EFFECT OF AEROBIC EXERCISE ON SELECTED PHYSIOLOGICAL VARIABLES FOR PEOPLE WITH HYPERTENSION IN MOTTA TOWN, EAST GOJJAM, ZONE AMHARA REGIONAL STATE

MEd.THESIS

ADDIS ABEBAYEHU TAMIR

MARCH 2018

HARAMAYA UNIVERSITY, HARAMAYA

Effect of Aerobic Exercise on Selected Physiological Variables for People with Hypertension in Motta Town, East Gojjam Zone, Amhara Regional State.

A Thesis Submitted to the Department of Sport Science

Postgraduate Program Directorate

HARAMAYA UNIVERSITY

In partial Fulfillment of the Requirements for the Degree of

MASTER OF EDUCATION IN TEACNHING PHYSICAL EDUCATION

Addis Abebayehu Tamir

March 2018

Haramaya University, Haramaya

HARAMAYA UNIVERSITY

POSTGRADUATEPROGRAM DIRECTORATE

As research advisors we hereby certify that we have read and evaluated this thesis entitled **"Effect of Aerobic Exercise on Selected Physiological Variables For People With Hypertension In Motta Town, East Gojjam Zone, Amhara Regional State."** prepared by Addis Abebayehu Tamir. We recommend that it can be submitted as fulfilling the thesis requirements.

Abinet Ayalew (PhD)	_____	_____
Major Advisor	**signature**	**date**
Wegene Waltenegus (PhD)	_____	_____
Co- Advisor	**signature**	**date**

As a member of the Board of Examiners of MEd. Thesis Open Defenses Examination, we certify that we have read and evaluated the thesis work prepared by Addis Abebayehu Tamir and examined the candidate. We recommend that the thesis be accepted as fulfilling the thesis requirements for the Degree of Master of Education in Teaching Physical Education.

_____	_____	_____
Chair Person	**Signature**	**Date**
_____	_____	_____
Internal Examiner	**Signature**	**Date**
_____	_____	_____
External Examiner	**Signature**	**Date**

DEDICATION

This thesis is dedicated to my family for their constant physical, emotional, and financial support throughout my educational career and life.

STATEMENT OF THE AUTHOR

First, I declare that this thesis is my genuine work and that all sources of materials used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for M.Ed. Degree at Haramaya University and is deposited at the university library to be made available to browsers under rule of library. I solemnly declare that this thesis is not submitted to other institutions anywhere for the award of any academy degree diploma or certificate.

Brief quotations from this thesis are allowed without special permission provided that accurate acknowledgements of sources are made. Requests for permission for extended quotation form or duplicate of this manuscript in whole or in part may be granted by the head of the department/school or the Director of Postgraduate Directorate when he/ she reaches judgment that the proposed use of the material is in the interest of scholarship. However, in all other instances permission must be obtained from the Author.

Name of Author: Addis Abebayehu Tamir
Place:Haramaya University
Department: Sport Science
Date of submission: _____.
Signature: _____.

BIOGRAPHICAL SKETCH

The author Addis Abebayehu was born in 1986 in East Gojjam zone Amhara Regional State Motta town. He started his primary and junior School in Aba Motsa and Motta junior school. Then he joined Motta senior secondary School, for his Secondary School education. After completing grade 12, he joined Bahir Dar University and graduated with diploma in health and physical education in 2005. He began practicing his career by teaching in Motta primary school for two consecutive years, and then he joined Bahir Dar University, Department of Sport Science in 2009 and graduated with B.Ed. Degree in sport science with biology minor in 2011. After graduated he was teaching in Enesse secondary school and then he joined Haramaya University for M.Ed. in teaching physical education program in 2015.

ACKNOWLEGEMENT

First and foremost I would like to express my heartfelt gratitude to almighty GOD who has guided me this far and to whom goes all the Honor and glory for the successful completion of this study. And I would like to thank my family for their valuable support and encouragement, blessing and love which has always been a source of inspiration and strength in accomplishing this academic task.

And my heartfelt gratitude to my Brother Gebeyaw and friends for their moral and material support for the accomplishment of this study. And I wish to express my sincere thanks to my guide/major advisor, Dr. Abinet Ayalew and Co-advisor Dr. Wegene Waltenegus for their judicious information, expert suggestions, valuable guidance, continuous support, incessant reassurance during every stage of this work and interest shown in this dissertation without which this work would not have been possible.

I would like to thank all Haramaya University Sport Science Department staff members for their great supports and positivity in helping students. And I would like to forward my sincere gratitude to staffs of Motta Hospital for their support in giving blood pressure tests for subjects. And I am thankful to people living with hypertension in Motta town and assistance to participate in three months of strenuous aerobic exercise training for collecting the necessary data. Last but not the least; I would like to thanks all the Individuals in my study without whom this task would not have been possible

ACRONYMS AND ABBREVIATIONS

ACSM	American College of Sport Medicine
BMI	Body Mass Index
BP	Blood Pressure
CVD	Cardio Vascular Disease
DBP	Diastolic Blood Pressure
DTT	During Training Test
EG	Experimental Group
ETB	Ethiopian Birr
HTN	Hypertension
mmHg	Millimeter mercury
MoE	Ministry of Education
PoT	Post Test
PT	Pre Test
RHR	Resting Heart Rate
SBP	Systolic Blood Pressure
WHO	World Health Organization

TABLE OF CONTENTS

Table of Contents (Continued...)

Table of Contents (Continued...)

LIST OF TABLES

LIST OF FIGURES

Figure **Page**

LIST OF TABLES IN THE APPENDIX

LIST OF FINGURE IN THE APPENDIX

EFFECT OF AEROBIC EXERCISE ON SELECTED PHYSIOLOGICAL VARIABLES FOR PEOPLE WITH HYPERTENSION IN MOTTA TOWN EAST GOJJAM ZONE, AMHARA REGIONAL STATE.

ABSTRACT

The study was conducted to investigate the effect of aerobic exercise on selected physiological variables for people with hypertension in Motta town east Gojjam zone Amhara regional state. A Subject of 15 male Motta town community hypertensive patients diagnosed with hypertension more than one year were purposively selected from those hypertensive patients visited the primary care center for their monthly regular follow up. Patients whose systolic blood pressure reading <160 mmHg, and diastolic blood pressure reading <100 mmHg and heat rate reading < 100 b/minute were included in the study and their age range were 35-40 years. All Selected subjects were participated in low to moderate intensity of aerobic exercise for 12 consecutive weeks, i.e.3 days per week 60 minute duration per day. Pre, during and post training tests were conducted on systolic and diastolic blood pressure, body mass index and resting heart rate. The data collected from the study subject was analyzed using SPSS version 20 software. The data pertaining to selected physiological variables (systolic and diastolic blood pressure, body mass index and resting heart rate) for hypertensive patients were analyzed by paired sample 't'test to determine the difference between initial and final mean for participant. According to analyzed data significant net weighted reduction in systolic blood pressure by 18.70 mmHg (P<0001), diastolic blood pressure by 10.00 mmHg (P<0001), body mass index by 2.69 (P<0001) and resting heart rate by14.00 b/minute (P<0001). The result obtained in this study indicated that there was significant reduction in systolic and diastolic blood pressure, body mass index and resting heart rate reading in hypertensive patients. Based on this finding, it can be concluded that Low to moderate intensity aerobic exercise has positive effect on selected physiological variables for people with hypertension

Key words - Aerobic exercise, systolic and diastolic blood pressure, body mass index, resting heart rate.

1. INTRODUCTION

The introduction part of this study reivews background of the study, statement of the problem, scope of the study, significance, general and specific objectives of the study.

1.1. Background of the Study

Hypertension, defined as resting systolic blood pressure of >= 140 and/or diastolic blood pressure of >= 90 mmHg, remains the most common risk factor for cardiovascular morbidity and mortality. Currently, more than a quarter of the world adult population suffer from hypertension and it is expected that this number will increase to 1.56 billion (29%) by 2025. The primary goal of the treatment of hypertension is to prevent cardiovascular disease and mortality. All guideline statements emphasize life style modification as the first step in the treatment of hypertension. In this regard, physical activity is recommended for the hypertensive patients as a part of life style modification (World Health Report, 2009)

Regular physical activity, fitness, and exercise are critically important for the health and wellbeing of people of all, whether they participate in vigorous exercise or some type of moderate health-enhancing physical activity. Even among frail and very old adults, mobility and Functioning can be improved through physical activity (Jakicic, et al.,2001).

.

Physical activity and training is important for initiating and sustaining cardiovascular health. As such, encouragement from childhood and the possibility to participate in sports activity is a major health issue which must be sustained. Reaching adolescence, however, increasing expectations and competitive demands have gradually emerged as an important aspect of recreational sports in the young (Alpert et al, 2012).

.

Regular aerobic exercise will produce beneficial effects for any age group providing the exercise is specific and appropriate to the level of fitness of the individual. Progressive exercise correctly performed will increase the level of fitness and improve health. It will also create a sense of well being, produce greater energy and reduce the risk of developing many

diseases. Exercise makes demands on the body systems over and above normal every day activities and as result the systems adapt anatomically and physiologically. All activities involve the co-ordinate interaction of many body systems the muscular system and the skeletal system interact to produce movement, the contracting muscles exert a force or full on the bones , resulting in movement at the joints. Muscle contraction requires energy, which is supplied by nutrients from the digestive system and oxygen from the respiratory system. These products are delivered to the muscles by the cardio-vascular system which also transports the waste products of metabolism such as carbon dioxide and lactic acid away from the contracting muscles. The endocrine system is also involved with the control and regulation of movement. This system will efficiently with every day activities as they are physiologically adapted to that level (ACSM ,2004).

Appropriate regular daily physical activity is a major component in preventing chronic disease, along with a healthy diet and not smoking. For individuals, it is a powerful means of preventing chronic diseases; for nations, it can provide a cost effective way of improving public health across the population. Available experience and scientific evidence show that regular physical activity provides people, both male and female, of and conditions including disabilities with a wide range of physical, social and mental health benefits. Physical activity interacts positively strategies to improve diet, discourage the use of tobacco alcohol and drugs, helps reduce violence, enhances functional capacity and promotes social interaction and integration (ACSM 2002).

Fitness for living in the house or on the farm or at office or factory or in work places or in any service implies freedom from disease, enough strength, endurance and other abilities to meet the demands of daily living. Doing physical activity everyday contributes to optimum health and quality of life. Life styles can be changed to improve health and fitness through daily exercises. Aerobic exercise stimulates heart, lungs and all working group of muscles and produces valuable changes in body and mind. Many physiological changes are determined by daily aerobic exercises (Blumenthal et al ,2002).

Many research studies says aerobic exercise are important for the improvement of different physiological variables for people with hypertension but very few research were done on the area of how much aerobic exercise is effective for the improvement of each physiological variables for people with hypertension such as blood pressure, resting heart rate, body weight and exercise heart rate and also no research was done in Ethiopia specially in Motta town on effect of aerobic exercise on selected physiological variables for people living with hypertension. Now a days in our country Ethiopia, because of sedentary life style most people are attacked by chronic disease such as; coronary heart disease, hypertension, diabetes, and. Some other upcoming diseases. This is caused by lack of awareness and their attitude towards the benefits of regular physical exercise for their health. According to many research studies finding physical inactivity is one of the causes for development of chronic disease and poor fitness. Similarly, in Motta town people are living in sedentary lifestyle due to poor culture of having regular physical exercise. That was the reason to conduct the research in this place. The research investigates the effects of aerobic exercises on selected physiological variables of blood pressure, resting heart rate and BMI for people with hypertension.

1.2. Statement of the Problem

physical exercise is important for the development of all physical fitness but very few research were done on the area of how much aerobic exercise is effective for the improvement of cardiovascular endurance, muscular endurance, muscular strength, body composition and flexibility and also no research is done in Ethiopia specially in Motta town on effect of aerobic exercise for hypertension, body mass index and resting heart rate. Now a days in our country Ethiopia, because of sedentary life style most people are attacked by chronic disease such as; coronary heart disease, hypertension, diabetes, and some other upcoming diseases. In Motta town peoples are living in sedentary lifestyle due to poor culture of having regular physical exercise and attacked by hypertension obesity and heart problem. Because of this the research become interested to conduct in this place. From this standing point of views the research investigates the effects of aerobic exercises on selected physiological variables of blood pressure, resting heart rate and BMI (Body Mass Index) for people with hypertension.

Based on the above reason the researcher tried to answer the following questions:

- ✓ What is the effect of aerobic exercise on blood pressure for people with hypertension ?
- ✓ What is the effect of aerobic exercise in Body Mass Index of people with hypertension ?
- ✓ What is the effect of aerobic exercise in resting heart rate for people with hypertension ?

1.3. Scope of the Study

Conducting the study in all physiological variables, cardio vascular disease and effect of all physical exercise were difficult, challenging, time constraints, financial problem and unmanageable.

As a result, the researcher assessed the effect of 12 weeks aerobic exercise on selected physiological variables for people with hypertension in Motta town, which is the researcher's working place the investigation again delimited on the above listed peoples in Motta town.

1.4. Significance of the Study

The main aim of this study was to analyze the effect of aerobic exercise on selected physiological variables for people with hypertension in Motta town community, but it does not mean that the outcome of this research is only restricted to Motta town; it also helps other urban and rural community as the study were intend to signify;

- ✓ helps to motivate and encourage sedentary community to engage in aerobic exercise to improve their physical fitness level and health.
- ✓ The study helps for others as research work for depth studies on the problem undertaken .
- ✓ The study can helps for people in Motta town conducting to control blood pressure, improve Body Mass Index and resting heart rate for people with hypertension .
- ✓ Hence there is need to analysis the influence of aerobic exercise on selected physiological

variables of blood pressure, resting heart rate and body mass index for hypertensive patients

- ✓ Promote aerobic exercise can help significance decrease in resting heart rate and body weight for essential hypertensive patients by participating aerobic exercises

1.5. Objectives of the Study

1.5.1. General objective

- To investigate the effect of 12 week aerobic exercise on selected physiological variables for people with hypertension in Motta town

1.5.2. Specific objectives

- To evaluate the effect of aerobic exercise on blood pressure
- To describe the effect of aerobic exercise on hypertension
- To assess the effect of aerobic exercise on Body Mass Index(BMI) of people with hypertension
- To evaluate the effect of aerobic exercise on resting heart rate of people with hypertension

2. REVIEW OF RELATED LITERATURE

2.1. Hypertension

Hypertension or high blood pressure is a worldwide problem that affects approximately 15-20% of all adults. Hypertension known as silent killer as it showed no symptom. Even though it is simple to diagnose and usually can be controlled by healthy diet, regular exercise, medication prescribed by doctors or a combination of these, untreated hypertension will cause serious condition (Campbell et al., 2002).

Hypertension is associated with cardiovascular disease, insulin resistance, obesity, carbohydrate tolerance, hyperuricacidemia, and atherosclerosis (Marengo et al., 2004). Hypertension affects the structures and functions of small muscular arteries, arterioles and other blood vessels and can cause damage at variable rate to various target organs including kidney, brain and eye, related with the end stage of renal diseaseand to be the cause of stroke (Chen et al ,2002).

It is associated with the alterations in the blood vessels wall that affecting the endothelium, the media and the adventitia, whereas alteration in the media leading to remodeling of the vessel wall patients with hypertension die prematurely with the most common cause of death are heart disease, while strokes and renal failure are frequently occurring, particularly in those with significant retinopathy (Bray and G.A,1999). Various antihypertensive drugs such as beta-blocking agents, hypotensive diuretics, calcium antagonist, angiotensin converting enzyme inhibitors (ACEI), angiotensin II receptor antagonists and alpha-receptor blocking agents were usually used to control hypertension and its alleviate symptoms clinically. Two or more 7 antihypertensive drugs from different categories usually were combined to achieve optimal results as the efficacy of these drugs is only about 40-60% (Bruce and R.A., 2008).

2.1.1 Essential hypertension

95% of all hypertension cases were categorized as essential hypertension that also known as primary hypertension or idiopathic hypertension it is a heterogeneous disorder as different patients have different factors that cause high blood pressure the cause of essential hypertension is still unknown but it is considered as the sum of interaction between genetic and multiple environmental factors (Dickinson et al., 2006). Environmental factors including obesity, high alcohol intake, high salt intake, insulin resistance, low potassium intake, aging, sedentary lifestyles, stress, and low calcium intake contribute to the development of hypertension Inherited blood pressure (Bp) known as blood pressure that are genetically determined, while hypertensinogenic factors are factors that cause high blood pressure such as obesity, high alcohol and salt intake (Dickinson et al, 2006).

Various of gene might involve in the development of hypertension can cause inherited blood pressure and the influences of these genes have been demonstrated by family studies that showed high blood pressure are associated among siblings and between parents and children Obesity is known as important risk factor for type 2 diabetes and cardiovascular disease (CVD).It is associated with an incidence of arterial hypertension and known to be one of powerful risk factors for non-communicable diseases (Dinenno et al., 2000).

Obesity also acknowledge as the main hypertensinogenic factor compared to high alcohol intake, high salt intake, stress, sedentary lifestyles, dyslipidemia, low potassium and low 8 calcium intake .According to the study in Shanghai on Chinese adults age 40 years and above, subject with obesity are significantly has higher risk of hypertension and type 2 diabetes (He et al., 2009). Obesity can cause insulin resistance, adult-onset diabetes mellitus, left ventricular hypertrophy, hyperlipidemia and atherosclerotic disease (Dinenno et al., 2000).

2.1.2 Secondary hypertension

Secondary hypertension can be caused by medical conditions such as renal parenchymal disease, renal artery stenosis, hyperaldosteronism, or pheochromocytoma temporary high blood pressure also can cause by medications such as corticosteroids, no steroidal anti-inflammatory drugs (NSAIDs), cold medicines and birth control pills. Corticosteroids such

as prednisone and prednisolone will lead to Cushing syndrome in long-term use. Usages of nonsteroidal anti-inflammatory drugs (NSAIDs) increase blood pressure as well as will interfere in anti-hypertensive treatment, and abolish its effect (Chobanian et al., 2003). NSAIDs interfere in some of the antihypertensive agents such as beta-blockers, diuretics agents as well as angiotensin converting enzyme inhibitors (ACEI), except for calcium antagonist and central-acting drugs (Chobanian et al., 2003). NSAIDS such as indomethacin, naproxen and piroxicam were the greatest that involves in the increasing of blood pressure, while rofecoxib raise systolic blood pressure more than celecoxib cold medicines such as pseudoephedrine hydrochloride that used for upper respiratory decongestant may elevate blood pressure in hypertensive patients (Chobanian et al., 2003). Intake of birth control pills contributes in the increasing of blood pressure particularly in women above 35 years old that overweight and smokers. Treatment for primary and secondary hypertension were specifically different thus, it is important in terms of its diagnostic, therapeutic and prognostic to be determined before patient with such conditions were treated (Fagard et al., 1998).

The mechanism mediating hypertension increasing of arterial blood pressure can be caused by several factors such as increased in vascular resistance and initial increase in volume. Neurogenic and humoral stimuli stimulates vasoconstriction of blood vessel and cause renal volume retention that lead to increasing of cardiac output, tissue blood flow and vascular resistance that has cause increasing of arterial blood pressure. Increasing of blood volume also lead to vascular resistance thus induced blood pressure (World Health Report, 2009).

2.2. Physical exercise and hypertension

2.2.1. Why exercise has a reducing effect on BP

One theory is that physical activity improves endothelial function. The endothelium lining of blood vessel walls maintains normal vasomotor tone, enhances fluidity of blood, and regulates vascular growth. Abnormalities in these functions contribute to many disease processes including hypertension angina, myocardial infarction, coronary vasospasm .Another theory proposes that exercise enhances shear stress (a force acting parallel to blood vessels) stimulating the production of nitric oxide (NO) by the endothelium. In healthy blood

vessels NO enhances smooth muscle relaxation and maintains the blood vessel in the normal resting state. Small changes in vessel diameter profoundly impacts vascular resistance. There are also vascular structural changes such as increased length, cross sectional area, and/or diameter of existing arteries and veins in addition to new vessel growth. Endurance trained subjects, for example, have larger arterial lumen diameter in conduit arteries than untrained controls. Aerobic based training also appears to increase large artery compliance.(Whelton et al, 2002)

2.2.2. How much can exercise lower BP?

The 2004 ACSM review of evidenced based literature on the BP-exercise relationship suggests the following important conclusions for the GP to consider:

- A lifestyle of physical activity can reduce the risk of developing hypertension. Inactive individuals have a 30–50% greater risk than their more physically active counterparts for developing high BP as they age. Therefore, an active lifestyle has an important preventive effect(2004 ACSM)
- Two types of endurance exercise effects are significant acute effects and chronic effects acute effects: there is an average reduction in BP of 5–7 mmHg immediately after an exercise session. This is referred to as post exercise hypotension (PEH). While PEH occurs in both normotensive and hypertensive patients, a greater PEH is seen in hypertensive. The PEH effects can occur for up to 22 hours regardless of the exercise intensity chronic effects: the average BP reduction with regular endurance exercise for hypertensive not normalized by drug therapy in the literature review is 7.4/5.8 mmHg. If baseline BP is normal because of drug therapy, the average decrease was an additional 2.6/1.8 mmHg irrespective of drug therapy type. The studies used a variety of endurance based programs involving walking, jogging or cycling of moderate intensity (30–90% of VO2 reserve) ranging from 4–52 weeks in length. Sessions typically lasted 30–60 minutes (2004 ACSM)

- Overall, resistance training has a favorable chronic effect on resting BP, but the magnitude of the BP reductions are less than those reported for an aerobic based exercise program. As well, limited evidence suggests that resistance exercise training has little PEH effect. These

decreases in BP do not seem to be large, but as the ACSM point out, a 2 mmHg reduction in systolic and diastolic BP reduces the risk of stroke (ACSM 2004)

2.3. Physiological variables

2.3.1. Blood pressure

Blood pressure is usually classified based on the systolic and diastolic blood pressure. Systolic blood pressure is the blood pressure in vessels during a heartbeat .Diastolic blood pressure is the pressure between heartbeats. A systolic or the diastolic blood pressure measurement higher than the accepted normal values for the age of the individual is classified as a pre hypertension or hypertension .Hypertension has several sub-classifications including ,hypertension stage 1, hypertension stage 2, and isolated systolic hypertension. Isolated systolic hypertension refers to elevated systolic pressure with normal diastolic pressure and is common in the elderly. These classifications are made after averaging a patient's resting blood pressure readings taken on two or more office visit .Individuals older than 50 years are classified as having hypertension if their blood pressure is consistently at least 140 mmHg systolic or 90 mmHg diastolic(ACSM, 2004).

2.3.2. Resting heart rate

Among mammals, the total number of heart beats per lifetime is remarkably constant, despite wide variations in body size and RHR . This implies, that the RHR, which is determined by the ratio between body volume (generating heat) and body surface (heat loss), is strongly related to life expectancy .The only exception among mammals is the human species; it can be speculated that modern humans have stretched the boundaries of biology to achieve a life expectancy of 80 years through improvements in living conditions such as a better hygiene, safeguarding of clean water and food supply, secure accommodation, the prevention and treatment of diseases and many more (102). However, also in humans, RHR is related to mortality; an increase in RHR of 10 beats/minute is associated with around 10-30% increased risk for all-cause mortality (karvonen, 1997) .

RHR is easily obtained, noninvasive and no expensive. Besides being a reflection of sympathetic tone, elevated RHR is also a reflection of severe disease, such as heart failure.

Finally, resting heart rate is an independent risk factor for cardiovascular disease and mortality. An increase in resting heart rate of 10 beats/minute is related to a 10-30% increased risk for cardiovascular events and mortality in the healthy population (104-108;112), in patients with cardiovascular risk factors such as diabetes (110) or hypertension (109) and in patients with coronary artery disease . Direct adverse effects of an increased RHR on cardiac and vascular function and morphology include endothelial dysfunction, direct stimulation of atherogenesis and atherosclerotic plaque rupture, increased susceptibility for ventricular arrhythmias and a negative influence on the balance between myocardial oxygen demand and supply (American Heart Association,2004) Heart rate reduction, using beta-blockers or non-dihydropyridine calcium channel blockers, reduces the risk for all-cause and cardiac mortality with about 30% per 10 beats/minute heart rate reduction in patients with a recent myocardial infarction, although these agents have more mechanisms of action such as lowering blood pressure (115). Recently, ivabradine, a pure heart rate-lowering agent without other known effects on the cardiovascular system, has shown to reduce the risk for hospital admission for fatal and non-fatal myocardial infarction (hazard ratio (HR) 0.64; 95%CI 0.49-0.84) in patients with coronary artery disease and to reduce the risk for cardiovascular death or hospital admission for worsening heart failure (HR 0.82; 95%CI 0.75-0.90) in patients with chronic heart failure on top (Bruce, et al,2008).

2.3.3. Exercise heart rate

The human body has an in-built system to measure your exercise intensity -your heart. your heart will increase in proportion to the intensity of your exercise .you can track and guide your exercise intensity by calculating your Target heart range target heart rate should be 40 - 80% of his or her maximum heart rate this maximum heart rate based on a person's age. An estimate of a person's maximum heart rate can be calculated as 220 beat per minute (bpm) minus your age (ACSM, 2000).

2.3.4. Body mass index

The BMI provides an indication of the appropriateness of a man’s weight relative to height. Body mass index is determined by the following formula: BMI = weight (kg) / height2 (m). An example is provided to demonstrate how weight and height interact to influence the BMI

score. A weighing 100 pounds (45.36 kg) who is 5 feet (1.52 m) tall would have a BMI of 19.6. Another of the same weight but 5 feet 2 inches (1.57 m) tall would have a BMI of 18.3. The same weight is more appropriate for the slightly taller person, so the BMI is slightly lower. Height and weight measures can be entered in pounds and inches, but they are converted to metric units to calculate BMI pounds to kilograms and feet to meters. This section describes how to collect height and weight data and how the results can be interpreted (Bray and G.A., 1999).

2.4. Aerobic Exercise and Its Benefits

2.4.1 Aerobic exercise

Aerobic exercise is a physical exercise of relatively low intensity that depends primarily on the aerobic energy-generating process. Aerobic means “with oxygen”, and refers to the use of oxygen to adequately meet energy demands during exercise via aerobic metabolism. Generally light to moderate intensity activities that are sufficiently supported by aerobic metabolism can be performed for extended periods of time and it refers to exercise that requires the consumption of substantially more oxygen than at rest .and can be undertaken for a prolonged duration without excessive fatigue. (http://www.newellness.com)

2.4.2. Benefits of aerobic exercise

The benefits of aerobic exercise are myriad. They include systemic changes such as reduced cholesterol and blood pressure, reduced body fat, increased metabolism, to name a few. Aerobic activities strengthen the heart and lungs, making them more efficient and durable, improving quality and quantity of life. Exercise not only extends your life, but also gives you more energy to live it to the fullest. Aerobic exercise improves the strength of your bones, ligaments and tendons, allows your body to use fats and sugars more efficiently, burns lots of calories and plays an important role in reducing the onset and symptoms of aging and illness. Aerobic exercise reduces your risk of heart disease, vascular disease and diabetes and can help those trying to quit smoking by relieving cravings and improving lung function. Research has confirmed that aerobic exercise reduces stress and combats depression as it raises self-esteem and physical and wellness (Kathleen, 2006).

Regular exercise causes your body to make adjustments that result in improved health and physical functioning. Continuing with regular exercise enables your body to maintain these benefits. Regularly doing the right types of aerobic exercise at the correct intensity, and for an appropriate duration, results in the most benefit. The benefits of aerobic exercise can be broadly categorized as either 'fitness' (physical capacity) or 'health'. Fitness and health are linked, and most forms of aerobic exercise will help you achieve both. Regular aerobic exercise improves your cardiovascular fitness by increasing your capacity to use oxygen. It does this by increasing your heart's capacity to send blood (and hence oxygen) to the muscles. This is mainly achieved through an increase in the size of the heart's pumping chambers (ventricles), which means that your heart doesn't have to beat as fast to deliver the same amount of blood. This is evident in a slower resting heart rate, and a slower heart rate for the same exercise intensity. Regular aerobic exercise has been shown to reduce high blood pressure, the risk of heart disease type 2 diabetes, colon cancer and breast cancer. It can lower blood pressure and improve your blood cholesterol by reducing the levels of LDL-cholesterol (so-called 'bad' cholesterol) and increasing the amount of HDL-cholesterol (so-called 'good' cholesterol). It can also reduce anxiety, stress and depression, as well as instilling a general sense of well-being. Regular aerobic exercise has even been shown to have the potential to increase your lifespan importantly,where as many health benefits can be gained from any form of aerobic exercise. Additionally, the health gains can be achieved from relatively moderate of exercise moving from a lifestyle involving no exercise to one that involves some exercise can lead to substantial improvements in health (Thomas *et al.*, 2008).

Aerobic activities should be used to develop cardio respiratory endurance. Basically aerobic activities are those in which a sufficient amount of oxygen is available to meet the body's demands. During the performance of elevated level for an extended period .this activity typically Involve vigorous and repetitive whole body or large muscle and movements that sustained for an extended period. Popular aerobic activities including running, walking rowing ,swimming, cycling, aerobic dancing, jogging, tread mill and somewhat continuous

in nature the intensity of work load can be easily regulated by controlling the pace (Shemelis, 2011).

2.5. Effect of aerobic exercise on blood pressure

2.5.1. The Antihypertensive Effects of Aerobic Exercise

The JNC 7 recommends exercise as a lifestyle therapy for the prevention, treatment and control of HTN. Those with HTN who engage in aerobic exercise exhibit a BP reduction of 5 to 7 mmHg . Further, the ACSM recommends moderate intensity aerobic exercise performed on most days of the week for 30-60 min·d-1 to lower BP. Fagard meta-analyzed the influence of exercise characteristics and the BP response to dynamic aerobic or endurance exercise in healthy individuals with normal BP and individuals with HTN. The results from the meta analysis concluded aerobic training 3 d·wk-1 for 40 min·d-1 at 65% VO2max reduces BP on average 3/2 mmHg in individuals with optimal BP, however greater reductions were seen among individuals with HTN; 7 mmHg SBP and 6 mmHg DBP. Therefore, training 3-5 d·wk-1 for 30-60 min·d-1 at 40-50% VO2max exhibits an effective mode of exercise to reduce BP and supports the ACSM guidelines for exercise. Mughal et al. looked at the changes in BP with aerobic exercise over a 12 wk period in 27 men (39 yr) with HTN (143/91 mmHg). Subjects engaged in an exercise training protocol walking at 50% VO2max for 30 min·d-1, 3-5 d·wk-1. The results showed BP reductions of 5.7 mmHg SBP and 1.4 mmHg DBP. Although these reductions are slightly less than ACSM, these findings indicate that walking, a low cost activity can still reduce BP in individuals with HTN. The prevalence of HTN increases with age with higher DBP values until the age of 55 at which values slowly decline, while SBP values continue to increases with age. Therefore it is important and beneficial to engage in exercise training for the prevention, treatment, and management of HTN. As previously discussed the literature indicates aerobic exercise is an effective non-pharmacological treatment to prevent, manage and treat HTN. BP reductions occur over a short period of time within 1-2 wk of the onset of aerobic exercise training and persist with continued exercise . Further, BP reductions are exhibited in individuals with normal BP and in individuals with HTN regardless of their pre exercise (resting) BP status.

However, the antihypertensive effects of aerobic exercise training appear to be more pronounced among individuals with pre HTN or HTN.(Halbert et al, 2007).

2.6. Variability to BP Response to Exercise Training

Although aerobic exercise has shown to be an effective antihypertensive strategy, the magnitude and duration of these BP reductions vary widely across studies. Bouchard and Rankinen noted high levels of heterogeneity in the BP response to different exercise programs and modalities (aerobic, resistance, and combined aerobic and resistance exercise) among individuals with HTN. SBP was taken during an acute bout of exercise, cycling at 50 Watts. These researchers from the heritage family study reported that 723 sedentary men and women aged 17-29 yr had a BP average overall reduction of 8.2 ±11.8 mmHg. However, individuals with higher resting mean SBP reduced overall BP 13.4 ± 12.2 mmHg and individuals with lower resting mean SBP resulted in a lesser BP reduction of 3±8.8 mmHg. In addition, the standard deviation of the overall reduction exceeded the average mean change (8.2 ±11.8 mmHg), which demonstrated the wide variability in the BP response to exercise training from individual to individual. The study concluded that there is evidence that there is considerable heterogeneity in the response of physiological indicators of risk factors to regular physical activity and pre training levels of SBP which has an impact on determining the response to exercise training (Jennings et al, 1998).

2.7. The Antihypertensive Effects of Resistance Exercise

As a supplement to aerobic exercise, the ACSM (2004) recommends individuals with HTN perform resistance exercise 2-3 d·wk-1 of at least one set of 8-12 repetitions [60-80% of 1 repetition maximum(RM)] .There is a large body of evidence to support the antihypertensive effects of aerobic exercise on resting BP. However, resistance training has been deemed safe for individuals with HTN with average reductions of 3 mmHg post training when performed in accordance with the current ACSM recommendations.These reductions exhibited with resistance training are less than those with aerobic training therefore resistance training is recommended as a supplement to aerobic training. Resistance training has positive health effects by increasing strength and by decreasing resting BP(Edwards and M.A, 2006).

2.8. Aerobic activity and high blood pressure

Normal blood pressures are lower than 140 mm Hg (systolic) and lower than 90 mm Hg (diastolic). High blood pressure is well recognized as a risk factor for cardiovascular disease. About 25 percent of U.S. adults have high blood pressure (hypertension). If untreated, high blood pressure eventually damages the heart, brain, eyes, and kidneys. The higher the blood pressure, the greater the risk of complications, such as heart attacks and stroke will develop (Whelton et al 2002).

Vigorous aerobic activity has been shown to decrease systolic and diastolic blood pressure there is some evidence that participation in more moderate physical activity may achieve similar or even greater effects in lowering blood pressure than vigorous activity (Hagberg et al, 1999). Hagberg, Park and Brown (2000) suggested that moderate aerobic activity was an important means of reducing blood pressure in those with hypertension, particularly in middle-aged people. A recent meta-analysis from the United States identified 54 random controlled trials, of a median duration of 12 weeks, conducted among a total of 2419 participants of different ethnic backgrounds and hypertensive status (mean ages, 21 to 79 years). Most trials recruited people with sedentary lifestyles to exercise on a bike, to walk or to jog for up to 150 minutes per week. Aerobic exercise was found to be associated with a significant reduction in mean systolic and diastolic blood pressure (-3.84mmHg and -2.58mmHg, respectively) in both hypertensive and normotensive subjects (Whelton, Chin and He, 2001; Chen et al, 2002).

2.9. Effect of aerobic exercise on resting heart rate

The present study investigated the effects of a 12-week aerobic exercise program on RHR, physical fitness, and arterial stiffness of female patients diagnosed with metabolic syndrome. Exercise has been discussed as a key intervention for managing clinical indicators of metabolic syndrome. The results of the present study show that aerobic exercise was effective at decreasing risk factors, such as weight, % body fat, waist circumference, fasting blood glucose, systolic BP, and diastolic BP, as well as increasing HDL-cholesterol. However, the triglyceride level did not show a significant change. These findings are similar to those of a previous intervention study that reported the risk factors of metabolic syndrome

were ameliorated by aerobic exercise[)]. Therefore, in addition to causing weight loss, aerobic exercise can contribute to improving metabolic deregulation, which plays a pivotal role in the onset of metabolic syndrome.Aerobic exercise plays a central role in the primary prevention and treatment of CVD, which is a co morbidity in many metabolic syndrome cases. Moreover, prospective studies have suggest RHR is an independent predictive factor of CVD, and elevated RHR has been shown to increase the risk of metabolic syndrome onset. Thus, measures for controlling RHR, which is related to the prognosis of CVD, have become important. The results of the present study show that aerobic exercise reduced RHR. This result is consistent with previous studies results, and is likely due to the inhibition of sympathetic nervous system activation and increased activation of the parasympathetic nervous system owing to the effects of cardiovascular adaptation elicited by aerobic exercise. In other words, aerobic exercise appears to play an important role in reducing RHR, which can subsequently influence CVD onset. Further, RHR is associated with physical fitness, and that RHR can be reduced through improved physical fitness (Edwards and M.A 2006).

The present study also showed that aerobic exercise increased cardiopulmonary and muscle fitness. A study by Lakka et al. verified that having higher fitness lowered the risk of metabolic syndrome development. This indicates that improved fitness, which is a benefit of exercise, is also important in metabolic syndrome. Therefore, it appears that aerobic exercise increases cardiopulmonary fitness and muscle fitness contributing to the lowering of CVD risk in patients with metabolic syndrome (Fagard et al ,2007).

In conclusion, in the present study, aerobic exercise was found to be effective at ameliorating the risk factors of metabolic syndrome. Moreover, it was also found to reduce RHR, increase physical fitness, and lower blood pressure, which is an indicator of arterial stiffness. Therefore, aerobic exercise can be considered as an important intervention strategy for reducing the risk of CVD in patients with metabolic syndrome. (European Society of Hypertension ,2003)

2.10. Effect of aerobic exercise on exercise heart rate

HR behavior during the exercise is mediated by ANS. HR variability is the oscillation in time between consecutive myocardial contractions (systoles). Studies with selective pharmacological block showed the exclusive role of the vagus nerve in HR response at the initial transient of the exercise, with predominance of the vagal activity at rest that is gradually inhibited at sub maximal exercise both active and passive, up to the maximum level of exercise, when parasympathetic activity is apparently totally inhibited, causing smaller or absence of HR variability. In the initial seconds of the exercise, HR increases due to inhibition of vagal activity, which not only increases atria contractility, but also conduction velocity of the ventricle depolarization wave from AV node, regardless of the level of intensity of the exercise and aerobic conditioning of healthy individuals. On other hand, an individual who does not elevate significantly his/her HR in the beginning of the exercise, may be signalizing an impaired vagal activity. After this initial stage, as one goes on exercising, HR increases again, due to adrenergic overstimulation on sinus node, or due to increase of serum norepinephrine, or atrial mechanics distention and therefore, sinus node distention due to a higher venous return, and the increase in body's temperature and blood's acidity. (karvonen et al, 1997)

While Tulppo et al. and Goldsmith et al. relate decrease of HR variability to age, in face of decreased physical fitness from aging, and that this could be reverted by maintaining or improving aerobic physical condition, results from Migliaro et al. and Byrne et al. suggest that age alone could be the main factor to decrease autonomic modulation, regardless of aerobic fitness. The increase in maximal O2 uptake through aerobic training can lessen the age-related decrease of baroreflex sensitivity. A program of mild-intensity exercises would be enough to show some improvement in the autonomic function of healthy adults or those with chronic heart failure, even without direct training supervision; changes on vagal activity caused by physical training would be central, possibly directly on bar reflex, whereas the sympathetic activity would be primarily related to peripheral changes (vasoconstriction) (Posner et al, 2002).

2.11. Effect of aerobic exercise on body weight

Prolonged exercise has been recognized as important factor for weight loss owning an appropriate diet and keeping the amount of energy consumption is of equal importance. Mild to severe level of exercise in combination with reducing body weight by 8 - 10%.Determining the level of exercise intensity and maintaining it at least 150 minutes per week of moderate intensity exercise is important until the power of person goes beyond the prescribed amount of exercise , which thus brings it to 60 minutes a day (WHO, 2012).

2.12. Physiological response of the body during aerobic exercise

Respiratory system

During exercise, ventilation might increase from resting values of around 5–6 litre min^{-1} to >100 litre min^{-1}. Ventilation increases linearly with increases in work rate at sub maximal exercise intensities. Oxygen consumption also increases linearly with increasing work rate at sub maximal intensities. In an average young male, resting oxygen consumption is about 250 ml min^{-1} and in an endurance athlete oxygen consumption during very high intensity exercise might reach 5000 ml min^{-1}. The increase in pulmonary ventilation is attributable to a combination of increases in tidal volume and respiratory rate and closely matches the increase in oxygen uptake and carbon dioxide output. Breathing capacity, however, does not reach its maximum even during strenuous exercise and it is not responsible for the limitation in oxygen delivery to muscles seen during high intensity activity. Hemoglobin continues to be fully saturated with oxygen throughout exercise in people with normal respiratory function.(WHO ,2003)

Changes in arterial blood gases

The changes which occur in arterial pH, P_{O2} and P_{CO2} values during exercise are usually small. Arterial P_{O2} often rises slightly because of hyperventilation although it may eventually fall at high work rates. During vigorous exercise, when sufficient oxygen for flux through the Krebs cycle is not available, the increased reliance on glycolysis results in increased accumulation of lactic acid, which initially leads to an increase in Pa_{CO2}.

However, this is counteracted by the stimulation of ventilation and as a result Pa_{CO2} is decreased. This provides some respiratory compensation for further lactic acid production and prevents a decline in blood pH, which remains nearly constant during moderate exercise (British Journal of Anaesthesia 2004).

Cardiovascular system

Substrate and oxygen requirements of working skeletal muscles are dramatically elevated above resting requirements. Resting blood flow to muscle is usually 2–4 ml·100 g muscle^{-1} min^{-1}, but might increase to nearly 100 ml·100 g muscle^{-1} min^{-1} during maximal exercise. This occurs in part because of vasodilatory metabolites such as AMP, adenosine, H^+, K^+ and PO_4^{3-} acting on pre-capillary sphincters, which override the vasoconstrictor effects of nor epinephrine. In addition, decreased pH and increased temperature shift the oxygen dissociation curve for hemoglobin to the right in exercising muscle. This assists in unloading more oxygen from the blood into the muscle. During muscular contraction, blood flow is restricted briefly but overall it is enhanced by the pumping action of the muscle. Whilst muscle and coronary blood flow increase, cerebral blood flow is maintained constant and splanchnic flow diminishes. However, essential organs such as the bowel and kidneys must be protected with some blood flow maintained. An additional demand on blood flow during exercise is the requirement to increase skin blood flow in order to enable heat dissipation (Ishikawa-Takata et al ,2003).

Circulatory changes

The increase in blood flow to muscles requires an increase in the cardiac output, which is in direct proportion to the increase in oxygen consumption. The cardiac output is increased by both a rise in the heart rate and the stroke volume attributable to a more complete emptying of the heart by a forcible systolic contraction. These chronoscopic and isotropic effects on the heart are brought about by stimulation from the noradrenergic sympathetic nervous system. The increase in heart rate is also mediated by vagal inhibition and is sustained by autonomic sympathetic responses and carbon dioxide acting on the medulla.The efficacy of systolic contraction is particularly important in trained athletes who can achieve significant increases in cardiac output as a consequence of hypertrophy of cardiac muscle. Heart rate

and stroke volume increase to about 90% of their maximum values during strenuous exercise and cardiovascular function is the limiting factor for oxygen delivery to the tissues. Oxygen utilization by the body can never be more than the rate at which the cardiovascular system can transport oxygen to the tissues. There is only a moderate increase in blood pressure secondary to the rise in cardiac output. This is caused by stretching of the walls of the arterioles and vasodilatation, which in combination reduce overall peripheral vascular resistance. There is a large increase in venous return as a consequence of muscular contraction, blood diversion from the viscera and vasoconstriction (ACSM, 2004).

Body temperature

The maximum efficiency for the conversion of energy nutrients into muscular work is 20–25%. The remainder is released in a non-usable form as heat energy, which raises the body temperature. In order to dissipate the extra heat generated as a result of increased metabolism during exercise, blood supply to the skin must be increased. This is achieved with vasodilatation of coetaneous vessels by inhibition of the vasoconstrictor tone. Evaporation of sweat is also a major pathway for heat loss and further heat is lost in the expired air with ventilation. The hypothalamus is responsible for thermoregulation and it is important that this process is effective. However, during exercise in hot, humid conditions evaporative heat loss through sweating might not be able to remove sufficient heat from the body. Regulation of body temperature may fail and temperatures may be high enough to cause heat stroke. This presents with symptoms of extreme weakness, exhaustion, headache, dizziness eventually leading to collapse and unconsciousness (Booth et al, 2005).

3. MATERIALS AND METHODS.

3.1. Description of the Study Area

This research was conducted at Motta town East Gojjam zone, Amhara regional state for three consecutive months, starting from October 30 up to January 30, 2017/18. And Motta is a town in North West Ethiopia. Located in the Misraq Gojjam Zone of the Amhara Region, and on the secondary road that links Dejen with Bahir Dar overlooking the Abay River found at a distance of 368 km from Addis Ababa and 120 km from Bahir Dar, this town has a latitude and longitude of 11°5′N 37°52′ E with an elevation of 2,487 meters above sea level. From the Central Statistical Agency in 2007, this town has an estimated total population of 31,483, of whom 15,619 are men and 15,864 are women. Motta became a major commercial center, which was described by at least one group of European travelers as "the most considerable market" in Gojjam; it attracted merchants from as far away as Begemder and Gondar. In Motta town most of peoples are poor culture for participating health related physical activities regularly.

3.2. Experimental Materials

The experimental materials that the researcher used for conducting this research includes rope, foot ball field, record sheets, paper, music player (G pass), pen, stop watch, 12 inch bench, weighing machine, whistle and an automated digital electronic blood pressure monitors (sphygmomanometer) apparatus that is used to measure systolic, diastolic and heart rate reading of the hypertensive patients.

3.3. Source of Data

The participants of study were all male hypertensive patients of Motta town communities selected from monthly treatment follow up in Motta town Hospital. Systolic blood pressure between 120-160 mmHg diastolic blood pressure between 80-100 mmHg and pre designed selected physiological variables test (measure resting heart rate and body mass index) and their age was 35 – 40.

3.4. Treatment and Study Design

The study design was experimental design that was examining the effect of aerobic exercise on selected physiological variables for people with hypertension. The independent variables are aerobic exercises and the dependent variables were resting heart rate, Body Mass Index, systolic and diastolic blood pressure. The research was pre, during and post blood pressure test, resting heart rate test and Body Mass Index patterned experimental method on purposively selected (n=15) experimental group (EG) was implemented without control group. And a total of 15 voluntary and hypertensive diagnosed patients, who lives in Motta town were, participate. While the researcher specially designed gradually increase intensity of low to moderate aerobic exercise, duration 60 minutes, frequency of 3 times a week for 12 consecutive weeks.

3.5. Description of population and Sampling Methods

The sample populations of this study were selected by using purposive sampling method. The researcher selected particular hypertensive patients for constituting a sample which represent the study population based on prepared physical activity readiness questions (PAR-Q).

The sample populations of the study were purposively selected 15 male individuals who have been diagnosed hypertensive their age ranges from 35 - 40 years in Motta town.

3.6. Inclusion and exclusion criteria

Hypertensive patients whose systolic blood pressure (SBP) reading < 160 mmHg, diastolic blood pressure (DBP) reading <100 mmHg and resting heart rate reading <100 b/minute was included in this study. However the patients whose systolic blood pressure reading ≥ 160 mmHg, diastolic blood pressure reading ≥ 100 mmHg and resting heart rate reading ≥ 100 b/minute subjects were hypertensive and not participated in any physical exercise program currently was excluded from participating in to this study.

3.7. Methods and Procedures of Data Collection

The researcher used quantitative data collection method to collect data from the subject. The B.Sc degree clinical nurse was measured a reading of blood pressure (systolic and diastolic) and resting heart rate of each patient before, in between and after physical training from the right arm in Motta hospital by using blood pressure monitor (sphygmomanometer).Height (m) and weight (kg) and body mass index kg/m^2 were measured with the patients wearing light clothes with in the inner and bare-footed and the body mass index was calculated using the formula weight (kg)/height $(m)^2$ and it is graded as per the WHO – International classification of BMI: < 18 under weight, 18.5 – 24.99 normal, 25 – 29.99 over weight, and > or = 30 obese. For the first 6 weeks of training session, the researcher guided the patients to execute physical activities at low intensity (55 - 60 %), duration of 60 minutes and frequency of 3 times a week and for the second 6 weeks of training session, the patients conducted aerobic exercise at moderate intensity of (60% -70%), duration of 60 minutes and frequency of 3 times a week. The researcher applied the principles of progressions while executing aerobic exercises.

3.8. Measurement Tools and Applications

3.8.1. Measurement of Resting Blood Pressure and Heart Rate test analysis

The measurement of systolic and diastolic blood pressure and heart rate were carried out at 6:00–7:00 am using a tabletop upper arm blood pressure monitor. The measurements were taken in a sitting position after a 10-min rest period. The subjects sat quietly in a chair and avoid moving his or her arm or hand during measurement. The Blood Pressure cuff was attached to the upper arm, approximately 2 cm above the elbow. The two rubber hoses from the calibrated blood pressure monitor were positioned over the biceps muscle (brachial artery). Mean of three measurements completed at intervals of 1 minute was used for analysis weather it is low (hypotension) or high (hypertension) of the formal level

Heart rate can be taken at radial pulse (wrist) index and middle fingers were placed together on the opposite wrist, about 1/2 inches on the inside of the joint, in line with the index

finger. Once the pulse found, the number of beats felt within a one minute period were counted per minute rate was estimated by counting over 15 seconds and multiple by 4,or over 30 second and doubling the result(American Heart Association,2011).

3.8.2. Body mass index test analysis

Body mass index: This test measure's the appropriateness of a subject's weight relative. Body height and weight were measured using calibrated height weight digital balanced beam scale in meter and kilogram and put under the formula

$$\text{Body mass index} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

3.9. Methods of Data Analysis

Data gathering techniques were used to analyzed and interpret the data which was collected through field and an automated digital electronic blood pressure monitor systole, diastole and heart rate tests before, during and after the intervention In this study descriptive statistical analysis of paired sample t-test was carry out, coding and analyzed by software, statistical package for social science (SPSS) version 20. .

3.10. Data Quality Control

The researcher was monitors and guides the frequency, intensity, time and type of aerobic activities that the participants perform throughout training session. The B.Sc degree clinical nurse was used an automated digital electronic blood pressure monitor(sphygmomanometer) apparatus to get accurate reading of systole, diastole and heart rate.

3.11. Limitation of the study

Limitation of this study was unable to control the life style of the participants after each exercise session because of these their nutrition is affects or limits the expected result of the study

3.12. Protocol and Ethical Consideration

The study was deal with the ethical issue related to the investigation. It was protected the privacy of research participant and can make guaranty and confidentiality of the information that will be given to the study, and risk harm due to participation. Participation of subjects in this study has purely a voluntary based activity and their right not to participate and can resign at any time of training session were respected. Therefore the study was conducted all action based on the university rule, code of conduct and policies concerning research ethics. Since subjects was volunteers they retraining from the situation if they are not ready or not feel comfort at any time they want. Ethical approval was obtained from institutional research ethics review committee (IRERC) of Haramaya University College of health science. The protocol approved by the university guidelines and written consent will be given and inform the concerned bodies.

4. RESULT AND DISCUSSION

4.1. Changes of Systolic Blood Pressure

Significance differences due to aerobic exercise effects were observed in reduction of systolic blood pressure (Table 1), as it is indicated in the table the net weighted systolic blood pressure reading of the hypertensive patients before starting to participate in aerobic activities training session was 143.05 mmHg, which was out of the average population normative 120 mmHg. However, after the first 6 weeks of low intensity (40% - 50% of net maximal oxygen uptake aerobic exercise performance duration of 60 minutes and frequency of 3 times a week) of aerobic exercise training session , systolic blood pressure reading was lowered by 8.60 mmHg (6.01%),after the second 6 weeks of moderate intensity (50% - 60% of net maximal oxygen uptake aerobic exercise performance, duration of 60 minutes and frequency of 3 times a week) of aerobic exercise training program, systolic blood pressure reading was lowered by 10.10 mmHg (7.51%).This result indicated that there was statistically significant difference ($P<0.05$) between each sample and experiment. On average, systolic blood pressure reading was significantly lowered by 18.70 mmHg (13.70%) for hypertensive patients throughout the whole aerobic exercise training session. This results tend to indicate that participation in low to moderate intensity of aerobic exercise training sessions significantly affected systolic blood pressures readings by keeping blood vessels flexible and open that help blood to easily move within blood vessels during contraction of the heart (systole). Most importantly from result we can understand that blood pressure continued to decrease as aerobic exercise training continued for another 6 weeks by increasing the flexibility efficiency of blood vessels. This result seems to be in line with that of (Fagard and Comelissen, 2007) reported that regular aerobic exercise program could be considered as a basic therapy for the prevention, treatment and control of blood pressure that resulted in a reduction of SBP by an average of 15.84 mmHg in hypertensive patients. A similar study (padilla,2005) reported that life style modification of which regular aerobic exercise training program had a major contribution in reduction of 12/10 mmHg blood pressure reading in both pre and hypertensive patients .(Hagberg ,2000 and Tipton.2001) also reported that the reduction in blood pressure following regular aerobic exercises

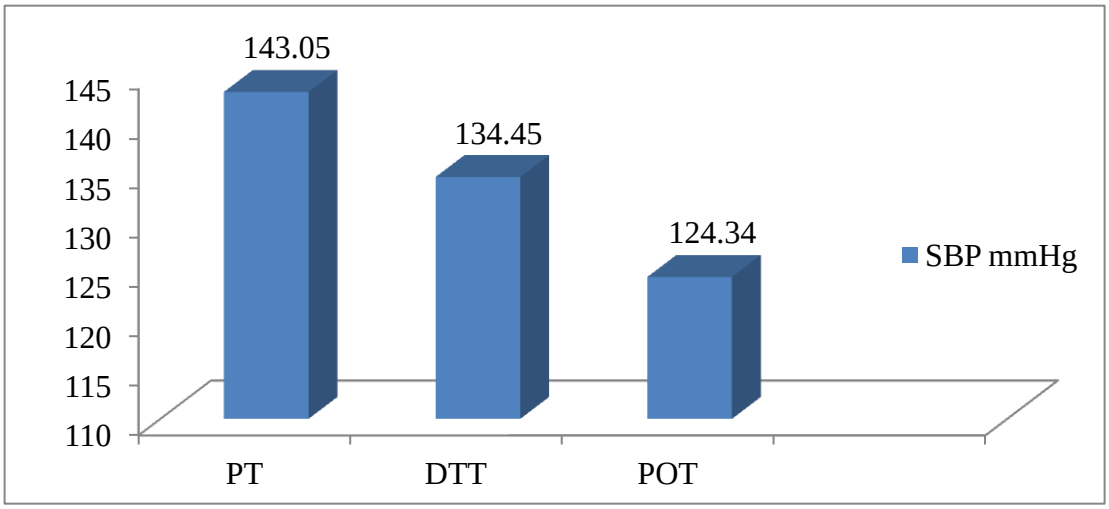
treatment ranges from 5 – 25 mmHg for systolic blood pressure with the average reduction for hypertensive patients to be 11 mmHg systolic blood pressure.

Table 1. Mean effect of aerobic exercise on changes of Systolic blood pressure of hypertensive patients

parameters	**Experiments**				
	N	**PT(X ,±SD)**	**DTT(X, ±SD)**	**PoT(X, ±SD)**	**ΔX(PoT and PT)**	**P**
SBP	15	143.05±5.9698	134.45 ±6.5811	124.34±5.2606	18.70±1.8258	.000

SBP= systolic blood pressure, X=mean value of each tests, ΔX= (MD) mean difference, PT=pre test result, DTT= during training test result PoT= post test results, SD=standard deviation, p=significance level.

Figure.1. Graphical presentation of net weighted change of systolic blood pressure as a result of aerobic exercise.



PT=pre test result, DTT=during training test, PoT=post test results, SBP=systolic blood pressue

4.2. Changes of Diastolic Blood Pressure

Significance differences due to aerobic exercise effects were observed in reduction of diastolic blood pressure (Table 2), as it is indicated in the table the net weighted diastolic blood pressure reading of the hypertensive patients before starting to participate in aerobic exercises training session was 91.42 mmHg, which was out of the average population normative 80 mmHg. However, after the first 6 weeks of low intensity (40% - 50% of net maximal oxygen uptake aerobic exercise performance duration of 60 minutes and frequency of 3 times a week) of aerobic exercise training session , diastolic blood pressure reading was lowered by 4.89 mmHg (5.34%), after the second 6 weeks of moderate intensity (50%-60%) of net maximal oxygen uptake aerobic exercise performance, duration of 60 minutes and frequency of 3 times a week) of aerobic exercise training program, diastolic blood pressure reading was lowered by 5.10 mmHg (5.57%).This result indicated that there was statistically significant difference ($P<0.05$) between each sample and experiment. On average, diastolic blood pressure reading was significantly lowered by 10.00 mmHg (10.93%) for hypertensive patients throughout the whole aerobic exercise training session. This results tend to indicate that participation in low to moderate intensity of aerobic exercise training sessions significantly affected diastolic blood pressures readings by keeping blood vessels flexible and open that help blood to easily move within blood vessels during relaxation of the heart (diastole). Most importantly from result we can understand that blood pressure continued to decrease as aerobic exercise training continued for another 6 weeks by increasing the flexibility and efficiency of blood vessels. This result seems to be in line with that of (Fagard and Comelissen, 2007) reported that regular aerobic exercise program could be considered as a basic therapy for the prevention, treatment and control of blood pressure that resulted in a reduction of DBP by an average of 10.58 mmHg in hypertensive patients. A similar study (Padilla, 2005) reported that life style modification of which regular aerobic exercise training program had a major contribution in reduction of 12/10 mmHg blood pressure reading in both pre and hypertensive patients. (Hagberg, 2000 and Tipton.2001) also reported that the reduction in blood pressure following regular aerobic exercises treatment ranges from 3 – 25 mmHg with the average reduction for hypertensive patients to

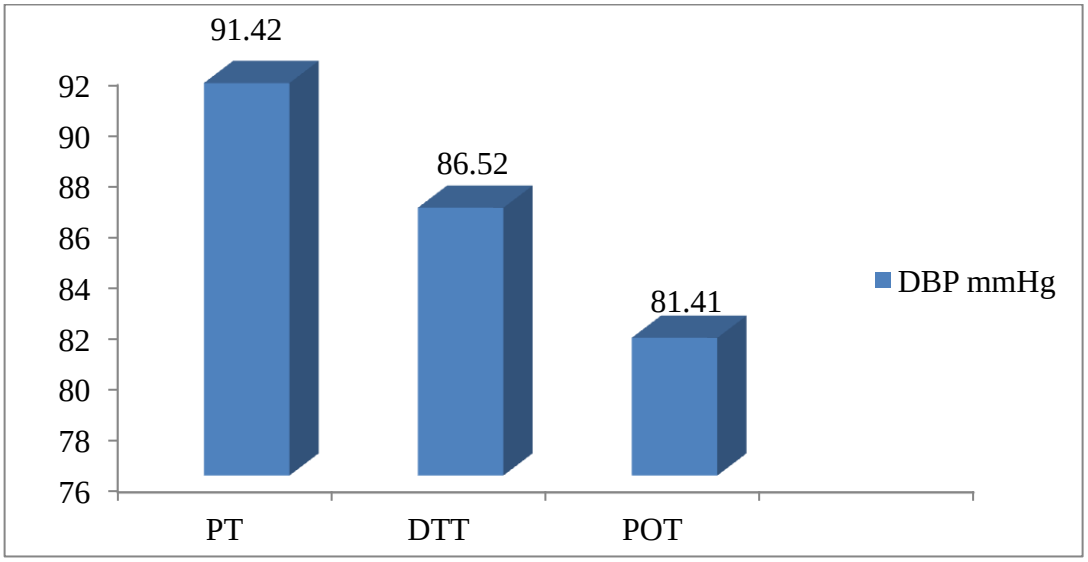
be 8 mmHg for diastolic blood pressure. (Whelton and Chin, 2002) also reported that regular aerobic exercise training sessions resulted in an improvement of cardiovascular endurance, flexibility of joints, strength of the heart and efficiency of the heart and flexibility of the blood vessels which had a major contribution in lowering blood pressure in hypertensive patients.

Table 2. Mean effect of aerobic exercise on changes of Diastolic blood pressure of hypertensive patients

Parameters	**Experiments**				
	N	**PT(X ,±SD)**	**DTT(X, ±SD)**	**PoT(X, ±SD)**	**∆X(PoT and PT)**	**P**
DBP	15	91.42±2.3405	86.52 ±1.7438	81.41±1.0646	10.00±1.7950	.000

DBP= diastolic blood pressure, X=mean value of each tests, ∆X= (MD) mean difference, PT=pre test result, DTT= during training test result, PoT= post test results, SD=standard devation, p=significance level.

Figure 2. Graphical presentation of net weighted change of diastolic blood pressure as a result of aerobic exercise.



PT=pre test result, DTT= during training test, PoT= post test results, DBP=diastolic blood pressure.

4.3. Changes of Body Mass Index

Significant differences due to experiment (aerobic exercise) effects were observed in physiological changes (Table 3). Low to moderate intensity of aerobic exercise training session were significantly affected the physiology of hypertensive patients. Before starting to participate in aerobic exercise training session, the mean weight of the patients was 79.87 kg. However, after the first 6 weeks of low intensity (40% - 50% of net maximal oxygen uptake physical activity performance (VO_2max), duration of 60 minutes and 3 times a week) of aerobic exercise training session , the mean weight of the patients was decreased by 4.06 kg (5.08%) and after the second 6 weeks of moderate intensity (50% - 60% of net maximal oxygen uptake aerobic exercise performance, duration of 60 minutes and frequency of 3 times a week) of aerobic exercise training sessions, the mean weight of the patients was decreased by 3.57 kg (4.46%). Statistically, there was significant difference ($P<0.05$) between each sample and experiment. On average, the mean weight of the patients was

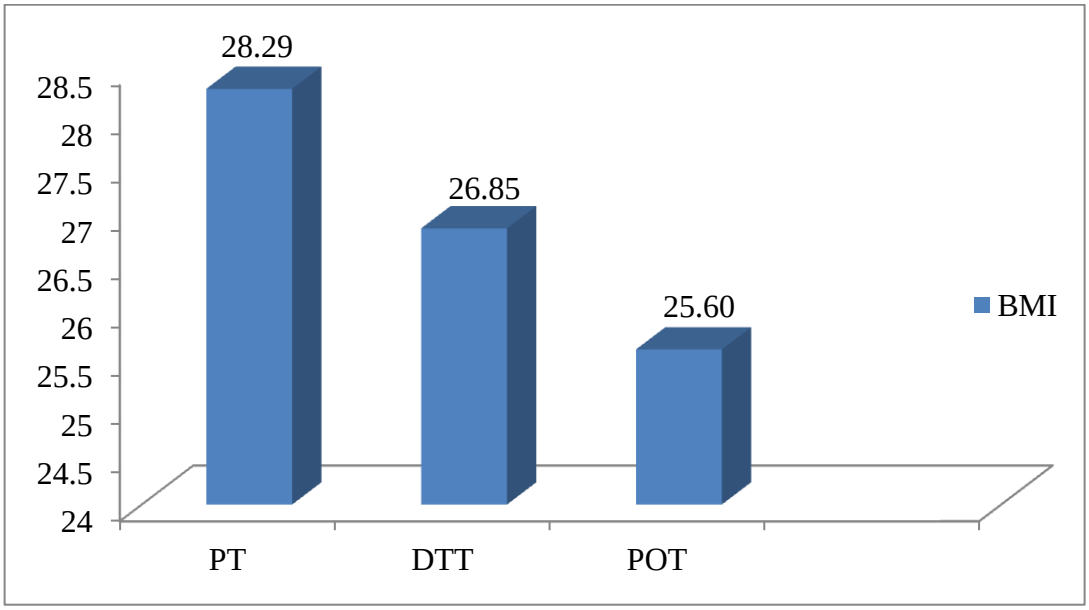
decreased by 7.60 kg (9.51%) throughout the whole training sessions; this result showed that, the loss of body weight due to aerobic exercise training consequence had a major contribution in lowering blood pressure in hypertensive patients. In connection with this (Bray, 1999) reported that overweight and obese individuals who increased regular aerobic exercise training program resulted in loss of 6.5 kg body weight and 2.53 kg/m^2 in body mass index (BMI) which resulted in reduction of blood pressure in hypertensive patients. The body mass index (BMI) which was calculated using the formula weight (kg)/height $(m)^2$ and (graded as per the WHO – International classification of BMI: 18.5 – 24.99 normal, 25 – 29.99 overweight, and ≥ 30 obese) was decreased by 1.44 (5.14%) during the first 6 weeks of low intensity of aerobic exercise training sessions. However, during the second 6 weeks of moderate intensity of aerobic exercise training sessions, the BMI was decreased by 1.25(4.46%). There was statistically significant difference ($P<0.05$) between each sample and experiment. On average, the patient's body mass index was decreased by 2.69 (9.60%) through the whole study period and the patients BMI changed from obese to overweight. This reveals that the flexibility of joints, the strength and efficiency of the heart, improvement of cardiovascular endurance, and reduction of body weight and BMI due to aerobic exercise training had a major contribution in lowering blood pressure in hypertensive patients. This result seems to be in line with that of (Marengo, et *al*., 2004) reported that systole and diastole reduction could be observed following weight and BMI loss , dietary modification and improvement of cardiovascular endurance, flexibility of joints, strength and efficiency of the heart and increased aerobic exercises training. Hence, it is possible that the loss of body weight and BMI as a result of regular aerobic exercises training sessions had a major contribution in lowering blood pressure in hypertensive patients

Table 3. Mean effect of aerobic exercise on changes of weight and BMI of hypertensive patients

parameters	**Experiments**				
	N	**PT(X ,±SD)**	**DTT(X, ±SD)**	**PoT(X, ±SD)**	**ΔX(PoTand PT)**	**P**
Weight (kg)	15	79.87±1.356	75.80±1.265	72.27±1.438	7.60±.910	.000
Height (m)	15	1.68	1.68	1.68	__	.000
BMI	15	28.29±.4797	26.85 ±.4486	25.60±.5080	2.69±.0832	.000

BMI= body mass index, X=mean value of each tests, ΔX=(MD) mean difference, PT=pretest result, DTT= during training PoT= post test results, SD=standard deviation, p=significance level.

Figure 3. Graphical presentation of net weighted change of body mass index as a result of aerobic exercise.



PT=pretest result, DTT= during training test, PoT= post test results,BMI=body mass index.

4.4. Changes of Heart Rate Reading

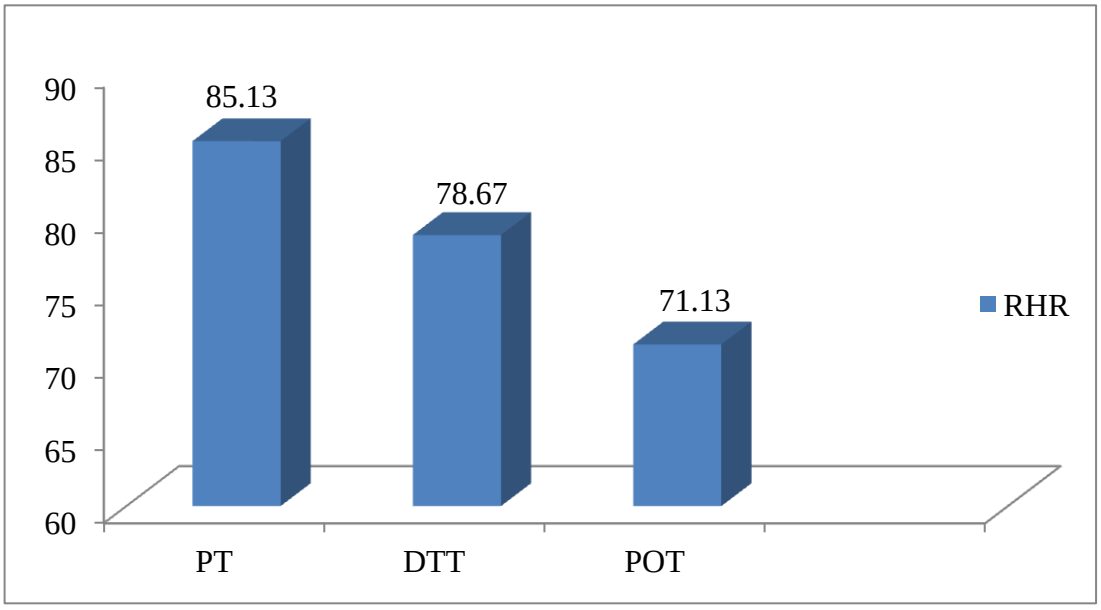
Table 4 showed there was significant decrease in resting heart rate of hypertensive patients for 12 week aerobic exercise program. As indicated in the table the net weighted heart rate reading of the hypertensive patients before starting to participate in aerobic exercise training sessions was 85.13 b/minute. However after the first 6 weeks of low intensity (40% - 50% of net maximal oxygen uptake aerobic exercise performance (VO_2max), duration of 60 minutes and frequency of 3 times a week) of aerobic exercise training session, the mean weight of the patients was decreased by 6.46 b/minute (7.58%) and after the second 6 weeks of moderate intensity (50% - 60% of net maximal oxygen uptake aerobic exercise performance, duration of 60 minutes and frequency of 3 times a week) of aerobic exercise training sessions, the mean weight of the patients was decreased by 7.53 b/minute (8.84%).Statistically, there was significant difference ($P<0.05$) between each sample and experiment. On average, the mean weight of the patients was decreased by 14 b/minute (16.44%) throughout the whole training sessions. This was the result of the aerobic exercise program they were involved in. Therefor it is possible to say that aerobic exercise has positive effect in the reduction of resting heart rate. A study conducted on the effect of twelve week aerobic exercise program on hypertensive patients by Ozcan and Mehmet (2011) showed a significant decrease 5.73% in resting heart rate. The result of a study conducted by Odiango et al., (2010) on effect of aerobic exercise program on physiological variables (heart rate, blood pressure) of hypertensive patients also reported similar results reported in this study. The result of the study showed pupils recorded lower heart rate in the post test as compared to pre test. This was an indication on aerobic exercise program was effective in improving subjects resting heart rate for hypertensive patients.

Table 4. Mean effect of aerobic exercise on changes of resting heart rate reading of hypertensive patients

parameters	Experiments				
	N	**PT(X ,±SD)**	**DTT(X, ±SD)**	**PoT(X, ±SD)**	**ΔX(PoT and PT)**	**P**
RHR	15	85.13±3.420	78.67 ±1.915	71.13±1.302	14.00±2.535	.000

RHR= resting heart rate, X=mean value of each tests, ΔX (MD) mean difference, PT=pre test result, DTT= during training test PoT= post test results, SD=standard deviation, p=significance level.

Figure 4. Graphical presentation of net weighted change resting heart rate reading as a result of aerobic exercise.



PT=pre test result, DTT= during training test , PoT= post test results, RHR=resting heart rate.

5. SUMMARY, CONCLUSION AND RECOMMENDATION

5.1. Summary

Blood pressure is the force exerted on the wall of blood vessels by the blood as a result of contraction of the heart (systole) or relaxation of the heart (diastole). An experimental study on effect of aerobic exercises on selected physiological variables (blood pressure, body mass index and resting heart rate) in hypertensive patients was conducted in Motta town for three consecutive months of aerobic exercise training sessions. The modes of exercise for the treatment of hypertension was cardiovascular mode, for duration of 60 minutes, frequency of 3 days per week , at intensity of low to moderate, 40 – 60% of net maximal oxygen uptake aerobic exercise performance (VO_2 max). A total of 15 male hypertensive patients were involved in the study. The objectives were to demonstrate the overall effect of aerobic exercise on selected physiological variables such as in lowering systolic and diastolic blood pressure, body mass index and resting heart rate in hypertensive patients after a consecutive three months of training sessions and suggested possible hypertension management options for the sustainable utilization. Data were collected through measurements of blood pressure (systolic and diastolic), body mass index and heart rate of the patients. Finally all the data collected were analyzed by using statistical packages of social science (SPSS) version 20.

To meet the objective of the study, systolic and diastolic blood pressure, body mass index and heart rate were measured three times (before training, in between training and after training) from hypertensive patients selected to be representative of the study population. However, blood pressure, body mass index and heart rate readings (measurements) were collected and analyzed for their reduction through out the whole study period.

5.2. Conclusion

The results of the current study revealed that, participation of regular aerobic exercise training resulted in weighted net decrease of body mass index by 2.69. Similarly, systolic, diastolic and heart rate readings were resulted in weighted net reduction by 18.70 mmHg, 10.00 mmHg, and 14 b/minute, respectively.

Generally to lower and manage blood pressure, body weight and heart rate reading in hypertensive patients and maintain and improved health conditions of the patients, it is essential for hypertensive patients to actively participate in regular aerobic exercise training sessions with a mean intensity of 50% VO_2 max, frequency of 3 times per week and duration of 60 minutes.

5.3. Recommendation

The following recommendations are suggested based on the results of the study

- Health workers and health care professionals should play an important role in helping hypertensive patients to achieve blood pressure control by influencing and reinforcing regular aerobic exercise training with appropriate intensity, frequency, time and type of aerobic activities.

- For primary prevention of hypertension, the ministry of health and other stakeholders should reinforce the concept of aerobic exercise and look for the implementation of low to moderate intensity of aerobic exercise training program for most, Preferably all, days of the week to lower blood pressure, body mass index and resting heart rate for hypertensive patients.

- Hypertensive patients should actively participate in regular aerobic activities training program for 3 times per week duration of 60 minutes per session at intensity of low to modeerate , 40 – 60% of net maximal oxygen uptake (VO_2 max) aerobic exercise performance in order to achieve reduction of systolic and diastolic blood pressure, body mass index and heart rate reading for hypertensive patients.

6. REFERENCES

ACSM, exercise heart rate and hypertension: *Med. Sci. Sports Exerc* 120:184–198,2000.

Alpert**,** B. S., J. H. Wilmore. Physical activity and blood pressure in adolescents. *Pediatr. Exerc. Sci.* 8:361–380, 2002.

American college of sport medicine, 2004, physical activity, physical fitness and hypertension medicine sports science exercise. 25(10); s-x

American College Of Sports Medicine. Position stand: exercise for patients with coronary artery disease. *Med. Sci. Sports Exerc.* 26:i–v, 2002.

American College Of Sports Medicine. Position stand: physical activity, physical fitness, and hypertension. *Med. Sci. Sports Exerc.* 25:i–x, 2004.

American Heart Association,2004. Resting Heart Rate and hypertension. 63: 137 - 142

Blumenthal, J. A., A. Boreham ,Sherwood, E. C. Gullette, et al. Exercise and weight loss reduce blood pressure in men and women with mild hypertension: effects on cardiovascular, metabolic and hemodynamic functioning. *Arch. Intern. Med.* 160:1947–1958,2002.

Booth, F.W.,C.C.Carlson,and M.T.Hamilton,2005.Moderate cronic disease prevention through exercise.*Journal of Applied physiology*.88(2):774 - 784

Bray, G.A., 1999. Health hazards of overweight and obesity. *Journal of Endocrinology and Metabolism clinics of north America*.87: 274 - 284

British *Journal of Anaesthesia* 2004

Bruce, R.A., 2008.Exercise testing of patients with coronary heart disease. Principles and normal standards for evaluation. Annals of Clinic Research.3: 323 - 332

Chen, C. Y., P. A. Munch, A. W. Quail, And A. C. Bonham. Postexercise hypotension in conscious SHR is attenuated by blockade of substance P receptors in NTS. *Am. J. Physiol. Heart Circ. Physiol*. 283:H1856–H1862, 2002.

Chobanian, A.V., G.L. Bakris, and H.R.Black,2003. Seventh report of the joint national committee on prevention, Detection, Evaluation, and Treatment of High Blood Pressure.*Journal of Hypertension* .42 (6): 1206 - 52

Dickinson, H.O., J.M. Mason, and D.J. Nicolson, 2006. Lifestyle intervensins toreduce raised blood pressure: a systematic review of randomized controlled trials. *Journal of Hypertension*.24 (2): 215 -33.

Dinenno, F. A., P. P. Jones, D. R. Seals, And H. Tanaka. Age-associated arterial wall thickening is related to elevations in sympathetic activity in healthy humans. *Am. J. Physiol. Heart Circ. Physiol.* 278:H1205–H1210, 2000.

Edwards, M.A., 2006.Effect of physical activities training on heart rate Level of hypertensive patients. Medicine and Sciense in sport. 6: 14 -19

Fagard, R. H., and V.A . cornelissen, 2007. Effect of physical activity on blood pressure control in hypertensive patients. *European Journal of Cardio. Prev. and Rehab*. 14: 12 - 17

Fagard, R. H., K. Pardaens, J. A. Staessen, and L. THIJS. Should exercise blood pressure be measured in clinical practice? *J. Hypertens.* 16:1215–1217, 1998.

Hagberg, J. M., R. E. Ferrell, D. R. Dengel, And K. R. Wilund. Exercise training-induced blood pressure and plasma lipid improvements in hypertensives may be genotype dependent. *Hypertens.* 34:18–23, 1999.

Hagberg, J.M., J.J. Park, and M.D. Brown, 2000. The role of physical activity training in the treatment of hypertension .An update. sports Medicine.30 (3): 193 - 206 .

Halbert, J., C.A. Silages, P.Finucane, P.A. Hamdorf, and G.R. Andrews, 2007. The effectiveness of exercise training in lowering blood pressure: a meta-analysis of randomized controlled trials of 4 weeks. *Journal of Human Hypertension*.11: 641 - 649

http://www.newellness.com/physfitn/benaero.htm Accessed on October 25(2012)

Ishikawa-Takata, K., T. Ohta, And H. Tanaka. How much exercise is required to reduce blood pressure in essential hypertensives: a dose-response study. *Am. J. Hypertens.* 16:629–633, 2003.

Jakicic, J. M., K. Clark, E. Coleman, American College of Sports Medicine position stand: appropriate intervention strategies for weight loss and prevention of weight regain for adults. *Med. Sci. Sports Exerc.* 33:2145–2156, 2001.

Jennings, G. L., G. Deakin, P. Korner, I. Meredith, B. Kingwell, and L. Nelson. What is the dose-response relationship between exercise training and blood pressure? *Ann. Med.* 23: 313–318, 1998

karvonen, M., K. Kentala, and O. Musstala, 1997. The effect of training on heart rate: A longitudinal study. Annals of Medicine Expert Biol Fen. 35: 307 -325

Kathleen, K., 2006. Understanding the Benefits of Aerobic Exercise .The New England Wellness web

Marengo, N.C., J. Tuomilehto, T.A. Lakka, A. Nissinen and P. Jousilahti, 2004. Relationship of physical activity and bodymass index to the risk of hypertension: prospective study in Finland. Journal of Hypertension. 43(1): 25 - 30

Ozcan, S. and M. A. Ozturk, 2011 The Effect of twelve week aerobic exercise programme on health related physical fitness components and blood lipids in obese girls. Academic Journals,5 (12):1441-1445

Padilla, J., J.P. Wallace, and S. Park, 2005. Accumulation of physical activity reduce blood pressure in pre-and hypertension. Medicine Sports Exercise. 37(8):1264-75

Posner, J.D, K.M. Gorman, L. Windsor-Landsberg, 2002. Low to moderate intensity physical activity training in healthy older adults:physiological responses after four months. *Journal of American Geriatr Soc*. 40: 1- 7

Roman, O., A.L. Villalon and C. Klenner, 2009. physical activity training program in arterial hypertension: A long-term prospective follow-up. Cardiology. 67: 230 - 243

Shemelis M., 2011. A study of the Effect of Moderate Intensity and Duration of Aerobic Exercise on Weight loss in Overweight Women Andhra University, India

Thomas, D.F., M.I Paul and T.R. Walton, 2008. FIT and WELL 8th Edition

Tipton, C.M., 2001. ptysical activities training and hypertension. Sport Science Review. 12: 254 - 306

Whelton, S.P., and A. Chin, 2002. Effect of aerobic exercise on blood pressure: a meta-analysis of randomized, controlled trials. Annals of internal Medicine.136(7):493 - 503

WHO,2003 Global strategy on Diet, Physical activity and Health. http:/www.who.int/dietphy sicalactivity/media/en/gsfs pa. Accessed on October 20(2012

World Health Report, 2009, http://www.who.int/whr/2002

7. APPENDICES

Appendix - A

PARTICIPANT INFORMATION SHEET AND INFORMED VOLUNTARY CONSENT FORM FOR PRE HYPERTENSIVE

My name is ---------- I am working a data collector for the study being conducted in this community by Addis Abebayehu who is studying for his master's degree at Haramaya University, the college of sport science academy. I kindly request you to lend me your attention to explain you about the study and your institution being selected as the study setting.

1. Title: Effect of Aerobic Exercises on selected physiological variables for people with hypertension in Motta town, East Gojjam, Amhara regional state**.**

2. Purpose of the study:

The purpose of this research study to investigate the effects of Aerobic Exercise on selected physiological variables for people with hypertension lowering blood pressure, improve resting heart rate and body mass index in hypertensive patients subjected to consecutive aerobic exercise session and to fulfill the requirements of Med. thesis research.

3. Procedure and duration

Your involvement will last for 60 minutes exercise per session, three days per week for 12 weeks. You will not any supplement you also participate in physical performance tests in three phases, at the beginning, after 6 week training and final test at the end of 12 week training. You will receive all the current standard care for your health.

4. Risks and Benefits:

The risk of being participating in this study is very minimal. In fact muscle strain, sprain and injuries may occur if proper worming up, gradual progression and safety procedures are not followed .there are benefits for participating in this study such as you will get your current ability concerning with the measured variables. Moreover, it is hoped that ,in the future ,the society will be beneficial from this study by understanding the effects of aerobic

exercise on selected physiological variables for people with hypertension and adjusting life style in doing their daily routine .

5. Confidentiality

Information of your participation in this research project will be kept confidential. Records pertaining to this research will be coded secretly in numbers and put in a secured storage area. Results will be reported in such a way that you cannot be identified. The findings of the study will be general for the study community and will not reflect any thing particular of individual.

6. Rights:

If you agree to participate in this study your participation should be voluntary. If not you will have full right to declare not to take part at all. You also will have the right to stop participating at any time. If you decide not to take part, or if you stop participating at any time, your decision will not result in any penalty or loss of benefits which you otherwise are entitled.

7. Contact address

If you have any questions or enquiries any time about this research project or procedures, please Contact:

Institutional Research Ethics Review Committee (IRERC) Tel. No. 0 256 661 899

Abinet Ayalew (PhD) (Advisor) +251 911 827 322
Email. amenab2012@yahoo.com
Wegene Waltenegus (PhD) (Co Advisor) +251 923 670 360
Addis Abebayehu (Investigator) Tell No. +251 918 745 890
Email. addisabebayehu1234@gmail .com

8. Declaration of informed voluntary consent

I have read the participant information sheet. I have clearly understand the purpose, procedures, risk and benefits of the research as well as issues of confidentiality, the rights of participating and the contact address for any inquires. I have been given the opportunity

to ask questions for things that may have been unclear. I will inform that I have the right to withdraw from the study at any time or not to answer any question or not to do things that I do not want. Therefore, I declare my voluntary consent to participate in this study with my signature bellow.

Signature of participants_____

Signature of data collector_____

Appendix - B

INFORMATION SHEET AND INFORMED VOLUNTARY CONSENT FORM FOR HEAD OF INSTITUTION FOR MOTTA HOSPITAL

My name is ---------- I am working a data collector for the study being conducted in this community by Addis Abebayehu who is studying for his master's degree at Haramaya University, the college of sport science academy. I kindly request you to lend me your attention to explain you about the study and your institution being selected as the study setting.

1. Title: Effect of Aerobic Exercises on selected physiological variables for people with hypertension in Motta town, East Gojjam, Amhara regional state.

2. Purpose of the study:

The purpose of this research study to investigate the effects of Aerobic Exercise on selected physiological variables for people with hypertension lowering blood pressure, improve resting heart rate and body mass index in hypertensive patients subjected to consecutive aerobic exercise session and to fulfill the requirements of Master of teaching in physical education thesis research.

3. Procedure and duration

Your involvement will last for 60 minutes exercise per session, three days per week for 12 weeks. You will not any supplement you also participate in physical performance tests in three phases, at the beginning, after 6 week training and final test at the end of 12 week training. You will receive all the current standard care for your health.

4. Risks and Benefits:

The risk of being participating in this study is very minimal. In fact injuries may occur such as muscle strain, sprain and joint dislocation. But to prevent these injuries by proper worming up, gradual progression and follow safety procedures .there are benefits for participating in this study such as you will get your current ability concerning with the measured variables. Moreover, it is hoped that, in the future, the society will be beneficial

from this study by understanding the effects of aerobic exercise on selected physiological variables for people with hypertension and adjusting life style in doing their daily routine.

5. Confidentiality

Information of your participation in this research project will be kept confidential. Records pertaining to this research will be coded secretly in numbers and put in a secured storage area. Results will be reported in such a way that you cannot be identified. The findings of the study will be general for the study community and will not reflect any thing particular of individual.

6. Rights:

If you agree to participate in this study your participation should be voluntary. If not you will have full right to declare not to take part at all. You also will have the right to stop participating at any time. If you decide not to take part, or if you stop participating at any time, your decision will not result in any penalty or loss of benefits which you otherwise are entitled.

7. Contact address

If you have any questions or enquiries any time about this research project or procedures, please Contact:

Institutional Research Ethics Review Committee (IRERC) Tel. No. 0 254 662 011

P.O.Box 235, Harar, Ethiopia

Abinet Ayalew (PhD) (Advisor) +251 911 827 322
Email. amenab2012@yahoo.com
Wegene Waltenegus (PhD) (Co Advisor) +251 923 670 360
Addis Abebayehu (Investigator) Tell No. +251 918 745 890
Email. addisabebayehu1234@gmail .com

8. Declaration of informed voluntary consent

I have read the participant information sheet. I have clearly understand the purpose, procedures, risk and benefits of the research as well as issues of confidentiality, the rights of participating and the contact address for any inquires. I have been given the opportunity

to ask questions for things that may have been unclear. I will inform that I have the right to withdraw from the study at any time or not to answer any question or not to do things that I do not want. Therefore, I declare my voluntary consent to participate in this study with my signature bellow.

Signature of participants_____

Signature of data collector_____

Appendix - C

Information record forum

Health history and physical readiness questionnaire of the participants

For most people physical activity should not pose any problems or hazard. This physical readiness questionnaire (PAR-Q) has been designed to identify the small number of adults for whom physical activity might be in appropriate or those who should have medical advice concerning the type of activity most suitable for them .In order to identify hypertensive patients from Motta town, filling all questions presented below will be vital for future progress.

For Participants: please read the following question carefully and indicate your correct response to each question by encircling it on the choice letter given.

1. Name_____

   Age_____

   Sex_____

   Educational level_____

   Place of work_____

2. Do you have any other health problems other than hypertension? (A) Yes (B) No

   If your answer is yes, mention_____

   _____

4. For how many years you are diagnosed with hypertension?

   A. One year B. Two year C. Three years D. Four years

5. Is there any exercise recommended to you by your medical doctor?

   A. Yes B. No

6. Do you have a recent physical injury such as bone, muscle and joint which will be aggravated by physical exercise?

A. Yes B. No

If yes indicate the type of injury that you had_____

7. Do you have suffered with heart condition?

A. Yes B. No

8. Do you have any of the following risk for heart disease: for example High blood pressure, High blood cholesterol and any close relatives (father, mother, brother etc.?)

A. Yes B. No

9. Have you ever felt pain in your chest when you do physical exercise?

A. Yes B. No

10. Have you ever suffered from shortness of breath at rest or with mild exercise?

A. Yes B. No

11. Is there any history of Coronary Heart Disease within your family?

A. Yes B. No

12. Do you ever feel feint, have spells of dizziness or have you ever lost consciousness?

A. Yes B. No

13. Do you currently smoke?

A. Yes B. No

14. Do you currently exercise regularly (at least 2 times per week) and/or work in a job that is Physically demanding.

A. Yes B. No

Client's full Name: _____ Trainer's Name_____

Client's Signature: _____ Trainer's Signature_____

Date: _____ Date:_____

Source: Barnes fitness.co.uk

Appendix – D

Table of Paired sample T test Mean effect of aerobic exercise

Appendix table 1. Paired Samples Test for Mean effect of aerobic exercise on change of systolic blood pressure of hypertensive patients

		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PT – DTT	8.60200	1.13855	.29397	7.97149	9.23251	29.261	14	.000
Pair 2	DTT– POT	10.10133	2.43955	.62989	8.75036	11.45231	16.037	14	.000
Pair 3	PT – POT	18.70333	1.82585	.47143	17.69221	19.71445	39.673	14	.000

Appendix Table 2. Paired Samples Test for Mean effect of aerobic on change of diastolic blood pressure of hypertensive patients

		Paired Differences					T	Df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PT – DT	4.89933	1.18230	.30527	4.24460	5.55407	16.049	14	.000
Pair 2	DT – POT	5.10467	1.16419	.30059	4.45996	5.74937	16.982	14	.000
Pair 3	PT – POT	10.00400	1.79501	.46347	9.00996	10.99804	21.585	14	.000

Appendix Table 3. Paired Samples Test for Mean effect of aerobic on change of body mass index of hypertensive patients

		Paired Differences					t	Df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PT – DT	1.44133	.24756	.06392	1.30424	1.57843	22.550	14	.000
Pair 2	DT – POT	1.25000	.26145	.06751	1.10521	1.39479	18.517	14	.000
Pair 3	PT – POT	2.69133	.32238	.08324	2.51281	2.86986	32.333	14	.000

Appendix Table 4. Paired Samples Test for Mean effect of aerobic on change of resting heart rate of hypertensive patients

		Paired Differences					T	Df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	PT - DT	6.467	1.807	.467	5.466	7.468	13.857	14	.000
Pair 2	DT – POT	7.533	.915	.236	7.026	8.040	31.870	14	.000
Pair 3	PT – POT	14.000	2.535	.655	12.596	15.404	21.385	14	.000

Appendix Table 5. Paired Samples Test for Mean effect of aerobic on change of body weight of hypertensive patients

		Paired Differences					T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pre test - During test	4.067	.704	.182	3.677	4.456	22.381	14	.000
Pair 2	During test - post test	3.533	.743	.192	3.122	3.945	18.412	14	.000
Pair 3	Pre test - post test	7.600	.910	.235	7.096	8.104	32.337	14	.000

Appendix - E

Daily Training Schedule of Three Month.

Appendix Table 6. Daily training schedule of Week One and Week Two

Day	Type of exercise	Week One			Week Two			
		Duration 60 minute	Set	Rest	Duration 60 minute	. Set	Rest	Intensity
Tu	Warming up Aerobic dance Jogging Rope jumping Cooling down Stretching	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	Low (55 - 60%)
Thr	Warming up Aerobic dance Jogging Rope jumping Cooling down Stretching	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	Low (55 - 60%)
Sat	Warming up Aerobic dance Jogging Rope jumping Cooling down Stretching	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	Low (55 - 60%)

Appendix Table 7. Daily training schedule of Week Three and Week Four

Day	Type of exercise	Week Three			Week Four			
		Duration 60 minute	Set	Rest	Duration 60 minute	Set	Rest	Intensity
Tu	Warming up Aerobic dance Jogging Rope jumping Cooling down Stretching	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	Low (55 - 60%)
Thr	Warming up Aerobic dance Jogging Rope jumping Cooling down Stretching	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	Low (55 - 60%)
Sat	Warming up Aerobic dance Jogging Rope jumping Cooling down Stretching	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	Low (55 - 60%)

Appendix Table 8. Daily training schedule of Week Five and Week Six

Day	Type of exercise	Week Five			Week Six			
		Duration 60 minute	Set	Rest	Duration 60 minute	Set	Rest	Intensity
Tu	Warming up Aerobic dance Jogging Rope jumping Cooling down Stretching	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	Low (55 - 60%)
Thr	Warming up Aerobic dance Jogging Rope jumping Cooling down Stretching	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	Low (55 - 60%)
Sat	Warming up Aerobic dance Jogging Rope jumping Cooling down Stretching	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	Low (55 - 60%)

Appendix Table 9. Daily training schedule of Week Seven and Week Eight

Day	Type of exercise	Week Seven			Week Eight			
		Duration 60 minute	Set	Rest	Duration 60 minute	Set	Rest	Intensity
Tu	Warming up Aerobic dance Jogging Rope jumping Cooling down Stretching	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	Moderate (60 - 70%)
Thr	Warming up Aerobic dance Jogging Rope jumping Cooling down Stretching	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	Moderate (60 - 70%)
Sat	Warming up Aerobic dance Jogging Rope jumping Cooling down Stretching	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	Moderate (60 - 70%)

Appendix Table 10. Daily training schedule of Week Nine and Week Ten

Day	Type of exercise	Week Nine			Week Ten			
		Duration 60 minute	Set	Rest	Duration 60 minute	Set	Rest	Inte .
Tu	Warming up Aerobic dance Jogging Rope jumping Cooling down Stretching	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	Moderate (60 - 70%)
Thr	Warming up Aerobic dance Jogging Rope jumping Cooling down Stretching	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	Moderate (60 - 70%)
Sat	Warming up Aerobic dance Jogging Rope jumping Cooling down Stretching	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	Moderate (60 - 70%)

Appendix Table 11. Daily training schedule of week Eleven and Week Twelve

Day	Type of exercise	Week Eleven			Week Twelve			
		Duration 60 minute	Set	Rest	Duration 60 minute	Set	Rest	Intensity
Tu	Warming up Aerobic dance Jogging Rope jumping Cooling down Stretching	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	Moderate (60 - 70%)
Thr	Warming up Aerobic dance Jogging Rope jumping Cooling down Stretching	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	Moderate (60 - 70%)
Sat	Warming up Aerobic dance Jogging Rope jumping Cooling down Stretching	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	10 min 4 min 4 min 2 min 10 min 4min	4X3 4X4 2X4	30 seconds Active rest b/n each set	Moderate (60 - 70%)

Appendix – F

Record sheet for pre, during and post training tests

Test code_____

No	Name of participants	Measurement (unit)	PT	DT	POT
EG-1					
EG-2					
EG-3					
EG-4					
EG-5					
EG-6					
EG-7					
EG-8					
EG-9					
EG-10					
EG-11					
EG-12					
EG-13					
EG-14					
EG-15					

Appendix - G

Test protocol (Norms)

Standard value of body mass index (BMI) IN kg/m2

BMI(kg/m2)	Classification
< 18.5	Under weight
18.5 -24.9	Healthy
25.0 - 29.9	Over weight
30.0 - 39.9	Obesity

Source: (ACSM, 2008)

Standard value of systolic blood pressure

Below or equal 120 mm Hg	Normal blood pressure
Between 120 - 139 mm Hg	Pre hypertension
Between 140 - 159 mm Hg	Stage 1 hypertension
160 mm Hg or higher	Stage 2 hypertension

Source: (WHO, 2004),

Standard value of diastolic blood pressure

Below or equal 80 mm Hg	Normal blood pressure
Between 80 - 89 mm Hg	Pre hypertension
Between 90 - 99 mm Hg	Stage 1 hypertension
100 mm Hg or higher	Stage 2 hypertension

Source: (WHO, 2002)

Appendix - H

Figure 1. Map of the study site

Source: http://scontent-amt2-1.xx.fbcdn.net