taking the recommended health action. The combination of these factors causes a response that often manifests into the likelihood of that behavior occurring (King & Bock, 2017)

The health belief model proposes that the perception of a personal health behavior threat is influenced by at least three factors, general health values, which include interest and concern about health; specific health beliefs about vulnerability to a particular health threat and beliefs about the consequences of the health problem (Hochbaum & Rosenstock, 1952). If a person perceives a threat to their health, is consecutively cued to action and their perceived benefits outweigh the perceived barriers, then they are likely to undertake the recommended preventive health action. For this study, the individual's belief about the risk of developing hypertension and its severity can influence him or her to be engaged in physical activity.

Therefore, the health belief model predicts that strong intentions start up within an individual when he/she feels vulnerable to an illness. The illness is perceived to be severe, and the individual believes that Physical Activity will reduce the health threat associated with the illness.

For example, individuals may feel susceptible to cardiovascular disease because they have a poor diet and have been told by their physician that they have hypertension. They may also believe that regular exercise may reduce the threat of cardiovascular disease.

Thus far research has shown that perceived severity and beliefs about the benefits of physical activity exert strong influences on readiness to engage in Physical Activity related behavior, while the perceive severity and barriers have lesser impact. In addition, evidence suggests that the direct effects of perceived vulnerability, severity, susceptibility, benefits and barriers on PA are small and are mediated by readiness. Therefore, the health belief model relates to this study in the following ways;

- For perceived susceptibility and severity, the individuals' perception of their risk of developing hypertension and its severity can influence their engagement in physical activity.
- Perceived benefits and barriers can help individuals think of the benefits of physical activity in reducing hypertension risk and the barriers they face like lack of time that is likely to affect their physical activity levels.
- The cues to action that triggers or reminders that prompt individuals to engage in physical activity, such as health education campaigns or social support from family or friends.
- Lastly self-efficacy that help an individual to gain confidence in their ability to engage in physical activity.

However, there are issues with using the health belief model and meta-analyses have found mixed results of its effectiveness (Carpenter, 2010; Taylor, 2006). In a UK review of research utilizing HBM there was no evidence that health belief model-based interventions have contributed positively to overall improved health outcomes in the United Kingdom (Taylor, 2006). Furthermore, a meta-analysis of 18 studies found perceived barriers and perceived benefits to be the strongest predictors of behavior, but perceived severity was weak (Carpenter, 2010). Carpenter (2010) suggested that future research should examine possible mediation and moderation between the core components of the health belief model, than to explore direct effects.

1.8.2 Conceptual framework

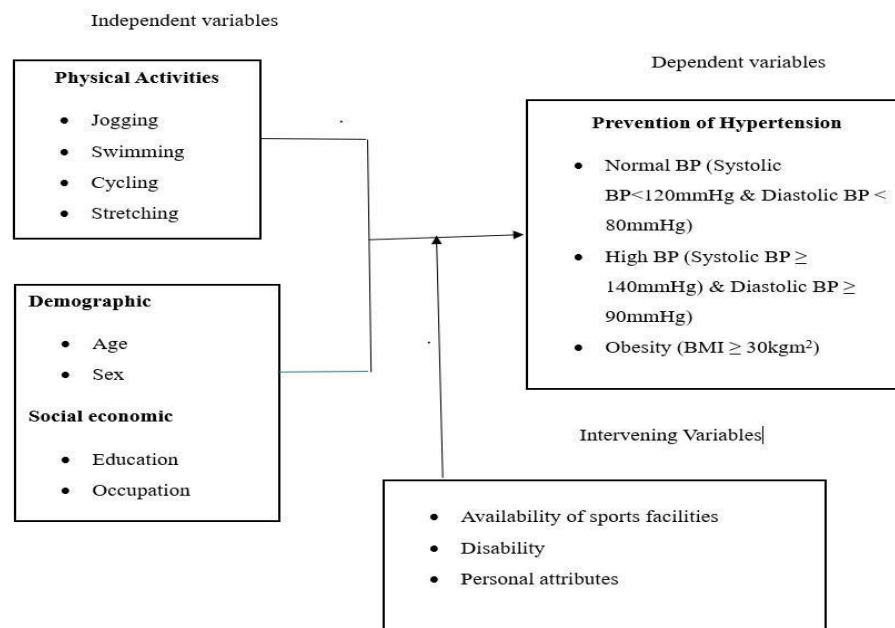


Figure 1: Conceptual Framework

As we age, we want to have the strength, endurance, flexibility, and mobility to remain active and independent so that we can take care of our own personal and household needs or participate in active social, recreational and sport activities, if that is our choice, According to this model, habitual physical activity can influence the physical fitness level, which can, in turn, modify the level of physical activity.

The model also specifies that less involvement in aspects that promote PA like aerobic activities can reduce body function and thus increase the risk of developing hypertension and other associated diseases like coronary heart diseases.

1.9 Scope of the study

1.9.1 Content scope

This study assessed the association between Physical Activity and prevention of hypertension among people aged 40 years and above in Mbarara city. The study determined the prevalence of hypertension, the relationship between demographic factors and Physical Activity involvement among people aged 40 years and above in Mbarara city. This was achieved by administering a questionnaire to the study participants. This activity involved data collection from the field, analysis, report writing, presentation of the findings and handing in the final report.

1.9.2 Geographical scope

This study was conducted in the two administrative divisions of Mbarara City, namely Mbarara City North and Mbarara City South. Both divisions were included because together they constitute the whole urban administrative area of Mbarara City, contain the target population for the study, and provide a balanced representation of adults aged 40 years and above from the northern and southern parts of the city. According to the National Population and Housing Census 2014, Mbarara City had a total population of 195,013 people.

1.9.3 Time scope

The research assistants were trained for 2 days on how to administer the questionnaire to research participants and the purpose of the study was explained; the study took eight months from January to August 2024.

2. LITERATURE REVIEW

2.0 Introduction

This chapter discusses and reviews similar or related researches and literature published by other authors' articles, books, journals, reports and previous dissertations related to the topic in question and its variables in order to give an insight into the study as well as expressing the need for this study.

2.1 Prevalence of hypertension

Hypertension is the most common cardiovascular disorder, affecting approximately one billion people globally, and is among the leading contributors to the global burden of disease and premature death, accounting for approximately 9.4 million deaths annually (Gawatudde et al., 2015; Ataklte et al., 2012). In 2000 alone, there was an estimated 972 million people with hypertension, 65% of whom lived in the developing world. The effects of hypertension if not controlled are devastating, and may lead to a number of non-communicable diseases (NCDs) including stroke, myocardial infarction, cardiac failure, and renal failure among others (Gawatudde et al., 2015). In sub-Saharan Africa (SSA), many countries still lack detailed basic data on the prevalence and the determinants of hypertension (Hendriks et al., 2012). However the World Health Organization (WHO) projects the number of hypertension cases in Sub Sahara Africa (SSA) to increase from an estimated 80 million in 2000 to 150 million in 2025 (WHO, 2013).

Hypertension in SSA is believed to be a problem of the urban areas due to transition to a more Western lifestyle. Early cross-sectional studies from rural areas in SSA report low mean blood pressures that are stable with age, and a low prevalence of hypertension (Hendriks et al., 2012). Migration studies in Low Middle Income Countries (LMICs) showed that migrants from rural to urban areas showed an increase in blood pressure (Ataklte et al., 2015). Recent studies from rural areas in SSA suggest that the prevalence of hypertension is increasing in rural populations. However, unrelated studies are difficult to compare due to a lack of age- standardized prevalence data (Hendriks et al., 2012; Ataklte et al., 2015).

Tackling the rising burden of hypertension in SSA is most likely a cost-effective approach to curbing the societal and economic impact of cardiovascular disease in the region. Such an approach would involve concerted efforts to improve early detection of hypertension, increase hypertension awareness in the community and improve access to affordable healthcare for those with the condition. Although there have been individual reports on prevalence of hypertension awareness, treatment and control in Sub Sahara Africa, the data have not been appropriately synthesized to date (Hendriks et al., 2012; Ataklte et al., 2015; Gawatudde et al., 2015).

In Uganda, the few studies conducted to estimate the prevalence of hypertension have been in small geographical areas and therefore have not sufficiently clarified the prevalence of hypertension countrywide (Gawatudde et al., 2015). This study will analyze blood pressure data from the respondents to describe the prevalence of hypertension and its distribution in the Mbarara city population.

2.2 Factors associated with physical activity involvement

Physical activity recommendations can be achieved through leisure time physical activity, which can be divided into four exercise categories, including sport, conditioning exercise, household tasks, and other (recreation) (Pharr et al., 2020). Sport has been defined as “a human activity of achieving a result requiring physical skill which by its nature and organization is competitive and is generally accepted as being a sport” (Australian Sports Commission, 2015). Previous research has found that both men and women who participate in sport, compared to the other three exercise categories, have reduced risk of cardiovascular disease, including stroke and heart attack, diabetes, high cholesterol, hypertension, and some cancers,

including skin cancer, chronic obstructive pulmonary disease, arthritis, kidney disease, and depression (Pharr & Lough, 2016 & 2021).

However several factors affect the frequency and intensity of physical activity (Pharr et al., 2020). These include age, sex and ethnicity. In general studies found that as age increases, physical activity declines (Pharr et al., 2020). This is consistent throughout the lifespan in childhood, adolescence, adulthood and old age (Miller et al., 2018). Women are less likely to engage in physical activity than men (Taniguchi & Shupe, 2014). This is especially true for those who belong in minority groups, such as Asian, non-Hispanic blacks, and Hispanics, compared to their non-Hispanic white counterparts

(Biddle; Edwardson & Rowlands, 2019). However, while both women and men who identify as South Asian have the lowest physical activity levels, in comparison to other ethnic groups, they are also the least sedentary and have low levels of being overweight (Biddle; Edwardson & Rowlands, 2019).

Other socio-demographic factors include marital status, income, employment, and education levels. Some studies found that married individuals spend less time exercising and engaging in moderate to vigorous physical activity than those who are not married, where the decrease among married women is more prominent than married men (Miller et al., 2018). However, another study found that spousal pairs had greater involvement in physical activity due to participation in activities together (Pharr et al., 2020). Children, adolescents, and adults who come from a low-socioeconomic background tend to have lower physical activity levels than those who come from a high-income background (Pharr et al., 2020; Shuval et al., 2017).

Highly educated individuals those who have a university degree or a higher vocational schooling are more likely to have higher levels of physical activity than those who are not as educated. Less educated individuals are likely to rely on employment for activity (Onge & Krueger, 2011).

Furthermore, they tend to participate in team sports rather than facility-based activities (going to the gym) due to the lack of resources (Onge & Krueger, 2011). Those who are unemployed tend to have lower physical activity levels than those who work full-time (Van Demelen et al., 2011). However, women with a full-time sedentary job engage in less physical activity than those who do not work (Van Demelen et al., 2011).

Although a great deal is known about the socio-demographic factors of physically active people, particularly when comparing people who are active to those who are not, the socio-demographic characteristics among physically active people like women, especially of the different subcategories of physical activity (sport, conditioning exercise, recreation, and household tasks) is not known (Pharr et al., 2020). No study has been found to have assessed the relationship of demographic factors with PA in Uganda. This still makes interventions for PA and its associated outcomes limited in Uganda. An understanding of correlates and determinants, especially in countries of low and middle income, could reduce the effect of future epidemics of inactivity and contribute to effective global prevention of hypertension.

2.3 Relationship between physical activity and prevention of hypertension

Ancient physicians including those from China in 2600 BC and Hippocrates around 400 BC believed in the value of physical activity for health. By the twentieth century, however, a completely opposite view that exercise was dangerous prevailed instead (Shiroma et al., 2012). During the early twentieth century, complete bed rest was prescribed for patients with acute myocardial infarction (Shiroma et al., 2012). This practice later changed after the opinion of Professor Jerry Morris who conducted the first rigorous, epidemiologic studies investigating physical inactivity and chronic disease risk, published in 1953 (Blair et al., 2011). Since then, a large body of evidence has clearly documented the many health benefits of physical activity including; low rates of mortality due to high blood pressure, CHDs, breast cancer, type 2 diabetes, colon cancer and depression (Shiroma et al., 2012; WHO, 2010). Despite this knowledge, a large proportion of the world's population remains physically inactive.

Globally, many adults and children do insufficient physical activity to maintain good health (Hallal et al., 2012). As the global burden of hypertension increases, risk factors such as physical inactivity become relevant in low-income and middle-income countries, not just in the most developed nations (Bauman et al., 2012). Physical activity starts from childhood with a gradual increase in frequency, intensity and duration in order to achieve its positive impact on physical fitness, mental health and to increase self-esteem (WHO, 2016).

About 2 million deaths per year are attributable to physical inactivity worldwide, and more than 80% of deaths from chronic diseases occur in developing countries (Oyeyemi, 2013). Reduced PA has been linked to the epidemiologic transition from infectious communicable diseases to chronic NCDs in the African continent (WHO, 2017).

Recent data from large prospective studies among U.S. populations including the Nurses' Health Study II, the Aerobics Center Longitudinal Study (ACLS), and the Coronary Artery Risk Development in Young Adults (CARDIA) study have shown that self-reported physical activity is associated with reduced risk of developing hypertension (Carnethon et al., 2010). Similarly data from the CARDIA and ACLS studies have also shown that cardiorespiratory fitness is inversely associated with the development of hypertension (Carnethon et al., 2010). Inverse associations between physical activity and or cardiorespiratory fitness and incident hypertension have also been reported amongst various international populations in Britain, China, Denmark, France, Italy, Korea, Saudi Arabi, and Thailand in recent years (Arsefag et al., 2011; Jae et al., 2012).

The 2008 Physical Activity Guidelines for Americans state that 'For most health outcomes, additional benefits occur as the amount of physical activity increases through higher intensity, greater frequency, and or longer duration (Diaz & Shimbo, 2013). In the Australian Longitudinal Study on Women, Pavey and colleagues showed that the risk for incident hypertension decreased with increasing total volume of physical activity (Pavey et al., 2013). The decreasing risk of hypertension was similar among women who engaged in only moderate physical activity and women who engaged in both moderate and vigorous physical activity at all volumes of MET equivalent physical activity with the exception of the highest volume of physical activity (>2000 MET minutes/week; 4 times greater than physical activity guidelines).

Investigators concluded that a dose-response relationship for total volume of physical activity and incident hypertension exists, but that the addition of vigorous physical activity does not provide additional benefits in the prevention of hypertension above those from moderate intensity activity, except at very high volumes of physical activity.

Williams and Thompson found that running and walking were associated with comparable risk reductions of incident hypertension when equivalent energy expenditures (MET hours/day) were compared (Williams & Thompson, 2013). There were incremental reductions in risk for incident hypertension with greater MET hours/day for both modes of exercise. This dose-response relationship was similar in both the walking and running groups, suggestive that exceeding current guidelines in terms of energy expenditure incurs greater health benefits, regardless of intensity (Diaz & Shimbo, 2013).

Regular physical activity and exercise over long periods of time can produce long-term health reimbursement. So, health experts say that older adults should be active every day that facilitate to maintain their health. Besides this, physical activity and regular exercise can reduce the risk of diseases and disabilities that develop as people grow older (Naglaa & Asmaa, 2018). However the mechanisms by which physical activity may reduce BP and prevent the development of hypertension are unclear. This is in large part due to the fact that the etiology of hypertension is multifactorial in nature and it is as of yet unclear how these factors interact to contribute to the development of hypertension. (Diaz & Shimbo, 2013). The knowledge gaps in this literature includes,

The studies focused on adults, potentially under looking the impact of physical activity on hypertension in younger population.

The literature did not consider other life style factors like diet, smoking, and alcohol consumption that could influence hypertension.

For further research on the same topic, the following should be put under consideration;

Investigating the relationship between physical activity and hypertension in younger age groups to understand early-life risk factors and preventive measures.

Examining the combined effects of physical activity, diet, and other lifestyle factors on hypertension to develop comprehensive prevention strategies.

Summary of Literature Review and Research Gaps

Hypertension remains a major global public health concern, affecting approximately one billion people worldwide and contributing substantially to premature morbidity and mortality (Gawatudde et al., 2015; Ataklte et al., 2015). In sub-Saharan Africa (SSA), the prevalence of hypertension is increasing, largely driven by rapid urbanization, lifestyle transitions, and low levels of physical activity (Hendriks et al., 2012; World Health Organization [WHO], 2013). Despite the growing burden, many countries in SSA,

including Uganda, lack comprehensive, population-based data on hypertension prevalence and its determinants. Existing Ugandan studies have often been conducted in small geographic areas or among specific population subgroups, limiting the generalizability of findings to urban centers such as Mbarara City (Gawatudde et al., 2015).

Physical activity has been consistently identified as a key modifiable determinant of hypertension and other non-communicable diseases. Evidence from high-income countries demonstrates an inverse relationship between physical activity and the risk of developing hypertension, with greater frequency, intensity, or duration of activity conferring additional benefits (Carnethon et al., 2010;

Diaz & Shimbo, 2013; Pavey et al., 2013; Shiroma et al., 2012). The research gaps include; Dose response and optimal prescription: The exact thresholds, minimum, optimal volume, frequency and duration of physical activity needed to prevent hypertension remain unclear and intensity discrepancies, Studies show conflicting results on whether vigorous exercise provides added benefits over moderate exercise for prevention of hypertension.

Modality and type of activity: Resistance and aerobic training, most prevention data focuses on aerobic exercise, while the independent preventive effects of resistance training and muscular strength remain understudied.

Sedentary interaction, the independent role of sedentary behavior prolonged sitting apart from lack of exercise requires deeper investigation across different populations.

Demographic and population: Underrepresented Groups, Most data originates from high-income or developed countries leaving a gap in evidence regarding low- and middle-income regions and diverse ethnic groups. More so age and sex nuances, Age-specific example young adults versus the elderly and sex-specific differences in the physiological response to exercise-based prevention need clearer mapping.

Methodological and mechanistic: Subjective measurement, many studies rely on self-reported questionnaires for physical activity instead of objective tools like accelerometers. In addition review details on optimal thresholds and risk factors in physical activity and the prevention of hypertension and examining community-level engagement barriers in factors influencing physical activity for hypertension prevention had been under researched.

Moreover, despite the rising burden of hypertension and low physical activity in Uganda, no studies to date have specifically investigated the relationship between physical activity and hypertension in Mbarara City. The local mechanisms by which physical activity may influence blood pressure remain unclear, and context-specific evidence is lacking to inform preventive strategies and public health interventions.

Therefore, this study seeks to address some gaps by:

1. Determining the prevalence of hypertension among adults aged 40 years and above in Mbarara City;
2. Identifying factors associated with physical activity involvement in this population.
3. Assessing the relationship between physical activity and prevention of hypertension, thereby generating contextually relevant evidence to guide health promotion and chronic disease prevention in urban Uganda.

3. RESEARCH METHODOLOGY

This chapter presents the methodology used in the study. It covers the study area, research design, study population, sample size and sampling techniques, data collection instruments and procedures, validity and reliability of the research instruments, data analysis, community engagement, ethical considerations, and limitations of the study.

3.1. Study area

This study was conducted in the two administrative divisions of Mbarara City, namely Mbarara City North and Mbarara City South. Both divisions were included because together they constitute the whole urban administrative area of Mbarara City, contain the target population for the study, and provide a balanced representation of adults aged 40 years and above from the northern and southern parts of the city. Mbarara City is found in the Western Region of Uganda and is a major commercial centre. The city headquarters is located approximately 270 kilometres by road southwest of Kampala. According to the National Population and Housing Census 2014, Mbarara City had a total population of 195,013 people.

The major socio-economic activities in the city include business, taxi driving, boda-boda riding, formal employment, informal trading, and subsistence agriculture on the outskirts of the city. Urban lifestyles, including consumption of snack and processed foods and frequent use of motorized transport, are common in the city and may influence physical activity patterns.

Mbarara City was selected because previous evidence indicates a high burden of hypertension in the area; for example, 51.7% of patients who visited Mbarara Regional Referral Hospital in 2021 were diagnosed with hypertension (Batte et al., 2023). The city was therefore an appropriate setting for examining the association between physical activity and hypertension prevention.

3.2 Study design

This study used a cross-sectional study design with quantitative approaches of data collection. The design was appropriate because data on physical activity and hypertension status were collected from respondents at one point in time, making it suitable for estimating prevalence and examining associations between variables in a defined population. A cross-sectional design was also practical for this community-based study because it allowed data to be collected from a relatively large sample within the available time and resources without manipulating any study variables (Whitley & Kite, 2012).

3.3 Study population

The study population consisted of 384 people aged 40 years and above living in Mbarara city. This age group is more exposed to the effects of physical inactivity like coronary heart disease, cardiovascular disease, stroke and hypertension.

3.4 Sample size and sampling techniques

3.4.1 Sample size determination

The sample size for the study was estimated using the Krejcie and Morgan (1970) sample size determination table. This approach was chosen because it provides a standard and widely used method for selecting an adequate sample size from a known population at a 95% confidence level and a 5% margin of error. According to the National Population and Housing Census (NPHC) 2014, Mbarara City had a population of 195,013 people. Using the Krejcie and Morgan (1970) table, this population corresponds to a sample size of 384 respondents, as shown in Table 1 below.

Table 1: Krejcie & Morgan table of 1970

<i>Table for Determining Sample Size of a Known Population</i>									
N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	100000	384
<i>Note: N is Population Size; S is Sample Size</i>					<i>Source: Krejcie & Morgan, 1970</i>				

3.4.2 Sampling procedure

3.4.2.1 Sampling of the study area

Mbarara City was purposively selected because previous evidence showed a high burden of hypertension in the area, while the level of physical activity involvement among adults aged 40 years and above had not been adequately documented (Batte et al., 2023). The two divisions of Mbarara City and all wards within those divisions were included to ensure geographical coverage and an evenly distributed sample of respondents.

3.4.2.2 Sample for each division

The sample size for each division was determined by considering the total population of Mbarara city (195,013) proportional to the total population in the two divisions. This was determined by dividing the division population by the total population of the city multiplied by the required sample size of 384 (Table 2). Thus the required sample size for each division was as follows; Mbarara city north (193) and Mbarara city south (191).

Table 2: Sample size determination for each division

No.	Division	Population	Sample size calculation	Required sample size for each county
1.	Mbarara city north	97,928	$(97,928/195013) \times 384$	193
2.	Mbarara city south	97,085	$(97,085/195013) \times 384$	191
	Total	195,013		384

3.4.2.3 Sample size for each ward

The sample size for each ward was determined by considering the sample of each division dividing it by the number of wards in the division (table 3). An equal sample size was obtained for each ward since population data for wards could not be obtained from anywhere. **Table 3: Sample size for each ward**

Division	Ward	Sample size
Mbarara city north (193)	Kakoba	49
	Katojo	48
	Rukindo	48
	Rwakishakizi	48
Mbarara city south	Kamukuzi	48
	Ruharo	48

(191)	Kakika	47
	Biharwe	47
Total		384

3.4.2.4 Sampling study cells and their sample size from each ward

Study cells for each ward were selected by simple random sampling. Names of cells for a ward were written on pieces of paper and then placed in a box. The box was shaken thoroughly and then a single paper was picked randomly. The name of the cell from the paper was read and recorded. Three cells for each ward were selected by this method. A total of 24 cells were selected for study. The sample size for each cell was determined by dividing the study sample for each ward by the three selected cells. For Mbarara city north and Mbarara city south, the following cells were selected (*table 4*). **Table 4: Sampling study cells and their sample size from each ward**

MBARAR CITY NORTH			
Kamukuzi ward	Ruharo ward	Kakiika ward	Biharwe ward
Kakyeka (16)	Kiyaja (16)	Byarufa (16)	Koranolya (15)
Nkokonjeru (16)	Rwizi (16)	Ntare (16)	Biharwe (16)
Booma (16)	Ruti (16)	Makenke (15)	Bigamba (16)
MBARAR CITY SOUTH			
Kakoba ward	Rukindo ward	Katojo ward	Rwakishakizi
Kakoba (17)	Nyakakoni (16)	Ngara (16)	Nyakayojo (16)
Lugazi (16)	Bwenkoma (16)	Kabingo (16)	Kibingo (16)
Nyapotani (16)	Rukindo (16)	Rwarire I (16)	Rucece (16)

3.4.2.5 Sampling of participants for structured interviews

Participants for structural interviews were systematically selected from the sampled cells using systematic sampling. A register of all households from each selected cell was obtained from the chairperson local council I. A participant to be interviewed was selected from every successive third household on the register. A household found not having a member aged 40 years and above was skipped. Members who were found in the household aged 40 years and above but weak or sick were not included in the study. This method of sampling is useful because it helps to get an evenly distributed sample.

3.5 Data collection

3.5.1 Data collection instruments

Personal Information Form

The study questionnaire consisted of participants' socio-demographics in terms of age, sex, marital status, level of income and occupation.

3.5.2 Measures

Blood pressure

The blood pressure (BP) was measured based on the American Heart Association BP measurement recommendations, which reduced the intra-observer error of BP measurements (Pickering et al., 2005). Participants were allowed to sit down for at least 5 minutes before measuring their BP. Blood Pressure measurement was taken on the left arm with the participant in the sitting position using battery powered digital blood pressure machine. Two readings were taken 3-5 minutes apart. The average of these two values was taken. If the two readings differed by more than 5mmHg, a third reading was taken and the average noted. Hypertension was classified based on the classification of the Joint National Committee on Prevention, Detection, Evaluation and Treatment (JNC-7) (Gamage & Seneviratne, 2021). Based on the JNC-7 criteria, a participant was considered hypertensive if she/he was already diagnosed of hypertension and on treatment or with a current systolic BP of ≥ 140 mmHg or diastolic BP ≥ 90 mmHg.

Anthropometric measurements

Body height was assessed using a tape measure, while body mass was measured by a digital weighing scale. For height, measurements were taken with the participant standing upright against a wall on which a height mark was made and a tape measure used to derive the height. Measurements were taken with the participant in barefoot, standing with the back against the wall and head in the Frankfort position with heels together. The participant was asked to stretch to the fullest. Height measurements was taken to the nearest 0.5 cm. Body Mass Index (BMI) was calculated as the ratio between body mass (kg) and squared body height (m^2), and was further collapsed into the following categories: underweight (< 18.5 kg/ m^2), normal weight (18.5–24.9 kg/ m^2), overweight (25–29.9 kg/ m^2) and obesity (≥ 30 kg/ m^2) (Pedisic et al., 2019).

Physical activity measure

Physical activity was assessed using the Global Physical Activity Questionnaire (GPAQ). The questionnaire asks about physical activity in the domains of work, transport, sports and leisure-time related PA in a typical week. Participants were asked to recall activities they were engaged in the last seven days and which at least lasted for at least 10 minutes. Energy utilization of all vigorous and moderated PA and walking was expressed as metabolic equivalent-of-task (MET) minutes per week. The following MET

values were used to measure the level of PA using the GPAQ: Vigorous PA = 8.0 METs, Moderate PA = 4.0 METs and Walking = 4.0 METs.

For all domains, minutes/week was converted to MET/minutes/week by multiplying total minutes/week by the MET values. All the domain-specific values were then added to get the total PA score. Considering the scoring protocol of the GPAQ, the levels of PA were categorized into low, moderate and vigorous/high. Participants who scored less than 600 MET-min./week were classified to be insufficiently active (Low PA), those that scored between 600 and 3000 MET-min./week were considered to be sufficiently active (moderate PA) (WHO, 2010), and those that scored more than 3000 MET-min./week were considered being highly active (vigorous PA).

3.5.3 Administration of Instruments

The principal researcher and research assistants had to seek for informed consent from respondents. The interviewer guided questionnaire was then administered to respondents that consented and their responses were recorded by the interviewers. Data collected was checked daily by the principal researcher for completeness. Filled questionnaires were kept in a safe place.

3. 6 Validity and Reliability of the Research Instruments

3.6.1 Validity

According to Fawcett (2013), a test is considered valid when it succeeds in measuring what it is supposed to measure. For this study, validity of the instruments was measured using the Content Validity Index (CVI), which was determined by rating the relevance of the questionnaire items among 15 people in Kagongi Sub County, Mbarara District, which was outside the study area. The formula used was:

CVI = Number of items rated relevant / Total number of items. A Content Validity Index of 0.813 was obtained. According to Amin (2004), a minimum CVI of 0.8 is considered acceptable for validity.

3.6.2 Reliability

According to Jackson (2011), reliability is a measure of the degree to which a research instrument yields consistent results. Cronbach's alpha was used to measure the internal consistency of the instrument. The formula was: $\alpha = (N \times \bar{c}) / [\bar{v} + (N - 1) \times \bar{c}]$, where N is the number of scale items, $\bar{c}$ is the average inter-item covariance among the scale items, and $\bar{v}$ is the average variance. Using Stata, a Cronbach's alpha coefficient of 0.571 was obtained. According to Mugenda (2003), a minimum coefficient of 0.5 is considered reliable.

3.7 Data analysis

Data were analyzed using Stata statistical software version 18. The prevalence of hypertension was analyzed using frequencies, percentages, and 95% confidence intervals derived from blood pressure

measurements. Factors associated with physical activity involvement were analyzed using cross tabulations and comparison of percentages across physical activity levels. The relationship between physical activity and hypertension was analyzed using binary logistic regression because the dependent variable, hypertension status, was measured on a binary scale (hypertensive versus non-hypertensive).

The strength of association was reported using odds ratios (ORs) and 95% confidence intervals. Statistical significance was set at 5% (p-value < 0.05).

3.8 Community engagement plan

On the commencement of the research, a pre-visit to the community was done where the researcher discussed with community local authorities to seek permission to carry out this research. The purpose of the study was explained. Community local leaders were requested for their support during the process of data collection. This involved reporting to them directly or through phone calls if the research team got a problem in the field. Some of the community members like village health teams and other trusted members were recruited to direct the research assistants to reach the households of the participants. Recruited participants to be interviewed were explained the reasons why they are asked to participate. A consent form was given to them to sign before the start of the interview.

3.9 Ethical Consideration

The following ethical issues were followed in this study:

The research was done and approved by Bishop Stuart University Research Ethics Committee (REC No. BSU-REC-2022-15). Prior to the commencement of the study, an approval letter was obtained from Bishop Stuart University Graduate studies, Research and Innovation Board. Permission to conduct the study was obtained from the office of Mbarara city health officer and the division's headquarters after explaining the purpose of the study. Informed verbal consent was sought from the cell's LCI Chairpersons after explaining the objectives of the study.

More critically, informed consent was obtained from the participants before the interview. They were informed of their right to withdraw from the study at any time and if they were unwilling to participate. Issues of confidentiality like asking and writing participant's name in addition to not exposing participant's responses was assured before the interview exercise could commence. Benefits of the study were explained to the participants. It was explained that the study had no direct benefits like giving money to participants but only that their contributions in giving views would help ministry of health to improve on service delivery.

3.10 Limitations of the study

This study presents limitations. First, there is little research done to assess Physical Activity in Uganda, therefore obtaining local literature was quite difficult. However, the researcher endeavored to use the limited literature available and supplement it with the one from other countries to obtain the measures. Secondly, this study was based on self-reported physical activity, which has been found to overestimate

duration of Physical Activity when compared with objective measures of PA in studies that conducted in the USA, Sweden and the UK (Gawatudde et al., 2016). The estimated durations of Physical Activity might also be difficult to estimate in minutes, then maybe in hours, particularly in African setting where estimation of time is not usually particularly precise as compared with European populations. It is therefore possible that the levels of PA that is reported from this study might be higher than in reality. However for further research on the same subject, the best way is to use expensive way of objective methods of measuring Physical Activity.

4. DATA ANALYSIS AND PRESENTATION OF RESULTS

4.1 Socio demographic characteristics of the respondents

Table 5: Showing the Socio demographic characteristics of the respondents (n=384)

Variable	Total (n)	Percentage (%)
Gender		
Male	148	38.5
Female	236	61.5
Age (years)		
40-49	193	50.3
50-59	85	22.1
≥60	106	27.6
Marital status		5.7
Never married	22	
Married	276	71.9
Divorced/separated/widowed	86	22.4
Education level		
No formal education	82	21.4
Primary	158	41.2
Secondary	100	26.0
Higher	44	11.4
Income		
10000-50000	282	73.4
>50000-100000	84	21.9
>100000	18	4.7
Body mass index (BMI)		
Normal weight	132	34.4
Overweight	162	42.2
Obese	90	23.4

This study was conducted upon 384 respondents in Mbarara city; 148 (38.5%) were males and 236 (61.5%) were females. The most prevailing age category was 40-49 years which consisted of 193 (50.3%) participants. More than a half of the respondents 276 (71.9%) were married, 86 (22.4%) were divorced/separated/widowed and only 22 (5.7%) were single. In relation to their educational level 82 (21.4%) had no formal education, 158 (41.2%) studied primary level, 100 (26.0%) reached secondary level, and only 44 (11.4%) passed secondary level.

In as far as weekly income is concerned, more than a half of the respondent 282 (73.4%) earn between 10000-50000shs weekly, and only 18 (4.7%) earned above 100,000shs. With respect to body mass index (BMI), 132 (34.4%) had normal weight, 162 (42.2%) were overweight and only 90 (23.4%) were obese.

4.2 Prevalence of hypertension

Table 6: Showing the prevalence of hypertension (n=384)

Variable	Total (n)	Percentage (%)
Blood pressure		
Normal	273	71.1
High	111	28.9
Having signs of hypertension		
No signs	199	51.8
At least 2 signs	85	22.1
3 signs and above	100	26.1
Diagnosed positive of hypertension		
Yes	82	21.4
No	322	78.6

Of the 384 respondents, 273 (71.1%) had normal blood pressure while 111 (28.9%) their blood pressure was high. Regarding signs of hypertension, 199 (51.8%) reported having no signs, 85 (22.1%) had at least two signs while 100 (26.1%) had three or more of the signs. In connection with diagnosis for hypertension at a health facility, only 82 (21.4%) were positive for hypertension where their systolic blood pressure was greater or equal to 140mmHg or with diastolic blood pressure greater or equal to 90mmHg. Majority of the respondents 322 (78.6%) were diagnosed negative or possibly did not know their hypertension status.

4.3 Overall prevalence of hypertension by participant socio-demographic factors

Table 7: Showing Overall prevalence of hypertension by participant socio-demographic factors (n=384)

Variable	Hypertension levels		
	All n (%)	Normal n (%)	High n (%)
	384 (100)	273 (71.1)	111 (28.9)
Gender			
Male			39 (26.3)
	148 (38.5)	109 (73.7)	
Female	236 (61.5)	164 (69.5)	72 (30.5)
Age			
40-49	193 (50.3)	158 (81.9)	35 (18.1)
50-59	85 (22.1)	41 (48.2)	44 (51.8)
≥60	106 (27.6)	74 (69.8)	32 (30.2)
Marital status	22 (5.7)	19 (86.4)	3 (13.6)
Never married			
Married	276 (71.9)	196 (71.0)	80 (29.0)
Divorced/separated/widowed	86 (22.4)	58 (67.4)	28 (32.6)
Education level			
No formal education	82 (21.4)	61 (74.4)	21 (25.6)
Primary	158 (41.1)	98 (62.0)	60 (38.0)
Secondary	100 (26.0)	79 (79.0)	21 (21.0)
Higher	44 (11.5)	35 (79.6)	9 (20.4)
Income			
10000-50000	282 (73.4)	202 (71.6)	80 (28.4)
>50000-100000	84 (21.9)	53 (63.1)	31 (36.9)

>100000	18 (4.7)	18 (100.0)	0 (0.0)
Body mass index (BMI)			
Normal weight	132 (34.4)	102 (77.3)	30 (22.7)
Overweight	162 (42.2)	115 (71.0)	47 (29.0)
Obese	90 (23.4)	56 (62.2)	34 (37.8)

The results of the study indicated that hypertension was highly prevalent in the age group 50-59 years (51.8%) and least in the age group 40-49 years (18.1%). Participant with primary education were highly hypertensive (38.0%) compared to their counterparts in secondary and higher.

The results also indicated that prevalence of hypertension decreases with increase in the level of education as observed in secondary level (21.0%) and higher (20.4%). Hypertension was also greater in participants with middle income between Shs50,000-100,000 per week (36.9%) and was not observed in those with high income (0.0%).

However, participants with normal hypertension were observed in those with high income 100%, those who never married (86.4%), and those between 40-49 years (81.9%), those having higher education (79.6%) and secondary education (79.0%), and those with normal weight (77.3%).

4.4 Physical activity intensities

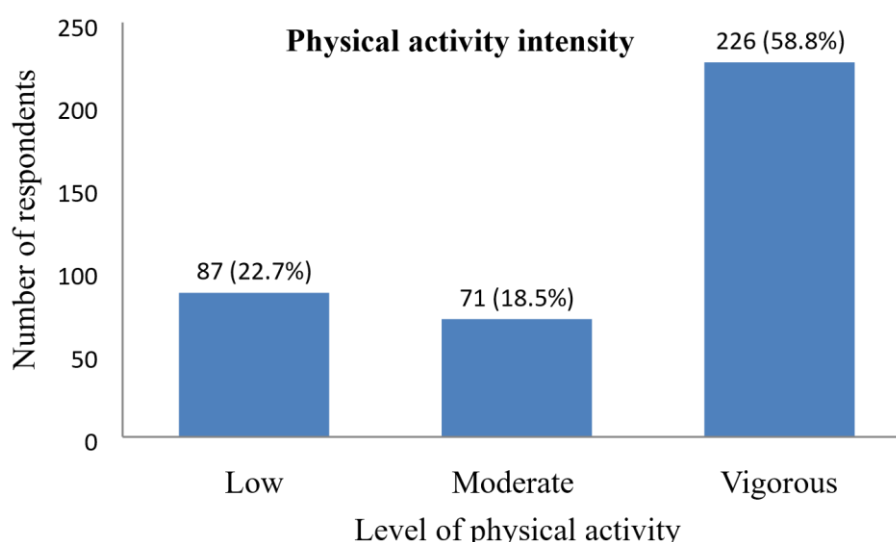


Figure 2: Showing the number of respondents with their level of physical activity intensities.

During the study, the total self-reported physical activity per week of respondents was calculated and categorized into three levels; low, moderate and vigorous. The study found out that majority of the participants 226 (58.5%) were involved in vigorous physical activity, 71 (18.5%) were involved in moderate while 87 (22.7%) were engaged in low physical activity levels. Participants who were involved

in moderate and vigorous physical activity all together 297 (77.3%) met the World health organization recommendations for sufficient physical activity.

4.5 Factors associated with physical activity involvement

Table 8: Showing the factors associated with physical activity involvement (n=384)

Variable	Physical activity levels			p-value
	All n (%)	Physical activity n (%)	Physical inactivity n (%)	
	384 (100%)	297 (77.3)	87 (22.7)	
Age				<0.001*
40-49			163 (84.5)	30 (15)
50-59			67 (78.8)	18 (21)
≥60			67 (63.2)	39 (36)
Marital status				0.119
Married	276 (71.9)	218 (79.0)	58 (21.0)	
Not married	108 (28.1)	79 (73.1)	29 (26.9)	
Education level				0.590
No formal education	82 (21.4)	65 (79.7)	17 (20.3)	
Primary	158 (41.1)	117 (74.0)	41 (26.0)	
Secondary	100 (26.0)	81 (81.0)	19 (19.0)	
Higher	44 (11.5)	34 (77.3)	10 (22.7)	
Income levels				0.369
Low income	282 (73.4)	214(75.9)	68(24.1)	
Middle income	84 (21.9)	67 (79.8)	17 (20.2)	
High income	18 (4.7)	16 (88.9)	2 (11.1)	
Involving in sports				0.009*
Involved	148 (38.5)	121 (81.8)	27 (18.2)	
Not involved	236 (61.5)	176 (74.5)	60 (25.4)	

The results of study showed that involvement in physical activity increases with low age. In this study 84.5% of the participants aged between 40-49 years were physically active and only 15.5% of them were physically inactive. Physical activity engagement lowered as age of participants increased. This is observed in age groups 50-59 years at 78.8% and 60 years and above at 63.2%.

Considering marital status, physical activity involvement was at least high in the married participants (79.0%) compared to those who were not married (73.1%). Only 21.0% of the married participants were physically inactive compared to 26.9% of the unmarried ones. There was no much difference in physical activity involvement between participants who are educated and those who are not. 79.7% of those who were not educated were slightly lower than those with secondary education (81.0%). However the results shows physical activity involvement increases with the level of education as observed from participant with primary (74.0%) to secondary (81.0%) and higher (77.3%).

Also physical activity rates increased with the level of income from low (75.9%), middle (79.8%), and high (88.9%). It was also high in participants who engaged in sports (81.8%) than those who did not engage in sports (74.5%).

4.6 Association of physical activity with hypertension

Table 9: Showing association of physical activity and prevention of hypertension

Physical activity levels	Hypertension levels				
	Normal	High	OR	95% CI	p-value
	n (%)	n (%)			
Physical activity	218 (73.4)	79 (26.6)	0.622	0.374 - 1.036	0.065
Physical inactivity	55 (63.2)	32 (36.8)			

This study showed that being physically active is likely to reduce the chances of developing hypertension (26.6%), (OR=0.622, CI=0.374-1.036) compared to being physically inactive (36.8%). However, this association was found not statistically significant ($p>0.05$)

5. DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Discussion

This study mainly investigated the association between Physical Activity and prevention of hypertension among 384 residents of Mbarara city with different gender, age, marital status, education level, income and BMI. In this study I found that males represented 38.5% (148) while females represented 61.5% (236). This study found out that the overall level of physical activity (PA) among participants was 77.3% and met the WHO recommendations for sufficient physical activity. This occurrence was much lower than that found in a country wide cross-sectional survey in Uganda where the occurrence was 94.3% (Gawatudde et al., 2016) but it varied greatly from other studies that have assessed PA in other parts of the country. A lower occurrence of PA (49%) was reported in Kasese district (Mondo et al., 2013) and even much lower (29.8%) in South-western Uganda (Murph et al., 2013)

However, in this current study, the occurrence was higher than that reported in a metropolitan Nigerian city where it was 68.7% (Adewale et al., 2013). It was also found to be higher than that found in Ivory Coast (66.7%), Algeria (66.5%), Mauritania (53.1%) and Mali (46.8%) reported in the 22 African countries that participated in the recent WHO Stepwise approach to chronic disease risk factor surveillance (Adewale et al., 2013). It was only in Mozambique where the level of PA was high (96.0%) than in this study (Guthold et al., 2011).

The high level found in this study is partially due to the fact that Mbarara city is predominantly both agrarian and business city where residents are involved in both labour intensive work like gardening alongside business. This explains the high level of occupational physical activity. Furthermore, the high level estimate might also be partially due to possible methodological issues. For example, overreporting of physical activity levels is a common methodological problem in physical activity studies based on self-reports (Peldisic et al., 2019). The validity of Global Physical Activity Questionnaire (GPAQ) estimates was previously found to be poor in Bangladesh (Peldisic et al., 2019) a low-income country similar to Uganda where Mbarara city is found. It might be that the validity of GPAQ estimates in Mbarara city was also poor. This should be examined in future validation studies for GPAQ conducted in the Mbarara city context.

On the other hand, this current study showed that the prevalence of hypertension among participants was 28.9%. This prevalence was slightly higher than that reported from a country wide cross-sectional survey in Uganda where it was 25.9% (Gawatudde et al., 2016). Findings from the national noncommunicable disease risk factor survey in Uganda also found out that the prevalence of hypertension in urban areas was 28.9% (Gawatudde et al., 2015) which was exactly similar to that in this current study.

Hypertension is among the chronic diseases that is on the rise globally and has been projected to increase to 150 million by 2025 in sub-Saharan Africa (Gamage & Sineviratne, 2021). This means that there are contributing factors leading to this rise and physical inactivity has been one of the major factors (Oyeyemi, 2013). A study among employees in the district of Colombo in Sri Lanka found out that physical inactivity was associated with high prevalence of hypertension (Gamage & Sineviratne, 2021). In this study, the level of physical inactivity was 22.7%. It was higher than that reported in a countrywide cross-sectional survey in Uganda where it was 5.7% (Gawatudde et al., 2016).

It should be noted that the sample in this study was small and it did not represent a national sample which is likely to reduce the comparability. A similar observation was found in a national physical activity study in Nepal where self-reported physical inactivity was much lower than other two previous Nepalese studies with small samples (Pedisic et al., 2019). However the level of physical inactivity in this study was lower when compared to other studies in Africa and Asia. It was found to be lower than 31.3% reported in a metropolitan Nigerian city (Adewale et al., 2013) and lower than 37.3% in Kunshan county-level city in Jiangsu Province, China (Saqib et al., 2020).

Although there was no significant association between physical activity and prevention of hypertension in this study ($p > 0.05$), the prevalence of hypertension was much lower (26.6%) in participants who were physically active compared to 36.8% among those who were physically inactive (OR=0.622, CI=0.374-

1.036). Physical activity is a natural preventive measure against different Non Communicable Diseases. Different NCDs are increasing due to physical inactivity as reported by Global Burden of Disease study that by 2030, NCDs including hypertension will increase by 75% (Saqib et al., 2020).

Fitness walking was found to have numerous health benefits and played a vital role in lowering the prevalence of hypertension (Saqib et al., 2020). Other studies reported a significant association between walking and all causes of mortality. Basing on this, walking was found to reduce all factors of mortality by 19–30% (Giada et al., 2008). Mortality due to hypertension can be reduced in primary and secondary prevention through regular physical activity and exercise (Giada et al., 2008). It was found to reduce by 31% among the age group 64–84 of men who participated in walking or cycling 20 minutes at least three times per week in china (Saqib et al., 2020). Bijnen et al found out that the risk factor of stroke was reduced by about 20% to 27% through moderate or high physical activity levels among individuals (Bijnen et al., 1998). A study conducted by Manton found that physical activity improves cardiovascular health through abdominal visceral fat accumulation, reduction in diastolic dysfunction, and improved endothelial vasodilator function.

As this study was carried among residents in Mbarara city, the results may not apply to all residents living in cities in Uganda. Physical activity was assessed based on self-reports which required participant's 7-day recall. This might not reflect accurate physical activity levels across their entire life.

5.2 Conclusion

Based on self-reported data on physical activity, the study found out that majority of participants met the recommended levels of physical activity. Hypertension was more prevalent in individuals who were physically inactive than those who were physically active.

Physical activity positively impacts human health and plays a dynamic role in health improvement, further reducing mortality due to hypertension. The study results have showed that the people of Mbarara city are involved in physical activity for lowering the prevalence of hypertension. The study results provide insight into understanding the trend of physical activity among residents in Mbarara city for health-being, which can also help the formation of policy regarding promoting physical activity.

However, this research had a number of gaps;

- (i) The study focused on individuals aged 40 years and above, potentially under looking the impact of physical activity on hypertension in younger population.
- (ii) The study did not consider other life style factors like diet, smoking, and alcohol consumption that could influence hypertension.
- (iii) The method used to measure physical activity was self-reported, this could impact the accuracy of the findings.

5.3 Recommendation

For further research on the same topic, the following should be put under consideration;

- (i) Conducting similar studies in other regions, for example urban versus rural setting to compare findings and understand the broader implication.
- (ii) Investigating the relationship between physical activity and hypertension in younger age groups to understand early-life risk factors and preventive measures.
- (iii) Examining the combined effects of physical activity, diet, and other lifestyle factors on hypertension to develop comprehensive prevention strategies.
- (iv) Implementing intervention studies to assess the effectiveness of physical activity programs in preventing or managing hypertension.

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APPENDICES

APPENDIX 1: QUESTIONNAIRE

Topic: Association between physical activity and prevention of hypertension among people aged 40 years and above in Mbarara city, Western Uganda.

Respondent's identification No..... Date of interview

Name of division..... Name of ward.....

Name of cell

Name of interviewer

Dear Sir/ Madam

I am Kabugho Aida a student at Bishop Stuart University pursuing a Master in Public Health. As one of the requirements for the award of the above degree, I am required to carry out a research project. The research is about determining the **Association Between Physical Activity and Prevention of Hypertension among People aged 40years and above in Mbarara city, Western Uganda**. You are kindly requested to spare some time and voluntarily respond to the following questions. All your responses will be treated confidentially and will be used for academic purposes and to give feedback to your leaders.

Your input is highly appreciated.

Section A: Socio Demographic data		
1.	Gender	Male Female
2.	Age (years)	40-49 50-59 ≥ 60
3.	Marital status	Never married Currently married Divorced/widowed/separated

4.	Education level	No formal schooling Primary Secondary Higher
5.	Level of income (UGx per week)	Between 10,000-50,000 Between 50,000-100,000 Above 100,000
6.	Body weight (kg)	
7.	Body height (m)	
8.	Systolic Blood Pressure (mmHg)	
9.	Diastolic Blood Pressure (mmHg)	
Section B: Assessing physical activity		
Next I am going to ask you about the time you spend doing different types of physical activity in a typical week. Please answer these questions even if you do not consider yourself to be a physically active person. Think first about the time you spend doing work. Think of work as the things that you have to do such as paid or unpaid work, study /training, household chores, harvesting food/crops, digging, fetching water, and seeking employment.		
10.	Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like [carrying or lifting heavy loads, digging or construction work] for at least 10 minutes continuously?	Yes No If no go to 13
11.	In a typical week, on how many days do you do vigorous-intensity activities as part of your work?	Number of days
12.	How much time do you spend doing vigorous-intensity activities at work on a typical day?	Hours : minutes
13.	Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking [or carrying light loads like firewood, baby, jerrican of water] for at least 10 minutes continuously?	Yes No If no go to 16
14.	In a typical week, on how many days do you do moderate-intensity activities as part of your work?	Number of days
15.	How much time do you spend doing moderate-intensity activities at work on a typical day?	Hours : minutes
Travel to and from places		
Now I would like to ask you about the usual way you travel to and from places. For example to work, for shopping, to market, to place of worship, and attending burials.		

16	Do you walk or use a bicycle (<i>pedal cycle</i>) for at least 10 minutes continuously to get to and from places?	Yes No If no go to 19
17	In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?	Number of days
18	How much time do you spend walking or bicycling for travel on a typical day?	Hours : minutes
Recreational activities		
Now I would like to ask you about sports, fitness and recreational activities (leisure)		
19	Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like [running or football,] for at least 10 minutes continuously?	Yes No If no go to 22
20	In a typical week, on how many days do you do vigorous intensity sports, fitness or recreational (<i>leisure</i>) activities?	Number of days
21	How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?	Hours : minutes
22	Do you do any moderate-intensity sports, fitness or recreational (<i>leisure</i>) activities that causes a small increase in breathing or heart rate such as brisk walking, (<i>cycling, swimming, volleyball</i>) for at least 10 minutes continuously?	Yes No If no go to 25
23	In a typical week, on how many days do you do moderate intensity sports, fitness or recreational (<i>leisure</i>) activities?	Number of days
24	How much time do you spend doing moderate-intensity sports, fitness or recreational (<i>leisure</i>) activities on a typical day?	Hours : minutes
Sedentary behavior		
Now I would like to ask you about the time you spend sitting or reclining at work, at home, getting to and from places, or with friends including time spent [sitting at a desk, sitting with friends, travelling in car, bus, train, reading, playing cards or watching television].		
25	How much time do you usually spend sitting or reclining on a typical day?	Hours : minutes
Section C: Assessing hypertension		
Now I would like to ask you about hypertension.		

25.	According to your general health, do you feel having some symptoms that make you suspect yourself of developing hypertension/high blood pressure?	Yes No
26	If yes, what symptoms do you have?	Difficult breathing Irregular heart beat Dizziness or fainting Fatigue Chest pain Nosebleed Severe headache Vision problems
27	Have you ever been diagnosed of hypertension at your health centre or hospital?	Yes No
29	If yes, are you currently on medication?	Yes No

APPENDIX 2: CONSENT FORM

Study topic: Association Between Physical Activity and Prevention of Hypertension people Adults 40years and above in Mbarara city, Western Uganda.

Date of interview

Name of division..... Name of ward.....

Name of cell

Name of interviewer

Dear Sir/ Madam

I am Kabugho Aida a student at Bishop Stuart University pursuing a Master's degree in Public Health.

As one of the requirements for the award of this degree, I am required to carry out a research project. The research is about determining the Association between Physical Activity and Prevention of Hypertension among people aged 40 years and above in Mbarara city, Western Uganda.

You are kindly requested to spare some time and voluntarily respond to some questions. All your responses will be treated confidentially and will be used for academic purposes, the result of the study will help the ministry of health to plan accordingly and give feedback to your leaders.



I am therefore requesting you to cooperate and answer these questions. The information gathered from you will be kept highly confidential.

Your input is highly appreciated.

However, you may decide to participate in this study or not.

Agree () Disagree () sign / thumb print.....

Thank you.

Researcher's Signature

I have fully explained the research study described by this form. I have answered the participant's questions and will answer any future questions to the best of my ability. I will tell the family or the person taking part in this research of any changes in the procedures or possible benefits of the study.

_____	_____	_____
Name of researcher	Signature	Date

APPENDIX 3: RESEARCH ETHICS COMMITTEE LETTER



To: Kabugho, A. B. 14/08/2023
BISHOP STUART UNIVERSITY
0775591803

Type: Initial Review

**BISHOP STUART UNIVERSITY
RESEARCH ETHICS COMMITTEE**
14 AUG 2024
APPROVED VALID UNTIL DATE SHOWN ABOVE
P.O. BOX 09, MBARARA

Re: BSU-REC-2022-15: ASSOCIATION BETWEEN PHYSICAL ACTIVITY AND PREVALENCE OF HYPERTENSION AMONG PEOPLE AGED 40 YEARS AND ABOVE IN MBARARA CITY, WESTERN UGANDA

I am pleased to inform you that at the 13 convened meeting on 20/07/2023, the Bishop Stuart University (BSU) REC meeting voted to approve the above referenced application.
Approval of the research is for the period of 14/08/2023 to 14/08/2024.

As Principal Investigator of the research, you are responsible for fulfilling the following requirements of approval:

1. All co-investigators must be kept informed of the status of the research.
2. Changes, amendments, and addenda to the protocol or the consent form must be submitted to the REC for re-review and approval **prior** to the activation of the changes.
3. Reports of unanticipated problems involving risks to participants or any new information which could change the risk benefit: ratio must be submitted to the REC.
4. Only approved consent forms are to be used in the enrollment of participants. All consent forms signed by participants and/or witnesses should be retained on file. The REC may conduct audits of all study records, and consent documentation may be part of such audits.
5. Continuing review application must be submitted to the REC **eight weeks** prior to the expiration date of 14/08/2024 in order to continue the study beyond the approved period. Failure to submit a continuing review application in a timely fashion may result in suspension or termination of the study.
6. The REC application number assigned to the research should be cited in any correspondence with the REC of record.
7. You are required to register the research protocol with the Uganda National Council for Science and Technology (UNCST) for final clearance to undertake the study in Uganda.

The following is the list of all documents approved in this application by Bishop Stuart University (BSU) REC:

No.	Document Title	Language	Version Number	Version Date
1	Informed Consent Waiver	PDF	English	2023-08-01
2	Site Specific Protocol	PDF	pdf	2023-08-01
3	Payment receipt for REC.	English	pdf	2023-03-03
4	Prior Ethical Approval	PDF	pdf	2023-02-15
5	Informed Consent forms	English	PDF	2022-08-31
6	Data collection tools	English	PDF	2022-08-31
7	Protocol	English	PDF	2022-08-31

Yours Sincerely,

Godfrey Rukundo
For: Bishop Stuart University (BSU) REC

