STUDY OF AN EXERCISE PROGRAM FOR ENHANCEMENT OF STUDENTS' FLEXIBILITY IN BISHOP STUART PRIMARY TEACHERS' COLLEGE MBARARA CITY UGANDA

BY

OYUKU THOMAS

18/U/GMSO/19475/PD

A DISSERTATION SUBMITTED TO THE DIRECTORATE OF RESEARCH AND GRADUATE TRAINING IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF SCIENCE IN SPORTS SCIENCE OF KYAMBOGO UNIVERSITY

OCTOBER, 2024

DECLARATION

This dissertation on the Study of An Exercise Program for Enhancement of Students' Flexibility in Bishop Stuart Primary Teachers' College (BSPTC) Mbarara City Uganda is my original work and has never been presented wholly or in part for a degree in this or any other university.

Sign ..... Date .....

Oyuku Thomas

APPROVAL

We as university supervisors confirm the work done by the candidate under our supervision

Signed..... Date .....

Dr. Mukana Roland Shimmey

Department of Sports Science

Signed..... Date .....

Dr. Lubega Samuel Kiwanuka

Department of Sports Science

DEDICATION

To my mother Lawino Pirina Ocan for the parental love and untiring support she has always given throughout my education endeavors.

ACKNOWLEDGEMENT

My heartfelt appreciation goes to individuals who supported me in different ways to complete this dissertation. First and foremost, I particularly appreciate my supervisors Dr. Mukana Roland Shimmey and Dr. Lubega Samuel Kiwanuka for their specialized guidance in shaping this work. I also appreciate my social group at BSPTC who kept encouraging me all through this study. My truthful pleasure also goes to the administrators, staff and students of BSPTC whose cooperation and help made me able to conduct this study successfully. I also express thanks to the data technician who helped me to compile and process the data. Lastly, I thank every member of my family for standing with me all through this challenging time, may the good Lord reward you all.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS AND ACRONYMS

AIS	Active Isolated Stretching
AOA	American Obesity Association
BSPTC	Bishop Stuart Primary Teachers' College
CBE	Community Based Exercise
CF	Cardio-respiratory Fitness
FM	Fibromyalgia
HR	Hold-relax
HRF	Health-Related Fitness
PA	Physical Activity
PE	Physical Education
PF	Physical Fitness
PSS	Passive Static Stretching
PTC	Primary Teachers' College
PTE	Primary Teacher Education
SPSS	Statistical Package for Social Science
YCMA	Young Men's Christian Association

ABSTRACT

This study aimed at applying an exercise program to enhance students' physical flexibility in BSPTC. The study employed an experimental design with 94 participants; of these 32 (34%) were male and 62 (56%) were female aged 19-24 years. The subjects were assigned randomly to either treatment group or control group. Modified training program designed to suit the case study was employed in which a one-hour physical flexibility training exercise was done four times a week for six weeks. Variations in physical flexibility levels of the participants over a period of six weeks were measured and monitored before and after the training. Standardized sit-and-reach test box was used to measure the flexibility level of the participants. Data were processed using Statistical Package for Social Science (SPSS) version 11 and descriptive statistic were used to analyze the data gathered through the sit-and reach test. Difference between the pre-test and post-test of both the intervention and control group was determined using T-test. The study revealed that a significant proportion of the respondents (19%) spent extended time (11 to 14 hours) sitting without participating in any physical activity. The study established that the mean pre-intervention physical flexibility level of the student in BSPTC was 39.14 cm with standard deviation of 4.95. The t-test conducted for the two outcome variables demonstrated significant difference between the pre and post flexibility test of the intervention group ($p = 0.000$) across all age group (19-24 years), but not the control group. The study concluded that 18% of the students do not engage in any form of Physical activity. Student of Bishop Stuart Primary Teachers' College had very low level of flexibility. The training program was effective in improving flexibility level of the students in BSPTC. Based on these facts, the study recommends that: the administration should plan and enforce physical activity programs in their learning institutions. Flexibility should be emphasized in the training program of the students in BSPTC. The training program employed in this study should be implemented in BSPTC and other Primary Teachers' Colleges.

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter provides the background to the study, problem statement, general objective of the study, specific objectives of the study, research questions, justification of the study, significance of the study, limitation of the study, scope of the study, conceptual framework, and operational definition of terms.

1.1 Background to the study

Physical fitness (PF) is very indispensable to our health and well-being (Janssen & LeBlanc, 2010). Everyone requires PF (Howie, Cannady, Messias, McNatt, & Walter, 2022). Mondal & Mondal (2018) have provided a number of benefits of PF which includes reduction of the possibility of heart attack, regulation of body weight, minimizing the level of blood cholesterol, reduction of type 2diabetes and some cancers' threat, lowering blood pressure, developing strong bones, muscles and joints, and reducing danger of falls among others.

According to Roy, Springer, McNulty, & Butler (2010) there are numerous factors that determine the level of PF of an individual. These factors include: - cardiovascular endurance, muscular strength, muscular endurance, flexibility and body composition. This study focuses on physical flexibility. Bardw (2015) stated that having flexible body is essential to our health and well-being, and as well responsible for sports performance. Dantas, Daoud, Trott, Nodari, and Conceição (2011) points out a number of health-related benefits of a flexible body across all age categories. It develops motor competence among children, including improvement of overall quality of movement in

youth and adults, reduction in the risk of injuries and muscle soreness, improvement of posture and balance, and makes it easy for an individual to perform certain exercise. In addition, flexibility decreases general aches and pain, prevents incorrect body alignment, enhances mood, promotes heart health, and leads to better overall shape.

Flexibility when not prioritized will begin to reduce throughout life, leading to muscles shortening with time, decrease in body's ability to maintain proper posture, limitation in proper joint motion, increase in the risk of lower-back and joint pain, more injuries during every day physical activities, and restriction in daily life and when exercising, hence it is a public health issue (Dantas *et al.*, 2011). According to Bardw (2015) there are a number of factors that determine flexibility level of an individual. Some of these factors are controllable, others are not. Controllable factors include muscle bulk, daily activities, and degree of physical training in the form of aerobic activities, flexibility and strength training program, quality of movement, activity level and previous injury regardless of the cause. Uncontrollable factors include age, gender, bone size and joint structure, connective tissues, and proprioceptors. Bardw emphasized that observation of these factors is essential for our health and well-being. This has made it very necessary to conduct a study aiming at enhancing physical flexibility of people world over.

Globally, flexibility has been given good attention. Several researches were done to enhance physical flexibility; Yousif, Yousif, and Fadhil (2013) carried out an experimental study on 18 junior physical strength group of Babylon for 2011 season. The training was conducted three times a week for 10 weeks. The study revealed that there was a considerable improvement in the level of

flexibility of the participants after stretching exercises intervention using surveyed teaching styles. Another study by Wee (2013) conducted on 50 pre-school boys in Malaysia showed improvement in the level of flexibility of the participants after adding stretching exercises for 2 minutes during 30 minutes' game activities carried out two times a week for 10 weeks.

In Africa, some scholars have expressed concern in addressing flexibility issues, while others have lagged behind. Janes (2007) conducted an experimental study on a group of young adulthood with back pain. The participants were subjected to flexibility training for 8 weeks. The result showed a considerable reduction on the intensity of pain in the experimental group but not the non-experimental group. In Uganda very few studies have been done on physical fitness and flexibility in particular. A comparative study was done by Mukana & Pila (2016) on PF of children from Mexico, Cuba and Uganda, ranging from the age of six to fourteen years. The study aimed at establishing and comparing the physical fitness level of children in the three countries. It was discovered that there is a lot of variations in physical conditions from one element to the other, in different age categories and sex in each of the three countries, however the general comparison of the level of growth of the physical capacity was in favor of Uganda with Cuba coming very close and Mexico taking position three with fairly large margin. In this study no intervention was made to improve the established physical condition of the children in all the three countries. The study also focused only some few components of physical fitness like speed, endurance and strength, leaving flexibility unattended to. It's on this ground that the study aims at designing

physical exercise program to enhance flexibility of the students in Bishop Stuart Core PTC.

1.2 Statement of the problem

Physical exercise has progressively attracted curiosity in promoting wellbeing and excellence in people's lives globally. There is a pressing issue requiring the prioritization of physical activity in health and all other key sectors including learning institutions. Bull, Al-Ansari, Biddle, Borodulin, Buman, Cardon, ... & Willumsen (2020) formulated exercise guideline to steer the setting up of exercise program for adults of all ages. The guideline provides the prescriptions of physical workout to enhancement cardio-respiratory and muscular strength. The guidelines can be adjusted based on the physical condition of the participants and the purpose of the intervention. Despite of the available guideline provided for the physical workout to promote fitness and health, the researcher noted with concern the health problems such as lower back and joints pain, difficulties in getting up from a sitting position, and numerous cases of injuries during Physical Education practical lessons among the students of BSPTC. According to Edlin and Golanty (2012) back pain is a result of inflexibility, poor posture, and limited physical activity or sitting for long periods of time. Freiwald *et al.* (2021) recommended that, exercise therapy should be used to manage lower back pain and promote physical fitness. However, the specific amount of physical exercise to address this particular issue is not available. The study was therefore focused on designing specific physical exercise program to enhance students' flexibility in BSPTC as a remedy to the health problems noted among the students of BSPTC.

1.3 General objective of the study

To assess the effects of physical exercise program on the flexibility of the students in BSPTC

1.4 Specific objectives of the study

i. To characterize the physical activity patterns of BSPTC students.

ii. To evaluate the flexibility level of the students in BSPTC.

iii. To determine the effects of the physical exercise program on the flexibility of the students in BSPTC.

1.5 Research questions

i. What are the physical activity patterns of BSPTC students?

ii. What is the physical flexibility level of the students at BSPTC?

Hypothesis

iii. Physical exercise program has no significant impact on physical flexibility of the students in BSPTC

1.6 Justification of the study

This study was conducted in BSPTC because there was a number of health-related challenges noted among the students of BSPTC which were suspected to be as a result of lack of physical flexibility, therefore developing exercise program to enhance students' physical flexibility would help to address those health-related challenges.

1.7 Significance of the study

Evidence on the benefits of physical exercise program generated by this study may act as an eye opener to the students and the entire staff of BSPTC. The study has come up with flexibility training program for continuous use by

fitness instructors. The study also may provide data to various education stakeholders to facilitate their decision making and innovations. Recommendations from this study may also help Uganda to catch up with other countries in developing physical exercise programs in the institutions of learning. It may also help the researcher to add on the existing literature. In addition, the study may also help the researcher to attain a master degree of science in sports science.

1.8 Limitation of the study

First, due to the threat of Covid 19 through the entire world Uganda inclusive at the start of the study, the researcher was interrupted by the lock down. The researcher handled this by complying with the government directives. Secondly, weather changes also affected greatly the training time since the study area receives much rainfall at most times. To address this challenge, the trainer had to become very flexible in conducting training sessions in case rain interrupted. In addition, participants' willingness to engage in the exercise program for every session was low. The researcher continuously kept encouraging them to participate in the training. More so, some participants were unable to perform some specific exercises effectively as designed in the program. The researcher focused on individual abilities and offered specialized support to every participant. In addition, measurement of the level of flexibility of some participants was not giving accurate results. The participants were measured three times while the researcher was taking keen observation of the process.

1.9 Scope of the study

This study was focused on determining the effects of physical exercise program on students' flexibility. The study was conducted at BSPTC from October to December 2023. Sit-and-reach test for flexibility was done before and after the training. The study involved32 male and 62 female students aged 19-24 years.

1.10 Conceptual Framework

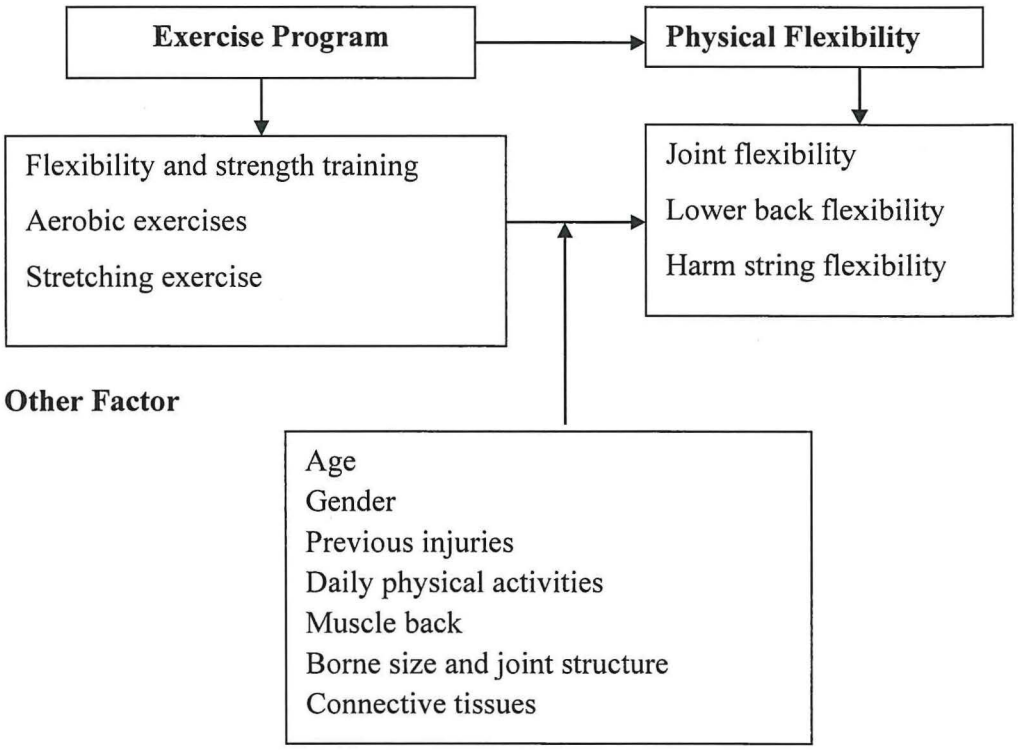


Figure 1: A model describing exercise program for promoting flexibility

The model describes physical exercise program for developing hamstring and lower back flexibility. The training program includes flexibility and strength training, aerobic exercises, and stretching exercises. The model shows that the training program enhances joints flexibility, hamstring and lower back flexibility. Other factors that influence the level of flexibility of an individual

include; age, gender, muscle bulk, bone size and joint structure, connective tissues, daily activity, and previous injuries.

1.11 Operational definition of terms

Cardio-respiratory Fitness (CF): The effective functioning of the respiratory system.

Exercise: Physical activities included in the training program to improve students' flexibility.

Flexibility: The ability of the joints to stretch without pain when performing daily living activities.

Health related fitness: The ability of the body systems to work effectively when carrying out physical exercises.

Muscular endurance: When the muscle is able to perform physical activities effectively for long time.

Muscular strength: The power that muscles can produce to perform physical workout.

Physical activity: Actions resulting from the use of skeletal muscles.

Physical fitness: Good physical health condition and skills in performing physical activities.

Range of Motion (ROM): Joint movement without any restriction when performing physical activities.

Stretching exercises: Physical workout for improving flexibility

Students: Learners in Bishop Stuart PTC.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This section focuses on the analysis of the text allied to the study. The analysis considers: Flexibility, physical training, physical exercise routine among students, exercise and flexibility.

2.1 Flexibility

Flexibility refers to the maximum point through which joints can stretch (Corbin & Lindsey, 1994). According to Corbin and Nobel (1980); Holt and Pelham (1995) flexibility is regarded key for our fitness, and it is required in all physical workouts to varying degrees. Dantas *et al.* (2011) argued that flexibility helps in improvement of overall quality of movement, reduction in the risk of injuries and muscle soreness, improvement of posture and balance, and makes it easy for an individual to perform physical exercise. In addition, flexibility decreases general aches and pain, prevents incorrect body alignment, enhances mood, promotes heart health, and leads to better overall shape. However, Dantas *et al.* (2011) further argued that having an excessive flexibility is just as much of a problem. If flexibility is beyond the limit, joints experience some damage by causing the tendons to get torn, hence reducing joint stability and causing sprains. While at the same time Dantas *et al.* highlighted that insufficient flexibility may lead to muscle strains, muscles shortening with time, decrease in body's ability to maintain proper posture, limitation in proper joint motion, increase in the risk of lower-back and joint pain, more injuries during every day physical activities, and limitation when exercising. They further argued that flexibility isn't a general characteristic

rather a joint-specific. In addition, Dantas *et al.* argues that a person may be flexible in one part of the body but the case may not be the same in the other parts of the body. They however stressed that it is beneficial to improve the overall flexibility status of a person.

Corbin and Nobel (1980) provided a brief history of flexibility research. They stated that the researchers started exhibiting great concern in carrying out flexibility research in early 1900s, as a result of escalating number of orthopedic cases arising from First World War and partly due to epidemic of polio at the start of the century. Much as the skill of flexibility measurement increased dramatically, interest in flexibility study has been erratic. During the period of 1930s and 1940s, only Cureton and some other few fitness researchers persisted on flexibility studies not until 1950s when greater concern was made on flexibility as a fitness and health promotion strategy. According to Plowman, Sterling, Corbin, Meredith, and Morrow (2006), Flexibility test (sit-and-reach) was conducted for the first time in 1980.Flexibility test is carried out by measuring joint range of motion (Meredith & Welk, 2010). According to Meredith and Welk, flexibility test generally takes two forms; laboratory and field test. Laboratory test is conducted using special device on a one-to-one basis, while field test is conducted in a group setting mainly in schools or sports clubs. There are also some other flexibility tests which are not commonly used in sports like Schober test and many others.

Bardw (2015) highlighted a number of factors that determine flexibility level of an individual. He categorized the factors into two; Controllable and

uncontrollable. Controllable factors include; muscle bulk, daily activities, and degree of physical training in the form of aerobic activities, flexibility and strength training program, quality of movement, activity level and previous injury regardless of the cause. Uncontrollable factors include; age, gender, bone size and joint structure, connective tissues, and proprioceptors. Bardw emphasized that proper attention to all these factors is very essential to our health and well-being.

An observational study was conducted by McKay, Baldwin, Ferreira, Simic, Vanicek, Burns, ... & 1000 Norms Project Consortium. (2017) to establish the level of flexibility of 13 joint in 1,000 participants between the age of 3–101 years and to examine the effects of demographic and anthropometric factors. The study revealed that flexibility level of the joint reduces steadily as the age increases, with small gender difference. Circumference of the waist also greatly affects the level of flexibility of the joint across all age categories.

Mistry and Sheth (2014) conducted a comparative study on 80 chronic LBP victims, to find out the gender relationship of hamstring flexibility of participants age 20-70 years. The results showed considerable weak negative relationship between age and hamstrings flexibility for both males and females.

Polly de Mille (2022) suggested six simple ways to increase one's flexibility; these include foam rolling, active stretching before the activity, stationary stretching after activity, stretching specific part of the body, frequent stretching, and ensuring safety.

2.2 Physical training program

Koh, Camiré, Lim Regina, and Soon (2017) defined physical exercise program as a detailed plan indicating the physical workout to be executed and the duration of each activity. The terms PA and physical exercise are used to mean the same, however Carl, Kenneth, and Gregory (1985) distinguish between these two terms; physical activity is a term that covers all disbursement of energy due to bodily movement through skeletal muscles irrespective of the amount of force required, Whereas physical exercise is an organized activity aiming at the development and maintenance of physical fitness. Therefore, physical exercise is an element of PA. According to Goel (2014), there is scientific proof that fitness and exercise is one of the keys to achieve good health.

Micheo, Baerga, and Miranda, G. (2012) stated that there are basically three categories of exercise defined by their impact on the body: exercise to improve the range of movement at a joint referred to as flexibility exercise, exercise targeting the development of cardiovascular endurance that is aerobic exercises, and exercise to improve muscle strength referred to as anaerobic exercises.

Assumpcao *et al.* (2017) designed a physical training program to examine the value of flexibility training and strength training in treating patients with fibromyalgia. The study involved participants; 14 were engaged in flexibility training, 16 participated in strength training and 14 were not engaged in any of the two exercise activities. All the participants continued with the usual medications. The two treatment groups were engaged in their respective exercises twice a week of 40 minutes per session for 12 weeks. On completion

of the 12 weeks training the participants were examined further. The results showed highest physical functioning score and lowest body pain score in the stretching group, while lowest depression score was noted in the resistant group. The study concluded that in relation to the two training exercises, flexibility training works best in promoting physical functioning and pain management, whereas strength training is the best for depression management.

Dadebo, White, and George (2004) conducted a study on 30 soccer players of England to examine the relationship involving existing flexibility training methods, like stretching, and hamstring strain rates (HSRs). Data were collected using questionnaire. Data coding was done and analysis was done using cross tabulation, correlation, and multiple regression. A number of flexibility training methods were used, with static flexibility being the most popular. The study concluded that there was variation in the flexibility training method based on coach's experience. Hamstring stretching was the main significant training factor linked with HSRs. In this study, other flexibility training methods were not specified.

López-Bedoya, Vernetta-Santana, Robles-Fuentes, and Ariza-Vargas (2013) studied the outcome of 3 different flexibility training modals on passive and active range of motion of hip flexion among physical education college students. The training included hold-relax (HR), active isolated stretching (AIS) and passive static stretching (PSS). 29 participants who consisted of 14 males and 15 females, 20 to 24 years were subjected to 9-weeks training. Pre and post flexibility test was carried out in the three different groups. The results showed considerable difference between the pre- and post-test among

all categories. The study concluded that PSS is the most appropriate way of improving both active and passive range of motion.

2.3 Physical exercise routine among students

Physical activity routine is a sporadic and sustained period of moderate or vigorous physical activity often achieved by an individual (Armstrong & Welsman, 2006). A study conducted by Kulinna, Martin, Lai, Kliber, and Reed (2003) established a difference in physical workout between boys and girls in secondary schools, where girls were reported to be highly engaged in individual games, and boys demonstrated high commitment in team sports. The study focused on the relationship between grade, sexual category, activity, and learners' engagement in sports. A total of 505 grade 3 through 12, students were involved in the study. Physical consignment on muscles were measured using Polar accurex Plus heart velocity telemetry structure. The study did not reveal the amount of time these students spent participating in the individual and in the team games.

Another study was conducted by Clemente, Nikolaidis, Martins, and Mendes, (2016) on 126 healthy university Portuguese students of 18-23 years old, to examine whether they conform to the public health recommendation of physical workout, and to assess how male and female students participate in PA based on days of the week. The researchers recorded the time students spend when they are physically inactive, the time they spend doing simple and hard exercises, and number of steps they accumulate. The results revealed close link between the two variables, where students were reported to have very low engagement in PA on week days. The study recommended for the adaptation of the new strategy to reduce physical inactivity.

A survey was conducted by Behrens and Dinger (2003) on 31 college students to establish the ambulatory exercise routine of the students. Participants were subjected to put on pedometers for a week and their total daily steps were recorded. The findings revealed that students were less active on weekend compared to weekdays. The study further reported no considerable gender difference in PA engagement.

Heath, Pratt, Warren, and Kann, (1994) investigated the physical exercise routine of 11631 students in American High school, by finding out from individual respondents their engagement level in hard physical workout. The investigation focused on time engaged in team sports, sedentary time, and the quality and quantity of PE lessons offered in the schools. The study revealed that students' engagement in PA and PE class time didn't meet the set goals of Healthy People 2000. The study further reported high decline in students' engagement in PA as they moved towards their graduation, and revealed high rate of television watching. The study recommended that focus should be on promoting PA among the young adults to boost their well-being and to lower the chances of potential unending illnesses.

Van Sluijs, Ekelund, Crochemore-Silva, Guthold, Ha, Lubans, D., ... & Katzmarzyk, (2021) conducted a study on physical activity behavior of school children (10-14 years) in developed counties. The study revealed that 80% of the school children are physically inactive, and many spend two or more hours watching television daily.

2.4 Exercise and flexibility

Yousif, Yousif, and Fadhil (2013) conducted an experimental study on 18 participants from physical strength squad of Babylon. The study focused on establishing the effect of stretching exercise on flexibility level of the participants. The participants were allocated to three different training groups, and were all subjected to 10-weeks stretching exercise, three times a week. Flexibility tests were done before and after the training. Results showed a considerable difference between the baseline and post measurement in all the groups. The significant improvement realized was attributed to the physical training administered. The study concluded that stretching exercise is effective in promoting physical flexibility.

Seco, Abecia, Echevarría, Barbero, Torres-Unda, Rodriguez, and Calvo (2013) conducted a longitudinal prospective study on 227 adults of 65 years and above. The study focused on determining effect of PA program on flexibility level of the older adults. The participants were tested before and after the three months' training. Results showed significant improvement in flexibility, strength, and heart rate of the participants after the three months training. The study concluded that a plain PA training for a fairly long period of time promotes strength and flexibility in both male and female adults. The researcher suggested that adults should begin engaging in physical exercise at an early stage and to participate in PA continuously.

Another study was conducted by Mikkelsson, Kaprio, Kautiainen, Kujala, Mikkelsson, and Nupponen (2006) to examine the impact of stretching exercises and strength training on future adults' knee injury, tension neck, and

lower back pain. A pre-test test were conducted in 1976 on 1125 participants (520 men and 605 women) aged 17 years on average. In 2001 the same group of participants aged 42 years on average after a period of 25 years was given a questionnaire to gather information out of individual participant's experience on long term incidences and risk of low back pain, tension neck and knee injuries. The results showed low threat of tension neck in men who had high level of flexibility at their earlier age. The results also revealed less threat of tension neck in the group of women who had high endurance strength at their earlier age compared to those who had low endurance strength. The study also reported higher risk of knee injuries in the men who had high endurance strength at their early age than those who demonstrated low endurance strength at their early age. This study also revealed that the men who engaged in PA during their school time stands lower threat of persistent low back pain in comparison to those that did not. The study concluded that adequate flexibility in boys and adequate stamina in girls may lead to reduction in the risk of tension neck, and also high stamina in boys may signify acceleration in the possibility of knee injuries.

O'Brien, Davis, Chan Carusone, Avery, Tang, Solomon, ... and Bayoumi (2021) conducted an experimental study in three phases on 108 members of the community in Toronto who were HIV positive. The study aimed at establishing whether exercise program within the community can improve physical fitness condition in HIV patients. The physical conditions tested included blood pressure, heart rate, cardiopulmonary fitness, back extension, strength. In the first phase, 8-months pre-intervention monitoring was conducted. Community based exercise (CBE) intervention was administered

in the second phase for 6 months, and it involved engagement in a supervised fitness exercise 3-times a week for 90 minutes each training session. A follow-up was made for 8 months while the respondents continued with the training at a reduced intensity three times every week on individual basis. Changes in the trend were measured using segmented regression, and it was judged based on change in slope in relation to the values at the beginning, and after the 6 months. The results revealed that 80% of the participants started the study and only 84% of the participants who started the training continued to the end of the program. There were considerable outcome of the training experienced for systolic blood pressure. A considerable decrease in the trend of benefits was also noted during the intervention phase for systolic blood pressure during the follow-up in the third phase. There was an inconclusive result pertaining to engagement of the HIV in the 6-months CBE intervention in connection with VO_2peak, and probable improvements in other outcomes of physical fitness. The study recommended for features tailored to support uptake and persistent commitment in self-regulating physical work out among HIV victims.

Another study was carried out by Stathokostas, McDonald, Little, and Paterson (2013) to examine the difference in adult's level of flexibility based on their age. Focus was on Shoulder abduction and hip flexion flexibility. Participants in the study included 436 older adults, where 205 were men and 231were women. Data was collected using questionnaire. The results showed a considerable reduction in shoulder abduction to 5 degrees/decade in men on average and 6 degrees/decade in women. An increased reduction in men's' Piecewise linear regression beginning at the age of 71 years at the rate of 0.80 degrees/year, while in women the reduction begins at the age of 63 years

at the rate of 0.74 degrees per year. The study concluded that there was a reduction in the level of flexibility of the shoulder and hip joints by around 6 degrees/decade from the age of 55 to 86 years in both sexes. Scrutiny based on age grouping revealed that both shoulder and hip joints begin to experience considerable decrease after 70 years. Conclusion was also made that there is no relationship between physical activity level and the variations in flexibility measures, and flexibility was not linked with functional ability. The study suggested for further analysis to determine whether the reduction in flexibility impact functional outcomes and whether is also linked to disability. Further suggestion was made that, a more direct matching of specific limb flexibility in particular and consequential useful ending is desired. In addition, a specialized physical exercise that may manipulate the age-related functional loss is required.

Based on the above review, there is significant improvement in the level of flexibility of the subjects exposed to physical training programs. This study focused on exercise program intervention to enhance students' flexibility in Bishop Stuart PTC. The study sought to characterize the physical activity patterns of Bishop Stuart PTC students, evaluate the flexibility level of the students in Bishop Stuart Core PTC, and to examine the effects of physical exercise program on the flexibility of the students in BSPTC.

CHAPTER THREE

METHODOLOGY

3.0 Introduction

This chapter focuses on the methods and procedures employed in conducting this study. These include; research design, study area, study population, target population, sample size and sampling procedures, research instruments, procedures of collecting data, analysis of data, and ethical considerations.

3.1 Research design

Experimental design was used to carry out this study. Experimental design is a systematic manipulation of some characteristics and examination of the outcome (Steven, 2022). It was specifically intended to administer flexibility training program to improve students' flexibility. The design was regarded appropriate for this study since it involves manipulation of the treatment variable in order to establish the cause-effect relationship. In this study a pretest was done to ascertain the baseline flexibility level of the students, after which the intervention group was subjected to flexibility training for six weeks, while the non experimental group was left to continue with their usual physical activity patterns. Post flexibility test was conducted to determine flexibility level of each subject after the six weeks' training. A modified flexibility training program from Assumpcao *et al.* (2017) was used for the training of the students in Bishop Stuart PTC. The training program was modified by making few adjustments targeting the improvement of hamstring and lower back flexibility.

Table 1: Flexibility exercises program adopted from Assumpcao *et al.* (2017)

Activity 1.—Paravertebral: In dorsal decubitus, hold your head on a folded sheet. bend both hips and knees; pull them to your chest and clutch them with your hands. **Activity 2.**—Gluteus: In dorsal decubitus, contract only one hip; bring the knee to the chest and clutch it with your hands. swap limbs. Ensure that the lumbar segment and head stay supported. **Activity 3.**—Ischiotibial: In dorsal decubitus, bend hips and knees, with feet resting on the mattress. Pull out one knee, holding it with your hands. Be careful with knee position. Swap limbs. **Activity 4.**—Hip adductor: In dorsal decubitus, bend hips and knees, join the soles of the feet and abduct the thighs. Ensure that the lumbar segment is kept in physiological and comfortable lordosis. **Activity 5.**—Latissimus dorsi: In dorsal decubitus, bend hips and knees, with feet supported on the mattress and lumbar segment in physiological lordosis. Bend your arms to the utmost limit, keep your elbows extended and your palms open. **Activity 6.**—Pectoralis: In dorsal decubitus, bend hips and knees, with feet resting on the mattress. Place the arms at about 45° abduction, keep the shoulders away from the ears, with the medial epicondyles resting on the mattress and hands open. **Activity 7.**—Paravertebral, gluteus, ischiotibial, triceps surae: Sitting on the ischial tuberosities, keep trunk and head resting against the wall and erect, pull out the knees and do the dorsiflex of the ankles.
Participants were subjected to training for 12weeks under supervision of the fitness instructor. Training was done twice a week, 40 minutes each training session. Respondents conducted different flexibility exercises individually. The stretching exercises targeted large muscles based on their locomotors functions. The training intensity was increased gradually; At the initial stage, the participants performed three repetitions, which was increased to four and five repetitions in weeks five and nine respectively. There was gradual increase in the amount of stretch to the magnitude of mild pain and that point was maintained for 30 seconds.

Table 2: A modified training program for promoting physical flexibility of the student in BSPTC adopted from Assumpcao *et al.* (2017)

DAY	EXERCISE	INTENSITY	PURPOSE	TIME
Monday	**Warm-up:-** -Jogging -Jumping jack	- 5 minutes light jogging - 3 sets of 60 jumping jacks	- To warm up the muscles -To increase muscle flexibility	10 minutes
	Static stretching: - -Trunk flexion -Trunk extension -Hip flexor extension -The simple hamstring stretches -The hurdler hamstring stretch -Standing hamstring stretch (one leg at a time) -Passive stretching	5 repetitions for each exercise	-To stretch the hamstring and lower back muscles	40 minutes
	Back exercise:- -Walking balance -Walking dead	Lower pace at a reduced intensity	-To remove lactic acid from the muscles	10 minutes
Tuesday	Rest			
Wednesday	**Warm-up** Dynamic stretching	-Clapping under the legs & others	-Decrease the chance of pulling the muscles	10 minutes
	Static stretching:- -The simple hamstring stretch -The hurdle hamstring stretch -Lower back mobiliser -Hip flexor extension -Standing hamstring stretch (both legs at once) -Towel hamstring stretch -Passive stretching	5 repetitions for each exercise	-To stretch the hamstring and lower back muscles	40 minutes
	Back exercise (cool down):- Slow jog	Lower pace at a reduced intensity	-To prepare muscles for the next exercise	10 minutes
Thursday	Rest			
Friday	**Warm-up:-** Jumping rope	2 sets of 4 minutes jumps	-Mental preparation for the upcoming exercise	10 minutes
	-Yoga class (Stretching targeting hamstring and lower back) -Head to knee pose (JanuSirsasans) -Happy baby (Anandabalasans) -Seated forward bend (paschimothanasana) -Staff pose (Dandasana) -Standing forward bend (Uttanasana) -Lunge	5 repetitions for each exercise	-To stretch the hamstring and lower back muscles	40 minutes
	Back exercise (cool down) Slow jog	Lower pace at a reduced intensity	To remove lactic acid from the muscles	10 minutes
Saturday	Rest			
Sunday	**Warm-up: -** Aerobic dance	8 minutes dance at two intervals of two minutes break	-Getting the body ready for the exercise	10 minutes
	Static stretching: - -Sitting stretch -The hurdle hamstring stretches -Prone hamstring stretches -Straight leg bend -Extended angle side bend -Trunk extension (standing) -Passive stretching	5 repetitions for each exercise	-To stretch the hamstring and lower back muscles	40 minutes
	Back exercise: - Walking or slow jog	Lower pace at a reduced intensity	-To avoid fainting and dizziness	10 minutes

The intervention included trunk flexion, trunk extensions, hip flexor extension, The simple hamstring stretch (sit and reach), The hurdle hamstring stretch, standing hamstring stretch (one leg at a time), standing hamstring stretch (both legs at once), sitting stretch, prone hamstring stretch (towel hamstring stretch), straight-leg bend, extended angle side bend, passive stretching, and yoga class. The intervention included body conditioning activities at the beginning and at the end of the main exercises. The illustration pictures of each of the above exercises are represented in Figure 9, Appendix C. This exercise program is in line with the description of Koh, Camiré, Lim Regina, and Soon (2017) who defined physical exercise program as a detailed plan indicating the physical workout to be executed and the duration of each activity. Micheo, Baerga, and Miranda (2012) further asserts that, there are basically three categories of exercise defined by their impact on the body: exercise to improve the range of movement at a joint referred to as flexibility exercise, exercise targeting the development of cardiovascular endurance that is aerobic exercises, and exercise to improve muscle strength referred to as anaerobic exercises. This study focused on flexibility exercises.

3.2 Study area

The study was conducted in BSPTC, Mbarara City Western Uganda.

3.3 Target population

This study involved 124 students of BSPTC, (n = 42 male) and (n = 82 female) aged 19-24 years.

3.4 Sample size and sampling procedure

A total of 94 participants were involved in the study. The sample size was estimated using Krejcies and Morgan (1970) table of sample size represented in table 3.

Table 3: Krejeie and Morgam table of sample size (1970)

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

Note. –N is population size. S is sample size.

Stratified sampling and simple random sampling were used to obtain a sample of 94 students for this study. Stratified sampling allows sub-division of the population into smaller homogenous groups in order to get more accurate representation while simple random sampling allows individuals to be chosen in such a way that each has an equal and independent chance of being selected (Best & Khan, 2010). Stratified sampling was used to sub-divide the target population into two groups basing on their gender. Simple random sampling using the lottery method was then used to select 32 members from the male stratum and 62 from females' stratum to form sample of the study. Stratified assignment was used to distribute 47 students to control group, and 47 students to experimental group from the selected sample.

3.6 Research Instruments

Data was collected using sit-and-reach-test and a data form before and after the training to determine flexibility level of each subject before and after the training. Sit-and-reach is the most commonly used assessment procedure because it is simple to manage and requires minimum apparatus Clinton and Jackson (2021). A standardized sit-and-reach testing box was used to test the flexibility level of the subjects. The following procedure was observed during sit-and-reach test; the subject removes the shoes and sits with legs extended together and straight, and feet aligned with the test box. The toes on the 26 cm mark of the box. Both hands kept palms down, one on top of the other. The participant gradually reaches onward as far as possible on the box and hold in the position for 2 seconds. The best record in cm from three trials is considered. If you can't reach your toes your flexibility is insufficient (Pescatello, 2014).

3.7 Data collection procedure

Quantitative data was collected from 94 students of BSPTC from November to December 2022. Data was collected by the researcher himself. The researcher obtained letter of introduction from the Directorate of Research and Graduate Training Kyambogo University. Following that, the researcher obtained permission from the principal Bishop Stuart PTC and proceeded to meet the participants. The participants signed a consent form implying agreement and acknowledging their willingness to take part in the study. Participants were informed of their right to privacy and their freedom to withdraw from the study if they so wish. Upon completion of consent form, the researcher conducted a pre-test, after which he carried out the flexibility training for six weeks, and then finally conducted the post-test.

3.8.0 Validity and Reliability

3.8.1 Validity

A specialized technique and framework that have been developed to guide the process of evaluating the materials used to assess a program is referred to as validation (Carol & Eric, 2014). It shows the magnitude to which an instrument measures what it is hypothetical to measure (Kothari, 2004). In this study, the researcher used a validated training program by Assimpcao *et al.* (2017) as a modal to come up with a training program.

3.8.2 Reliability

A measuring implement is reliable if it gives constant outcome (Kothari, 2004). A standardized sit-and-reach test box obtained from Kyambogo University sports science laboratory was used to measure participants' level of flexibility before and after the 37

training to ensure reliability.

3.9 Data analysis and presentation

SPSS version 11was used to process the data and descriptive statistic were used to analyze the data gathered through the sit-and reach test, using measures of central tendencies such as mean, median, and mode, and measures of dispersion such as quartile deviation and standard deviation. T-test was used to determine the difference between the mean score of the pre-test and post-test of both the control and experimental groups. Level of significance was accepted at $p < 0.05$. Tables and figures were used to present results accompanied by explanations to highlight the contents.

3.10 Ethical considerations

Ethical standards were observed during the study as the doctrine of secrecy. A letter of introduction was solicited from the Directorate of Research and Graduate Training Kyambogo University. The investigator sought permission from the principal BSPTC after explaining the reason for the study and the modality to be used to conduct the research. All participants and college staff were fully informed verbally about the nature of the study. The participants completed a consent form implying agreement and acknowledging their willingness to take part in the study. Participants were also informed of their right to pull out from the study if they so wish. Privacy of the participants was observed.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter covers data presentation, analysis, interpretation, and discussion. The presentation of the findings is done following the objectives.

4.1.1 Demographic information of the respondents

This section presents the demographic information (age and sex) of the participants. The study found it essential to gather this information to ensure accurate evaluation of the data quality. According to Bardw (2015) age and gender affect the flexibility level of an individual.

4.1.2 Description of the participants according to their age

Table 4: Description of the participants according to their age

Age Category	No. of participants	Percentage (%)
19 – 20	35	37
21 – 22	49	52
23 – 24	10	11
Total	**94**	**100**

From the results in table 2 above, 52% which was the majority of the participants were aged 21 to 22 years, 37% were aged 19 to 20 years, while only 11% were aged 23 to 24 years. This is further presented graphically in Figure 7, Appendix B. The age category of the participants in this study tallies with that of Clement et al. (2003) who conducted a study on 126 healthy university Portuguese students of 18-23 years old, to examine whether they conform to the public health recommendation of physical workout, and to assess how male and female students participate in PA based on days of the

week. The researchers recorded the time students spend when they are physically inactive, the time they spend doing simple and hard exercises, and number of steps they accumulate. The results revealed close link between the two variables, where students were reported to have very low engagement in PA on week days. The study recommended for the adaptation of the new strategy to reduce physical inactivity.

4.1.2 Description of the participant according to gender

Table 5: Description of the respondents according to gender

Gender	No. of participants	Percentage (%)
Male	32	34
Female	62	66
Total	**94**	**100**

Basing on results from table 3 above, the study found out that the greater proportion of the participants 66% were identified as female, while 34% were identified as male. These findings suggest that study population was predominantly female. Figure 8, Appendix B presents this information in graphical form. The proportion of male and female participants involved in this study comprises of more females than males which is similar to that of Mikkelsson *et al.* (2006) who conducted a study on 1125 participants (520 men and 605 women) to examine the impact of stretching exercises and strength training on future adults' knee injury, tension neck, and lower back pain where a baseline flexibility and strength test were conducted.

4.2 Physical activity pattern of Bishop Stuart PTC students

The first objective of the study sought to characterize the Physical activity pattern of Bishop Stuart PTC students. This investigation sought information from the students who were the subjects in this study and focus was on physical exercise participation status, weekly physical exercise participation routine, the kind of physical exercise/ activity students participate in, and daily inactivity time of the respondents (time spent sitting).

4.2.1 Physical exercise participation status

Table 6: Description of respondents according to physical exercise participation status

Participate	No. of participants	Percentage (%)
No	17	18
Yes	77	82
Total	**94**	**100**

Based on the findings in table 4 above, it appears that majority of the participants 82% were engaging in some form of physical exercise during their free time at collage. However, there's still a significant minority 18% who weren't participating in any form of physical exercise at all. Figure 9, Appendix B represents the same information graphically. This study results conform with that of Van Sluijs *et al.* (2021) who found out that 80% of the school children are physically inactive, and many keep watching television for 2 hours or more daily.

4.2.2 Weekly physical exercise participation routine

Table 7: Description of respondents according to their weekly physical exercise routine

Duration	No. of participants	Percentage (%)
Daily	15	16
At least three times	44	47
less than three times	18	19
None	17	18
Total	**4594**	**100**

Looking closer at the frequency of physical exercise performed in a week, as reported in table 5 above, the study found out that a high proportion of participants (47%) engage in physical workout at least three times a week. 19% take on physical exercise for less than three times a week. Nearly a quarter of the participants (18%) never engage in any physical exercise, while the smallest proportion of the participants (16%) was engaged in physical exercise daily. Figure 10, Appendix B provides graphical representation of this information. This result agrees with that of Gregory *et al.* (2022) who carried out a study to investigate the physical exercise routine of 11631 students in American High school, by finding out from individual respondents their engagement level in hard physical workout. The investigation focused on the time spent watching television, time engaged in team sports, and the quality and quantity of PE lessons offered in the schools. The study revealed that students' engagement in PA and PE class time don't meet the set goals of Healthy People 2000. The study further reported high decline in students' engagement in PA as they move towards their graduation, and revealed high rate of television watching. The study recommended that focus should be on

promoting PA among the young adults to boost their well-being and to lower the chances of potential unending illnesses.

4.2.3 The physical exercises/ activities students participate in

Table 8: Description of respondents according to the physical exercise they participate in

Physical Activities	Participants	Percent (%)	Percent of Cases
Football	54	30	57
Running	35	19	37
Press ups	2	1	2
Volleyball	28	16	30
Athletics	9	5	10
Gymnastics	1	1	1
Jogging	2	1	2
Dancing	3	2	3
Long Jump	5	3	5
Net ball	37	21	39
Basket Ball	1	1	1
Hand Ball	3	2	3
Total	**180**	**100%**	**190**

During data collection, participants were asked about the kind of physical exercise/ activity they participate in. Their responses represented in Table 6 above showed that 57% of the participants engaged in football and this constituted 30% of all the responses. 39% of the participants engaged in netball and this constituted 21% of all the responses.37% of the participants engaged in running and this constituted 19% of all the responses.30% of the participants engaged in volleyball and this constituted 16% of all the responses. 10% of the participants engaged in athletics and this constituted 5% of all the responses regarding athletics.5% of the participants engaged in long jump and this constituted 3% of all the responses regarding long jump. 3% of

the participants engaged in handball and dancing, and this constituted 2% of all the responses regarding handball and dancing. And lastly 1percent of the participants engaged in press-up, gymnastics, jogging, and basketball. And this constituted 1 percent of all the responses regarding press-up, gymnastics, jogging, and basketball. Figure 11, Appendix B elaborates more. In the literature reviewed, only one study mentioned the kind of exercise students were engaged in; Clement *et al.* (2003) reported students engaging in distance walking, but the rest of the studies did not specify the kind of physical exercise students engaged in. This call for more studies to investigate the specific physical exercise students engage in within the learning institutions.

4.2.4 Daily inactivity time of the respondents (time spent sitting)

Table 9: Description of respondents according to their daily inactivity time (time spent sitting)

Sitting duration	No. of participants	Percentage (%)
< 6 hrs	12	13
6-10 hrs	61	65
11-14 hrs	18	19
> 14 hrs	3	3
Total	**94**	**100**

Regarding how long participants spend sitting in a day, as reported in table 7 above, finding reveals that a significant proportion of participants were sitting for long time. 65% of the participants reported sitting for six to ten hours in a day, 19% reported sitting for eleven to fourteen hours, and only 13% reported sitting for less than six hours in a day, while some respondents 3% reported

sitting for more than 14 hours a day. The information is further shown in Figure 12, Appendix B. This result concurs with a study conducted by Clement *et al.* (2003) which showed high incidence of sedentary time among the healthy university Portuguese students, especially during weekdays. This kind of physical inactivity leads to a serious health consequence as pointed by Goel (2014). Therefore, the finding confirms the assumption that physical inactivity is the main cause of the health-related challenges noted among the students of BSPTC.

4.3 Physical flexibility level of the students in Bishop Stuart Core PTC

Table 10: General pre-test flexibility status of the respondents

Age category	Mean flexibility	Standard deviation	No. of participants
19 – 20	39.3	4.21	35
21 – 22	38.36	5.11	49
23 – 24	37.23	5.17	10
Overall	**38.3**	**4.83**	**94**

Table 8 above indicates that among the entire sample of the respondents without any grouping, respondents aged 19 and 20 years have a mean physical flexibility (measured in centimeters) of 39.3while those aged 21 to 22 and 23 to 24 years had a mean flexibility of 38.6 and 37.23 respectively. The overall mean physical flexibility and its intervention Standard deviation are 38.3 and 4.83 respectively basing on the age groups and the pretest physical flexibility score. In comparison with the standard Sit-and-reach norms established by Pescatello (2014), this result shows low (below average) level of physical flexibility for the adults of 19 to 24 years old.

4.3.1 Dynamic behavior test for the general group

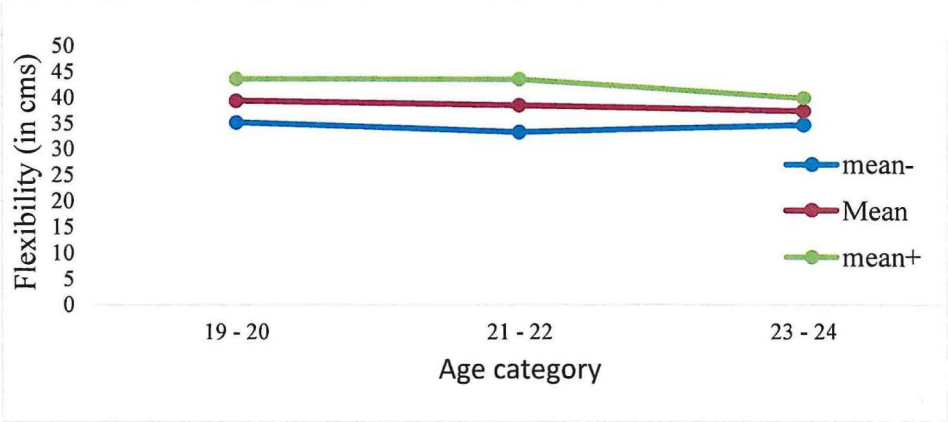


Figure 2: Graphical representation of the general group mean pre-test physical flexibility and its standard deviation

The dynamic behavior pattern in Figure 2 above shows that flexibility decreases as the age increases. The pattern shows higher uniformity in the data collected in the age group of 23 to 24 than those with ages ranging from 19 to 22 years as shown by the standard deviation. It further revealed highest level of flexibility among the age categories of 19 to 20, which kept reducing as the age increases. This result concurs with an observational study which was conducted by McKay *et al.* (2017) to determine reference standards for isometric power of 12 muscle groups and flexibility of 13 joint movements in 1,000 healthy male and female participants aged 3–101 years which revealed that joint flexibility steadily reduces with age.

4.3.2 Dynamic behavior basing on pre-test physical flexibility score of the treatment group

Key

Mean– (minus) is the difference between individual age group mean and its standard deviation

Mean is the individual age group mean

Mean + (plus) is the sum of individual age group mean and its standard deviation.

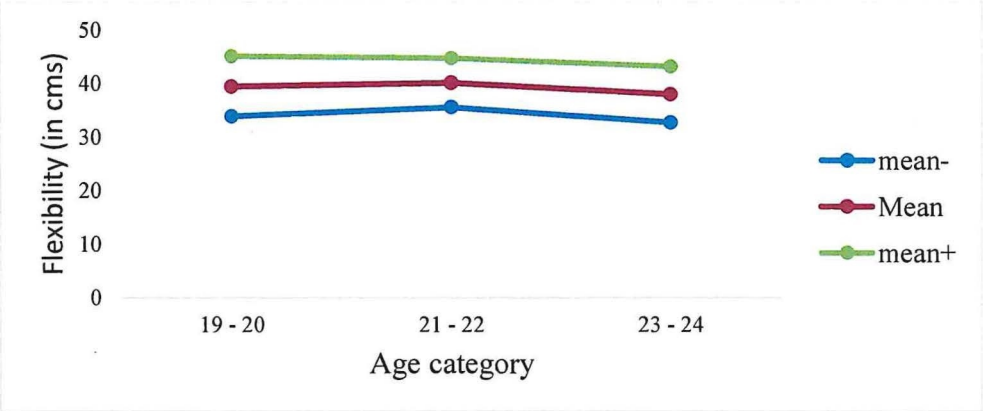


Figure 3: Treatment group mean pre-test physical flexibility and its standard deviation

Figure 3 shows slightly up and down swing in the level of flexibility of the participants across the different age groups with a general decrease as the age increases. Uniformity in the data collected is greatly achieved at the age of 21 and 22 years and there after a sharp decrease as shown by the standard deviation. This result agrees with that of Stathokostas *et al.* (2013) who carried out a study to examine the difference in adult's level of flexibility based on their age, with focus on shoulder abduction and hip flexion flexibility. Participants in the study included 436 older adults, where 205 were men and 231were women. The results showed a considerable decrease in the level of flexibility of the shoulder and hip joints as the age increases.

4.3.3 Dynamic Behavior basing on pre-test physical flexibility score for the control group

Key

Mean – (minus) is the difference between individual age group mean and its standard deviation

Mean is the individual age group mean

Mean+ (plus) is the sum of individual age group mean and its standard deviation.

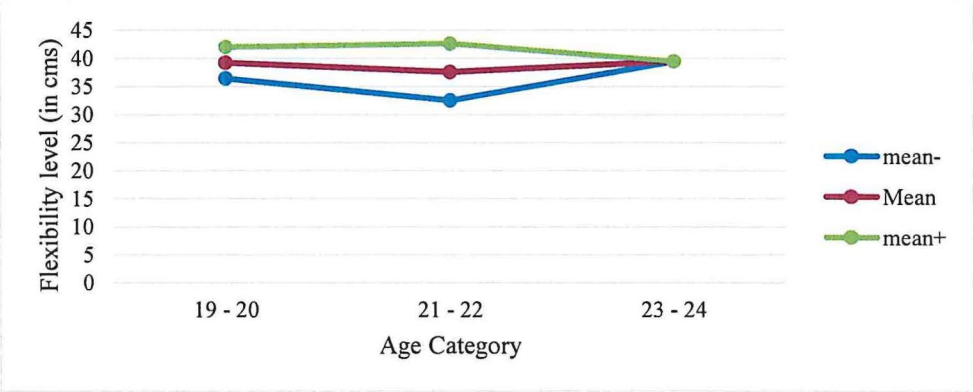


Figure 4: Mean pre-test physical flexibility and its standard deviation of the control group

From the dynamic behavior plot as depicted in figure 4 above, the results showed that at 19 to 20 years of age respondents have almost the same level of flexibility. At the age of 21 to 22 years of age the level of mean flexibility slightly decreases with slight increase in the variation of the flexibility scores, and the mean flexibility remains almost at the same level up to the age of 24 years but with high level of uniformity in the data collected. This result concurs with that of Mistry and Sheth (2014) who conducted a study to find out the link of hamstring flexibility for males and females of different age groups in chronic lower back pain (LBP) subjects. The results showed

statistically significant moderate to weak negative correlation between age and hamstrings flexibility.

4.4 Effect of the physical exercise program on the flexibility of the students in BSPTC.

This study also sought to establish the effect of the physical exercise program on the flexibility of the students in BSPTC. A post-test was done to collect the data on the level of flexibility of the participants after the exercise program intervention. The results are presented in figure 5 below.

4.4.1Dynamic Behavior basing on post-test physical flexibility score for the treatment group

Key

Mean – (minus) is the difference between individual age group mean and its standard deviation

Mean is the individual age group mean

Mean+ (plus) is the sum of individual age group mean and its standard deviation

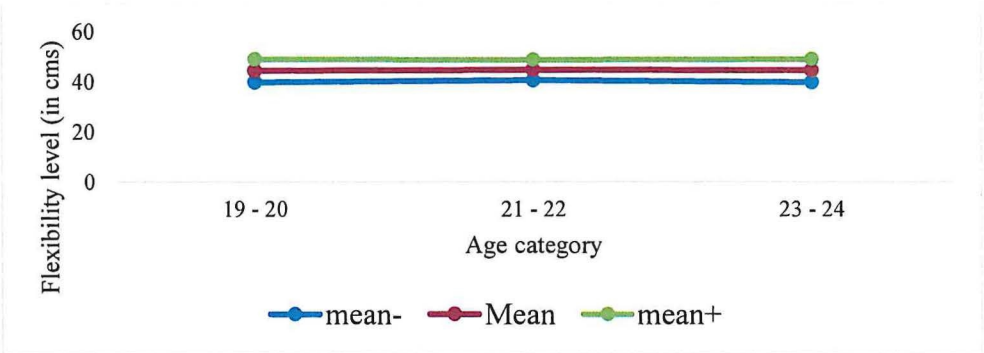


Figure 5: Graphical representation of the mean post-test physical flexibility and its standard deviation for the treatment group

Figure 5 shows slight fluctuation in the level of flexibility across different age groups but with general decrease as the age increases. Uniformity in the data collected is constant across all age groups as shown by the standard deviation.

4.4.2 Dynamic Behavior basing on post-test physical flexibility score for the control group

Key

Mean – (minus) is the difference between individual age group mean and its standard deviation

Mean is the individual age group mean

Mean+ (plus) is the sum of individual age group mean and its standard deviation

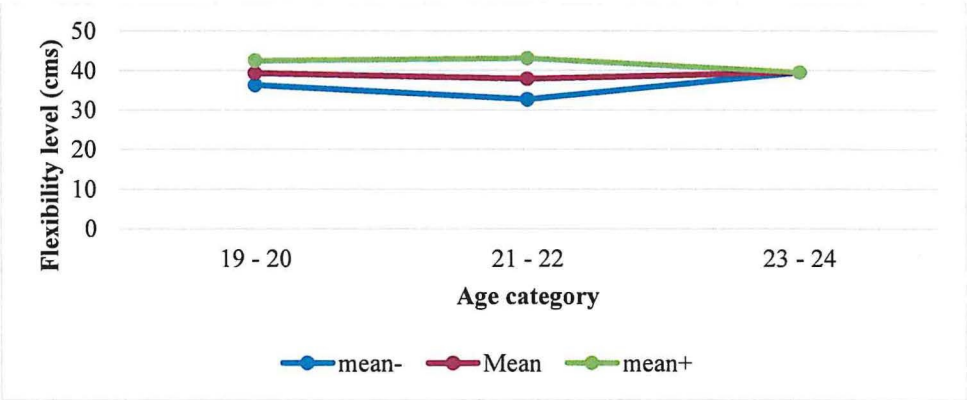


Figure 6: Graphical representation of the mean post-test physical flexibility and its standard deviation for the control group

The dynamic behavior plot in figure 6 above reveals a general decrease in the level of flexibility as the age increases. There is fluctuation in the uniformity of the data collected between the age of 19 and 22 as shown by the standard deviation; however, at the age of 24 years, the dynamic plot depicts the same level of flexibility for all the respondents. This graph therefore shows the same

dynamic behavior like that of mean pre-test physical flexibility and its standard deviation for the control group

4.4.3 Comparison of pre-test and post-test physical flexibility for the control group

Ho: The training program has a significant impact on physical flexibility (Post-test mean physical flexibility, Mean2 >pre-test mean physical Flexibility, Mean 1)

Ha: The training program has no significant impact on physical flexibility (Post-test mean physical flexibility (Mean 2)≤pre-test mean physical flexibility, Mean 1)

Treatment group

Ho: The training program has no significant impact on physical flexibility (Post-test mean physical flexibility, Mean 2≤pre-test mean physical flexibility, Mean 1)

Ha: The training program has a significant impact on physical flexibility (Post-test mean physical flexibility, Mean 2) >pre-test mean physical Flexibility, Mean 1)

Table 10: Significance of training program on physical flexibility

Paired t test for control group								
Pre-test			Post-test					
Age group	**No. of participants**	**Mean**	**Mean**	**Difference**	**Standard Error**	**T .V**	**P. V**	**Level of significance**
19-20	15	39.787	39.780	-0.007	0.119	-0.050	0.956	No significant difference
21-22	30	38.120	38.380	0.260	0.090	2.900	0.007	No significant difference
23-24	2	39.400	39.400	0.000	0.300	0.000	1.000	No difference
Paired t test for treatment group								
Pre-test			Post-test					
Age group	**No. of participants**	**Mean**	**Mean**	**Difference**	**Standard Error**	**T .V**	**P. V**	**Level of significance**
19-20	20	40.240	44.685	4.445	0.274	16.250	0.000	Significant difference
21-22	19	39.553	44.058	4.505	0.201	22.450	0.000	Significant difference
23-24	8	37.913	43.000	5.087	0.238	21.400	0.000	Significant difference

Results in table 10 above indicates that under the control group, Mean1 = Mean 2 in the age groups of 19 to 20, and 23 to 24. This signifies no difference between the pre and post-test mean flexibility among the respondents in those age categories in the control group. The table also shows no significant difference between the mean pre-test and mean post-test among 21 to 22 age group; Men 1 (38.120) < Men 2 (38.38). This means that the difference between the mean pre-test and mean post-test of the participants in the control group is not significant. Therefore, the null hypothesis is rejected

and the alternative hypothesis that the training program has no significant impact on physical flexibility of the students is accepted. This study results conform with that of Assumpcao *et al.* (2017) who noted no significant difference between the pre-test and post-test results among the participants in the controlled group, as compared to the respondents in the flexibility training group and those in the resistance training group, after a 12-weeks training to validate and match up the value of stretching exercise and strength training for symptoms and quality of life in fibromyalgia: patients.

In the treatment group, the table shows that Mean 2 > Mean 1 across all age categories; 19 to 20, Mean 2 (44.685)>Mean 1 (40.240). 21 to 22, Mean 2 (44.058) >Mean1 (39.553). And 23 to 24, Mean 2 (43.000) >Mean 1 (37.913). Therefore, the null hypothesis is rejected and the alternative hypothesis that the training program has a significant impact on physical flexibility of the students is accepted. This finding concurs with that of Yousif *et al.* (2013) who studied the effect of stretching exercises in improvement of physical flexibility for beginner physical strength players and the result showed a considerable difference between the pre and post measurement for all the research groups. Yousif *et al.* (2013) also conducted related studies on the effect of various exercise programs on physical flexibility of the participants. The finding showed considerable outcome of the exercise programs on physical flexibility level of the participants. The researcher therefore attributes the considerable difference between the pre and post flexibility test of the intervention group to the effect of training program administered during the study.

CHAPTER FIVE

SUMMARY OF THE FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents summary of the findings, conclusions, recommendations and areas for further research.

5.2 Summary of the findings

The main objective of the study was to assess the effect of the training program on flexibility level of the students in BSPTC. The core of the investigation was to characterize the physical activity patterns of BSPTC students, establish the flexibility level of the students, and to determine the effect of the exercise program on physical flexibility level of the students in BSPTC. The demographic information of the participants was also captured in this study to ensure accurate interpretation of the results.

In regards to demographic information of the participants, the study revealed that the majority of the participants 66% were female and the rest of the participants 34% were male. The study also revealed that the greater proportion of the participants 52% were aged 21 to 22 years, followed by 37% of the participants who were aged 19 to 20 years, and 11% who were aged 23 to 24 years.

The result in regards to physical activity patterns showed that 18% of the participants were not engaging in any form of physical exercise at all during their free time at college. The study further revealed that out of the 82% of the participants who were engaging in different forms of physical exercises, only 16% were participating in physical exercise on a daily basis, 47% were engaged at least three times a week, and a significant proportion (19%) were

engaging less than three times a week. The study also revealed significant proportion of the participants (22%) spent extended time (≥11hours) sitting without participating in any PA. It was further noted that majority (30%) of the student who engage in PA regard football, while the rest engage in different physical exercises such as netball (21%), running (19%), volleyball (16%), athletics (5%), and dancing (2%).

The pre-intervention physical flexibility test result shows that the mean physical flexibility level of the students was 38.3 cm with standard deviation of 4.83. The dynamic behavior depicts that physical flexibility has slightly an up and down swing with a slight drop as one gets older.

As pertain the effect of the training program on the flexibility level of the participants, the results showed a significant difference between the pre and post flexibility test of the intervention group ($p = 0.000$) and ($t = 30.75$). In the control group the results showed no significant difference between the pre and post flexibility test.

5.3 Conclusion

Basing on the study findings, the following conclusion has been made;

i. The study found out that 18% of the students do not engage in any form of Physical activity.

ii. The study also revealed that student of BSPTC had very low level of flexibility.

iii. The training program was effective in improving flexibility level of the students in BSPTC.

5.4 Recommendation

Based on the findings and conclusion of this study, the following recommendation was made.

i. The administration should plan and enforce physical activity programs in their learning institutions.

ii. Flexibility should be emphasized in the training program of the students in BSPTC.

iii. The training program employed in this study should be implemented in BSPTC and other Primary Teachers' Colleges.

5.5 Areas for further Research

This study was carried out to provide remedy to the health challenges noted among the students of BSPTC, which included among others lower back and joint pain. The fact is that focus was not made to evaluate the magnitude of the pain before and after the exercise program intervention. It's therefore recommended that similar study be conducted with focus on its effect on lower-back and joints pain. It would also be fruitful to investigate the cause of physical inactivity among the students in the higher institutions of learning.

REFERENCES

1. Armstrong, N., & Welsman, J. R. (2006). The physical activity patterns of European youth with reference to methods of assessment. *Sports medicine*, *36*, 1067-1086.
2. Assumpcao, A., Matsutani, L. A., Yuan, S. L., Santo, A. S., Sauer, J., Mango, P., & Marques, A. P. (2017). Muscle stretching exercises and resistance training in fibromyalgia: which is better? A three-arm randomized controlled trial. *European journal of physical and rehabilitation medicine*, *54*(5), 663-670.
3. Bardw, S. (2015). *Five factors that affect your flexibility. SVMTG Blog: Word Press. 175*(suppl_8), 14-20.
4. Behrens, T. K., & Dinger, M. K. (2003). A preliminary investigation of college students' physical activity patterns. *American Journal of Health Studies*, *18*(2/3), 169.
5. Bessy, S. P., James, T., & Abdul, S. (2019). *Need Analysis of Multi-Ball Exercise Methods Toward the improvement of Forehand Drive Skill on Beginner Table Tennis Athletes.* Indonesia: Atlantis Press.
6. Best, J.W. & Kahn, J.V. (2010). *Research in education (10th ed.*). PHL Learning Private Limited: New Delhi.
7. Braam, K.I., Torre, P., Takken T., Veening, M.A., Broeder, E., Kaspers, G.J.L. (2013). *Physical exercise training interventions for children and young adults during and a,er treatment for childhood cancer.* Cochrane: John Wiley & Sons, Ltd.
8. Bull, F. C., Al-Ansari, S. S., Biddle, S., Borodulin, K., Buman, M. P., Cardon, G., ... & Willumsen, J. F. (2020). World Health Organization

2020 guidelines on physical activity and sedentary behaviour. *British journal of sports medicine*, *54*(24), 1451-1462.

9. Carl, J. (1985). Caspersen; Powell, Kenneth E.; Christenson, Gregory M. Physical activity, exercise, and physical fitness: Definitions and distinctions for health-related research. *Public Health Reports*, *100*(2), 126-31.
10. Clemente, F. M., Nikolaidis, P. T., Martins, F. M. L., & Mendes, R. S. (2016). Physical activity patterns in university students: Do they follow the public health guidelines? *PloS one*, *11*(3), e0152516.
11. Clinton, C. K., & Jackson, F. L. (2021). Historical overview, current research, and emerging bioethical guidelines in researching the New York African burial ground. *American Journal of Physical Anthropology*, *175*(2), 339-349.
12. Dadebo, B., White, J., & George, K. P. (2004). A survey of flexibility training protocols and hamstring strains in professional football clubs in England. *British journal of sports medicine*, *38*(4), 388-394.
13. Danielle, H. (2021). *Physiological components contributing to flexibility.*
14. Dantas, E., Daoud, R., Trott, A., Nodari, R., &Conceição, M. (2011). Flexibility: components, proprioceptive mechanisms and methods. *Biomedical human kinetics*, *3*, 39
15. Fraenkel, J.R., & Warren, N.E. (2000). *How to design and evaluate research in Education*. McGraw. London.
16. Francesco, F., Gianpiero, G., Stefania, C., Carla, M., Giacomo, L., & Attilio, G. (2019). *Effects of Physical Exercise Intervention on*

Psychological and Physical Fitness in Lymphoma Patients. Italy: Medicina.

17. Freiwald, J., Magni, A., Fanlo-Mazas, P., Paulino, E., Sequeira de Medeiros, L., Moretti, B., ... &Solarino, G. (2021). A role for superficial heat therapy in the management of non-specific, mild-to-moderate low back pain in current clinical practice: A narrative review. *Life*, *11*(8), 780.
18. Gabriel, K. K. P., Morrow, J. R., & Woolsey, A. L. T. (2012). Framework for physical activity as a complex and multidimensional behavior. *Journal of Physical Activity and Health*, *9*(s1), S11-S18.
19. Garber, M., Carol E., Blissmer, P., Bryan, N., Deschenes, T., Michael R., ... David, P. (2011). *Quantity and Quality of Exercise for Developing and Maintaining Cardiorespiratory, Musculoskeletal, and Neuromotor Fitness in Apparently Healthy Adults Guidance for Prescribing Exercise.* American college of sport medicine.
20. Goel, M. (2014). Importance of Physical Fitness in Human Development. *Physical Fitness Journal*, *1*(3), 133-136.
21. Heath, G. W., Pratt, M., Warren, C. W., & Kann, L. (1994). Physical activity patterns in American high school students: results from the 1990 Youth Risk Behavior Survey. *Archives of pediatrics & adolescent medicine*, *148*(11), 1131-1136.
22. Howie, E. K., Cannady, N., Messias, E. L., McNatt, A., & Walter, C. S. (2022). Associations between physical activity, sleep, and self-reported health with burnout of medical students, faculty and staff in an academic health center. *Sport Sciences for Health*, *18*(4), 1311-1319.

23. Janssen, I., & LeBlanc, A. G. (2010). Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *International journal of behavioral nutrition and physical activity*, *7*, 1-16.Jay, M. P., Brandon, M. E., and Roch, J. L. (2016). *Impact of 10-weeks of yoga practice on flexibility and balance of college athletes.* U.S. National Library of Medicine.

24. Kim, S. Y., Busch, A. J., Overend, T. J., Schachter, C. L., van der Spuy, I., Boden, C., & Cochrane Musculoskeletal Group. (1996). Flexibility exercise training for adults with fibromyalgia. *Cochrane Database of Systematic Reviews*, *2019*(9).

25. Knudson, D. V., Magnusson, P., & McHugh, M. (2000). Current Issues in Flexibility Fitness. *President's Council on Physical Fitness and Sports Research Digest.*

26. Koh, K. T., Camiré, M., Lim Regina, S. H., & Soon, W. S. (2017). Implementation of a values training program in physical education and sport: a follow-up study. *Physical Education and Sport Pedagogy*, *22*(2), 197-211.

27. Kothari, C. R. (2004). *Research Methodology, Methods and Techniques*. New Delhi: New Age International Publishers.

28. Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. Educational and Psychological Measurement, 30(3), 607–610.

29. Kulinna, P. H., Martin, J., Lai, Q., Kliber, A., & Reed, B. (2003). Student physical activity patterns: Grade, gender, and activity influences. *Journal of Teaching in Physical Education*, *22*(3), 298-310.

30. Liz, (2019). *Factors Affecting Flexibility and Joint Mobility. Spincer institute:* NESTA Pinterest.

31. López-Bedoya, J., Vernetta-Santana, M., Robles-Fuentes, A., &Ariza-Vargas, L. (2013). Effect of three types of flexibility training on active and passive hip range of motion. *The Journal of sports medicine and physical fitness*, *53*(3), 304-311.

32. McKay, M. J., Baldwin, J. N., Ferreira, P., Simic, M., Vanicek, N., Burns, J., ... & 1000 Norms Project Consortium. (2017). Normative reference values for strength and flexibility of 1,000 children and adults. *Neurology*, *88*(1), 36-43.

33. Meredith MD, Welk GJ, editors. Fitnessgram/Activitygram test administration manual. 4th ed. Champaign, IL: Human Kinetics Publishers; 2010.

34. Micheo, W., Baerga, L., & Miranda, G. (2012). Basic principles regarding strength, flexibility, and stability exercises. *Pm&r*, *4*(11), 805-811.

35. Mikkelsson, L., Kaprio, J., Kautiainen, H., Kujala, U., Mikkelsson, M., &Nupponen, H. (2006). School fitness tests as predictors of adult health-related fitness. *American Journal of Human Biology: The Official Journal of the Human Biology Association*, *18*(3), 342-349.

36. Mistry, G. S., Vyas, N. J., &Sheth, M. S. (2014). Correlation of hamstrings flexibility with age and gender in subjects having chronic low back pain. *International journal of therapies and rehabilitation research*, *3*(4), 1.

37. Mondal, S., & Mondal, H. (2018). *Exercise for homemakers:* A little step to overcome the barriers.

38. Mukana, R., and Pila, H. (2016). *Physical fitness: tripartite comparison of 6-14-year-old children from Uganda, Cuba and Mexico.* Retrieved fromhttps://efdeportes.com › comparison-childre...May 2022.

39. O'Brien, K. K., Davis, A. M., Chan Carusone, S., Avery, L., Tang, A., Solomon, P., ... & Bayoumi, A. M. (2021). Examining the impact of a community-based exercise intervention on cardiorespiratory fitness, cardiovascular health, strength, flexibility and physical activity among adults living with HIV: a three-phased intervention study. *PloS one*, *16*(9), e0257639.

40. Patriana, N. A. (2019). *Life Kinetik Training in Improving the Physical Condition of Football Athletes*. Universitas Pendidikan Indonesia: Atlantis Press. *physical activity*, *7*(1), 1-16.

41. Pescatello, L. S. (Ed.). (2014). *ACSM's guidelines for exercise testing and prescription*. Lippincott Williams & Wilkins.

42. Plowman, S. A., Sterling, C. L., Corbin, C. B., Meredith, M. D., Welk, G. J., & Morrow, J. R. (2006). The history of FITNESSGRAM®. *Journal of Physical Activity and Health*, *3*(s2), S5-S20.

43. Roy, T. C., Springer, B. A., McNulty, V., & Butler, N. L. (2010). Physical fitness. *Military medicine*,

44. Sanal, E., Ardic, F., and Kirac S. (2012). *Effects of aerobic or combined aerobic resistance exercise on body composition in overweight and obese adults: Gender differences. A randomized*

intervention study. European Journal of Physical and Rehabilitation Medicine: PubMed.

45. Seco, J., Abecia, L. C., Echevarría, E., Barbero, I., Torres-Unda, J., Rodriguez, V., & Calvo, J. I. (2013). A long-term physical activity training program increases strength and flexibility, and improves balance in older adults. *Rehabilitation Nursing Journal*, *38*(1), 37-47.
46. Sibel, K., Fatma, O. Y., Deniz E, Saime, A.Y., Aslihan, A, Miray M., Emine, S. (2016). *Can a pilates exercise program be effective on balance, flexibility and muscle endurance? A randomized controlled trial.* Edizioni Minerva Medica.sity of Sherbrooke.
47. Sparling, P. B., & Snow, T. K. (2002). Physical activity patterns in recent college alumni. *Research quarterly for exercise and sport*, *73*(2), 200-205.
48. Stathokostas, L., McDonald, M. W., Little, R. M., & Paterson, D. H. (2013). Flexibility of older adults aged 55–86 years and the influence of physical activity. *Journal of aging research*, *2013*(1), 743843.
49. Stephen b. t., Julie G., Donna F. S., and Dexter C. K. (2005). *The impact of stretching on sports injury risk: a systematic review of the literature*. American College of Sports Medicine
50. Stephen b. T., Julie, G., Donna f. S., and Dexter K. C. (2004). *The Impact of Stretching on Sports Injury Risk: A Systematic Review of the Literature*. American College of Sports Medicine.
51. Steven, R., Terrell. (2022). Writing a proposal for your dissertation. *Guidelines and examples*. Second edition, Guilford press, New York.
52. Thomas C., Laura L. B., Daniel S., Nadja S., Claudia V., Charlotte M., Luisa Marie A., … Bettina W. (2019). *A multicomponent exercise*

intervention to improve physical functioning, cognition and psychosocial well-being in elderly

53. Van Sluijs, E. M., Ekelund, U., Crochemore-Silva, I., Guthold, R., Ha, A., Lubans, D., ... & Katzmarzyk, P. T. (2021). Physical activity behaviours in adolescence: current evidence and opportunities for intervention. *The Lancet*, *398*(10298), 429-442.
54. Wee, A. S. S. L., Shabeshan, R., and Subramaniam, R. (2013). *The Effectiveness of an Additional Stretching Exercise Program in Improving Flexibility Level among Preschool Boys.* University of Malysia: MOSES.
55. Yousif, A., Yousif, S., & Fadhil, A. (2013). *The Effect of Stretching Exercises in Development of Physical Flexibility for Beginner Physical Strength Players*.Babylon University: UITM, Malaysia.

APPENDICES

Appendix A: Questionnaire

QUESTIONNAIRE ON EXERCISE PROGRAM INTERVENTION FOR ENHANCING STUDENTS' FLEXIBILITY IN BISHOP STUART PRIMARY TEACHERS 'COLLEGE, MBARARA CITY, UGANDA

Dear Respondent,

This instrument seeks to collect data on the topic of Physical Exercise Program Intervention for enhancing students' flexibility in Bishop Stuart Primary Teachers' College, Mbarara City, Uganda. Please answer the following questions as honestly as possible. The information you will give will be subject to confidentiality and used strictly for academic purposes.

Section A: Preliminary data

1. Identification number ☐
2. Age: 19 ☐ 20☐ 21 ☐ 22 ☐ 23 ☐ 24 ☐ above 24 ☐ specify
3. Sex: Male ☐ Female ☐
4. Do you participate in any form of physical exercise/activity during your free time at the college? Yes ☐ No ☐
5. If yes, what kind of physical exercise/activity do you participate in?

i. .....

ii. .....

iii. .....

6. How many times a week do you perform the physical exercise/activity?

a) Daily ☐

b) At least three times ☐

c) Less than three times ☐

d) None ☐ specify.....

7. Have you ever been involved in any accident? Yes ☐ N o ☐

a) If yes, when was it?

- Less than six month ago ☐
- A year ago ☐
- Two years ago ☐
- More than two years ago ☐

8. How long do you spend sitting in a day?

a. Less than six hours ☐

b. Six to ten hours ☐

c. Eleven to fourteen hours ☐

d. More than fourteen hours ☐

Section B: Flexibility test

Sit-and-reach test for flexibility

S/NO	Test	Distance reached in centimeters
1	Sit-and-reach pre-test	.....
2	Sit-and-reach post-test	.....

I have read, understood and accurately completed this questionnaire and will take part in the exercise program, and take part in the flexibility test.

Signature..... Date.....

THANK YOU FOR YOUR COOPERATION

Appendix B: Graphical representation of information

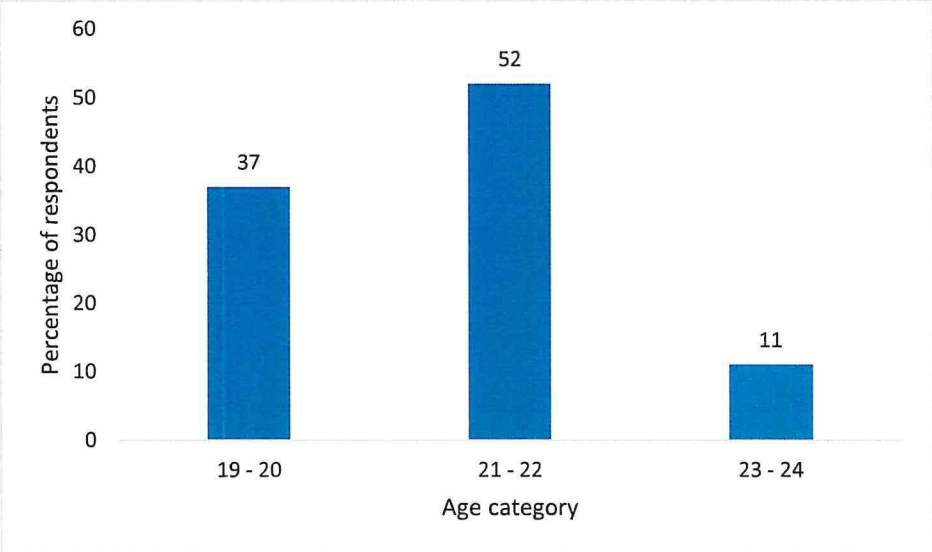


Figure 7: Graphical representation of participants by age

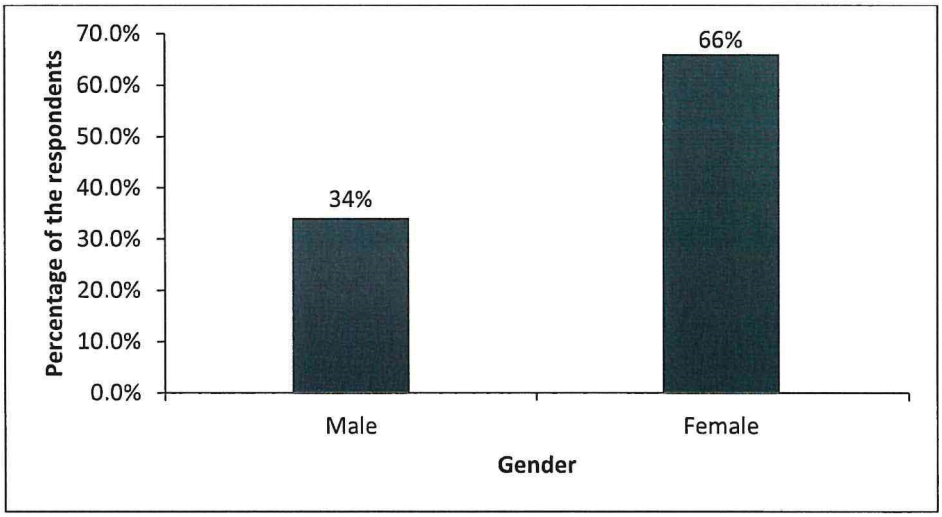


Figure 8: Graphical representation of respondents by gender

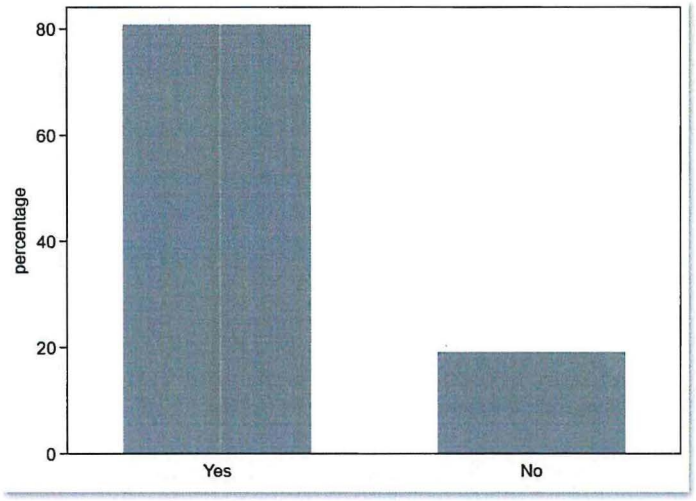


Figure 9: Graphical representation of respondents by physical exercise participation status

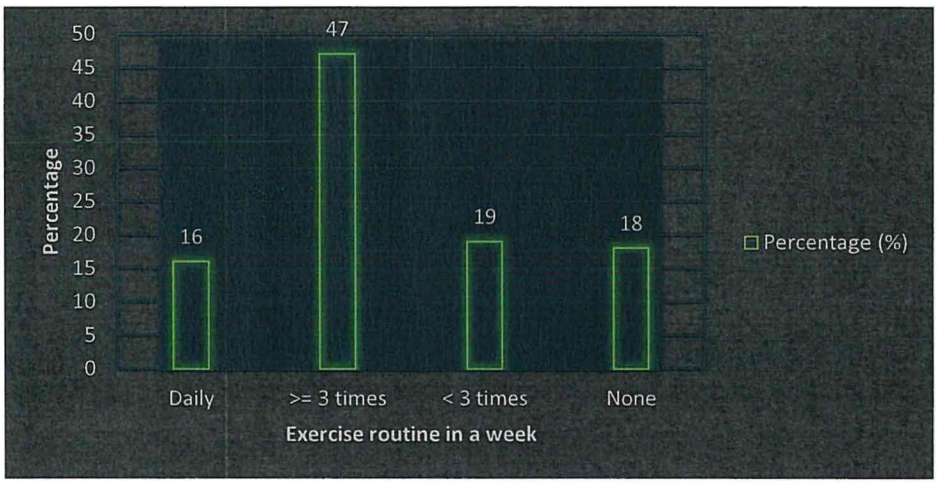


Figure 10: Graphical representation of respondents by their weekly physical exercise routine

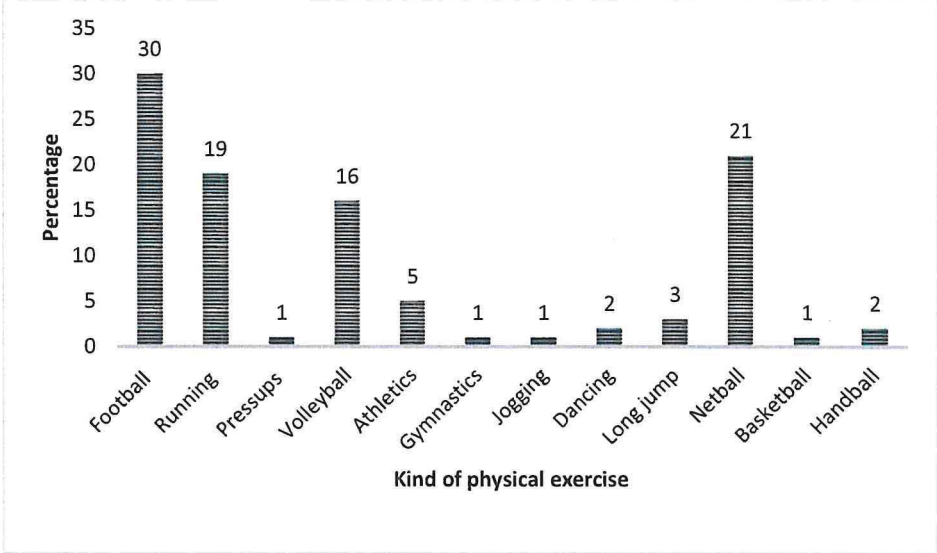


Figure 11: Graphical representation of respondents by the physical exercise they participate in

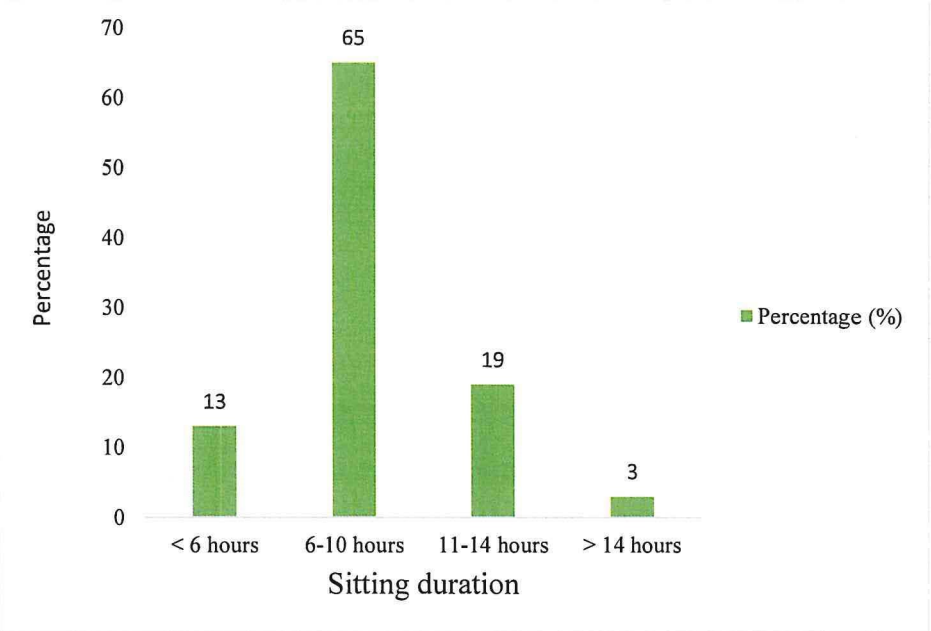


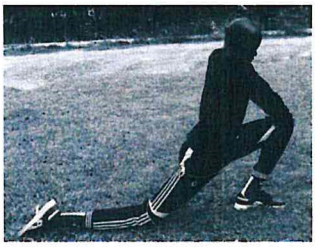
Figure 12: Graphical representation of respondents by time spent sitting in a day

Appendix C: Picture illustration of hamstring lower back flexibility exercises

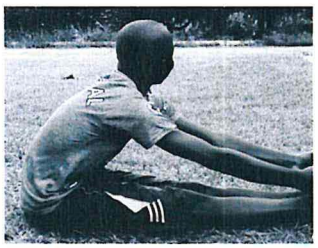
Figure 12: Hamstring and lower back flexibility exercise demonstration pictures

Trunk Flexion

Trunk Extensions



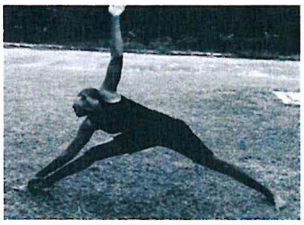
Hip Flexor Extension



The simple hamstring stretches (sit and reach)

Straight-leg bend

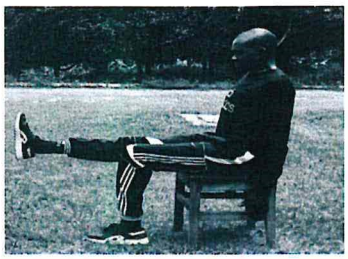
The hurdle hamstring stretches



Standing hamstring stretch (one leg at a time)

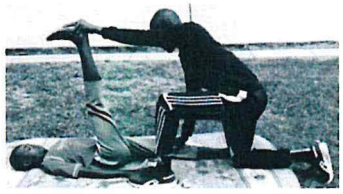
Standing hamstring stretch (both legs at once)

Prone hamstring stretches (Towel hamstring stretch)



Sitting stretch

Extended angle side bend



Passive Stretching