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EFFECT OF 12 WEEKS AEROBIC EXERCISE ON SELECTED PHYSIOLOGICAL VARIABLES FOR PEOPLE WITH HYPERTENSION IN D/MARKOS TOWN EAST GOJJAM, AMHARA REGIONAL STAT

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By

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JANUARY/2021

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APROVAL PAGE

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As thesis research advisor, I certify that I have read and evaluated this thesis entitled “The effect of 12 weeks Aerobic exercise on selected physiological variables for people with hypertension in Debre Markos town, East Gojjam Zone, Amhara regional state.” prepared under I guidance by Birhan Haimanot. I recommended that to be submitted as fulfilling the thesis requirement.

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As members of the board, examiners of the MED thesis open defense, we certify that we have read and evaluated the thesis prepared by Birhan Haimanot and examined the candidate. We recommended that the thesis to be accepted as fulfilling the thesis requirement for the degree of master of teaching in physical education.

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Name of Internal Examiner Signature Date

3_____ _____ _____

Name of chairman Signature Date

DEDICATION

This thesis is dedicated to all mothers that learn with child developmentary.

DECLARATION

I, the under signed declare that this thesis is the result of my own work, all sources and materials used for this thesis have been appropriately acknowledged. This thesis is submitted in partial fulfillment of the requirement for degree of master of education in teaching physical education.

I confidentially declare that this thesis has not been submitted by any scholar to any other institution or university for the award of any academic degree or diploma.

Ms. Birhan Haimanot

Place: Bahir Dar University

Signature _____

Date _____

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ABSTRACT

The primary purpose of this study was to investigate the effect of 12 weeks aerobic exercise on selected physiological variables for people with hypertension in Debre Markos town. A Subject of 17 male Debre Markos town community hypertensive patients diagnosed with hypertension more than a year were purposively selected from those hypertensive patients visited the primary care center for their monthly regular follow. Patients whose systolic blood pressure reading <140 mmHg, and diastolic blood pressure reading <89 mmHg and heat rate reading < 100 b/minute were included in the study and their age range were 36-42 years. All Selected subjects were participated in low to moderate intensity of aerobic exercise for 12 consecutive weeks, i.e., 3 days per week 30- 60-minute duration per day. Pre 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 23 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 1.647 mmHg (P<0.05), diastolic blood pressure by .412 mmHg (P<0.05), body mass index by 0.7471 (P<0.05) and resting heart rate by1.294 b/minute (P<0.05). 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. So all hypothesizes was accepts in this study. 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.

Table of Contents

LIST OF TABLES

LIST OF TABLE IN APPENDIXES

LIST OF FIGURE

LIST OF FIGURES IN THE APPENDIXES

ABBREVIATIONS

ACSM	American College of Sport Medicine
BMI	Body Mass Index
BP	Blood Pressure
CVD	Cardio Vascular Disease
DBP	Diastolic Blood Pressure
EG	Experimental Group
HTN	Hypertension
MmHg	Millimeter mercury
ME	Ministry of Education
PT	Post Test
PT	Pre Test
RHR	Resting Heart Rate
SBP	Systolic Blood Pressure
WHO	World Health Organization

CHAPTER- ONE

INTRODUCTION

1.1. Background of the Study

Hypertension is an important determinant of the incidence of coronary heart disease stroke congestive heart failure renal failure and peripheral vascular disease. Both the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of Blood Pressure and the World Health Organization recommend regular aerobic exercise as part of an initial lifestyle modification for patients with essential hypertension (Tanaka et al., 2003).

The heart rate measures the number of times the heart beats per minute. There is recommended maximum heart rate that varies depending on the age of the individual. It is not only the speed of the heart rate that is important. The rhythm of the heart beat is also crucial, and an irregular heartbeat can be a sign of a serious health condition. One in every for four deaths in the United States occurs as a result of heart disease. Monitoring your heart rate can help prevent heart complication (Ismail, 2018).

The body mass is a measure of relative weight based on an individual's mass and height. Nowadays the BMI is commonly is commonly used to classify underweight, overweight and obesity. Moreover, it is adopted by the British government in an effort to promote healthy eating. (Nuttall, 2015)

Aerobic activity can be effective way to control blood pressure, but flexibility and strengthening exercise such as weight lifting are also important Portions of a general Mayo-based fitness plan for medical education and research MFMER (1998-2019).

Regular physical exercise reduces blood pressure and is a broadly recommended by current American and European hypertension guide line (Dimeo et al., 2012).Hypertensive's are encouraged to "engage in aerobic exercise on a regular basis, such as walking, jogging, or swimming for 30-45 minutes daily (Telles & Nagarathna , 1994). In normotensives, regular

exercise reduces systolic blood pressure by 3 to 5 mmHg and diastolic blood pressure by 2 to 3 mmHg (Cornelissen & Fagard, 2005). In hypertensive patients this effect is even more pronounced; a recent meta-analysis indicated a mean reduction of 7 mmHg systolic and 5 mmHg diastolic. However, to date there are no trials on the effect of exercise on resistant hypertension. Resistant hypertension is a common problem faced by both primary care physicians and specialists, while the exact prevalence of resistance hypertension is unknown. Clinical studies suggest that it is not uncommon for perhaps 20 to 30 of the patients in the study to be involved in (Caihoun et al., 2008).

As the global prevalence of high blood pressure continues to rise, primary prevention of high blood pressure has become a major global public health initiative. Physical activity is commonly recommended as a major lifestyle modification that can help prevent hypertension. Recent epidemiological evidence has shown a consistent time and dose-dependent relationship between physical activity and the development of high blood pressure. Experimental evidence from interventional studies has further confirmed a relationship between physical activity and hypertension. As the favorable effect of exercise on blood pressure reduction have been well characterized in recent years. Despite the available evidence strongly supporting the role of physical activity in the prevention of hypertension, many unanswered questions about the protective benefits of physical activity in high- risk people factor that may moderate the relationship between the physical activity and hypertension, and the optima prescription for hypertension prevention remain. They would review the most recent evidences for the role of physical activity in the prevention of hypertension of and discuss recent studies that have sought to address these unanswered questions (Keith & Daichi, 2014).

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 wellbeing, 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 (Rosser, 2001).

Adequate regular daily physical activity is an important component in preventing chronic diseases along with a healthy diet and not smoking. For people it is a powerful means of preventing chronic diseases for nations, it can provide a cost-effective way to improve public health throughout the population. Available experience and scientific evidence show that regular physical activity provides both men and women 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 (Medicine, 2002).

Lifestyle changes and modifications can lower blood pressure and lower the risk of health complications. Life changes include weight loss, physical exercise, decreased salt intake, reduced alcohol intake, and a healthy diet in this sense, physical activity is recommended for hypertensive patient as part of lifestyle modification (WHO, 2003).

Ability to live in the home or on the farm or in the office or factory in any ministry, disease freedom means sufficient strength endurance and other skills to meet the demands of daily life. 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, 2010).

The researchers said the most effect of modality to increase aerobic capacity and the blood pressure. The fact that the evidence shows that involve endurance activities such as walking, jogging, running or cycling coupe with resistance training can help prevent the development of hypertension and lower blood pressure in adults but the most recent evidence for the Role of

Physical activity in Preventing High Blood Pressure and Discussing Recent Studies That Have Tried to Answer These Unanswered Questions. In Ethiopia very few research was done on the area 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 there is no research was done in Debre Markos town on effect of aerobic exercise on selected physiological variables for people living with hypertension.

After recent years in Ethiopia, because of sedentary life style most people are attached by chronic disease such as; coronary heart disease, hypertension, diabetes and some other upcoming disease because of the awareness of peoples is low about benefits of regular physical exercise for their health. So, in Debre Markos town people are living in sedentary life style due to poor culture of having regular physical exercise. That was to initiate to conduct the research in this place.

By considering the above facts researcher objectives of this study was discovered the effect of aerobic exercise on selected physiological variables, helps the individuals with hypertension to incorporate aerobic exercise in their training program, and thus the researcher assumes that there were be a statistical significance between pre and post-test of selected physiological variables: systolic blood pressure, diastolic blood pressure, body mass index and resting heart rate traits among aerobic exercise.

1.2. Statement of the Problem

Health is one of interest to economists, first because it is an important element of wellbeing, and second because it is a component of human capital, and as such is of major importance for growth and development. In poor countries, where physical jobs tend to be more abundant, health may be more important than education in determining labor productivity (Ayal., 2002).

A physically active population is a healthier population, improving the productivity of the work force and increasing economic output. Sport and physical activity also provide one of the most cost effective forms of preventive medicine, with the potential to cut health care costs dramatically. Even though involving in some forms of exercise, no matter how little or how much, is fine, it will be better if it is carried out in a correct manner. Physical activity is an

essential component strategy that aims to seriously address the problems of sedentary living and obesity among children and adult (UN, 2003).

Physical exercise is important for the development of all physical fitness, but very little research has been done on the effectiveness of aerobic exercise in improving cardiovascular endurance, muscular endurance, muscular strength, body composition and flexibility, and neither has no investigation has been conducted. In Ethiopia, especially in the city of Debre Markos, on the effect of 12 weeks aerobic exercise on hypertension, body mass index and resting heart rate. Today in our country Ethiopia, due to the sedentary lifestyle, most of the people are attacked by chronic diseases such as; coronary heart disease, hypertension, diabetes and some other future illnesses.

In Debre Markos 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 becomes interested to conduct in this place. From this standing point of views the research investigates the effects of 12 weeks aerobic exercises on selected physiological variables of systolic BP, diastolic BP, resting heart rate and BMI (Body Mass Index) for people with hypertension. According to many research studies, physical inactivity is one of the causes of the development of chronic diseases and poor fitness. Similarly, in Debre Markos town most people are poor culture for participation of regular physical exercise. With this in mind this research project was to find out the "effects of 12 week aerobic exercise on selected physiological variables for people with hypertension.

1.3. Hypotheses

This study has the following hypotheses:

1. 12 weeks of aerobic exercise has significant effect on systolic blood pressure for people with hypertension.
2. 12 weeks of aerobic exercise has significant effect on diastolic blood pressure for people with hypertension.
3. 12 weeks of aerobic exercise has significant effect on body mass index for people with hypertension.
4. 12 weeks aerobic exercise has significantly affect on resting heart rate for people with

hypertension.

1.4. Objectives of the study

1.4.1. General Objective

To investigate the effect of 12-week aerobic exercise on selected physiological variables; blood pressure, body mass index and resting heart rate, for people with hypertension in Debre Markos town**.**

1.4.2. Specific Objectives

1. To evaluate the effect of 12 weeks aerobic exercise on systolic blood pressure.
2. To measure the effect of 12 weeks aerobic exercise on diastolic blood pressure.
3. To test the effect of 12 weeks aerobic exercise on body mass index (BMI) of people with hypertension
4. To measure the effect of 12 weeks aerobic exercise on resting heart rate of people with hypertension

1.5. Delimitation

This study is delimited to investigate the effects of 12 weeks aerobic exercise on selected physiological variables for people with hypertension in Debre Markos town. This study is delimited to selected physiological variables are systolic and diastolic blood pressure, body mass index and resting heart rate. Also the sample populations of the research were delimited to purposively select 17 male individuals who have been diagnosed hypertensive their age ranges from 36 - 42 years in Debre Markos town.

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.

1.6. Limitation of the Study

In conducting any research there is limitation facing. The same is true when process this research some of the problem was face follow;

- Lack of related research article by breaking of internet and also in case of CORONA.

- The tests that were used for variables were limited to specific tests that are easily monitored and administered.

- The external variables might not be controlled properly this and other factors might affect the results of this study.

1.7. Definition of Operational Terms

Aerobic exercise: Exercise designed specifically to improve cardiovascular fitness and subsequently, the body's use of oxygen.

Aerobic dance: Involving any kinds of dance put to music and can include everything from zumba (a Latin-inspired dance aerobics) to hip-hop dancing. Atypical dance class usually begins with a 5-to-10-minute warm-up, followed by a 20-to-30-minute aerobic routine, and ends with 5-to-10-minute cool down.

Rope jump: The activity, game or exercise in which a person must jump, bounce or skip repeatedly while a length of rope is swung over and under, both ends healed in the hands of the jumper, or alternately, held by two other participants.

Jogging: running at a slow regular pace usually over a long distance as part of an exercise routine

Systolic blood pressure: is the top number that refers the amount of pressure in arteries during the contraction of the heart muscle.

Diastolic blood pressure: is the bottom number that refers to the blood pressure when the heart muscle is between beats.

Body mass index: a person's weight in kilograms divided by the square of height in meters.

Resting heart rate: is the number of times the heart beat per minute (b/m) while at complete rest.

1.8. Significance of the Study

The significances of the study were designing suitable training program and procedure to analyze the effect of aerobic exercise on selected physiological variables for people with hypertension in Debre Markos town community, but it does not mean that the outcome of this research is only restricted to Debre Markos town; it also helps other urban and rural community as the study were

intend to signify.

In general, the finding of this study would help to:

- ✓ Motivate and encourage sedentary community to engage in aerobic exercise to improve their physical fitness level and health.
- ✓ For others as research work for depth studies on the problem undertaken.
- ✓ For people in Debre Markos town conducting to control blood pressure, improve Body Mass Index and resting heart rate for people with hypertension.
- ✓ analysis the influence of aerobic exercise on selected physiological variables of blood pressure, body mass index resting heart rate 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

1.9. Organization of the Study

This study consists of five chapters; the first chapter deals with the back ground of the study, statement of the problem, hypothesis, objectives of the study, significance of the study, delimitation of the study, limitation of the study, and definitions of terms used in the study. The second chapter deals with the review of related literature, and the third chapter deals with the research design and methodology. The fourth chapter deals with result and discussion of the study and the last chapter focuses on the summary of the findings, conclusion and recommendations of the study.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1. Hypertension

Hypertension is generally defined by the presence of a chronic elevation in systemic blood pressure above a certain threshold value. However, increasing evidence indicates that the cardiovascular (CV) risk associated with elevation of blood pressure (BP) above approximately 115/75 mm Hg increases in a log-linear fashion (Kannel et al., 1996). In the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) a category of ''pre hypertension'' was created using BP criteria of 120/80 mm Hg to 139 / 89 mmHg. This category did not emphasize that some individuals with pre hypertension already had the disease, hypertension, while others did not. In 2003, a writing group offered a written definition of hypertension that did not depend on threshold values of BP above optimal. The purpose of this present position paper is to further refine and update the definition and classification of hypertension. It should be noted that while definitions of disease are useful for detection, management, research, and education, definitions alone do not constitute recommendations for treatment (Thomas et al., 2009).

2.1.1 Definition of Hypertension

Hypertension is a progressive CV syndrome arising from complex and interrelated etiologies. Early markers of the syndrome are often present before BP elevation is sustained; therefore, hypertension cannot be classified solely by discrete BP thresholds. Progression is strongly associated with functional and structural cardiac and vascular abnormalities that damage the heart, kidneys, brain, vasculature, and other organs and lead to premature morbidity and death. Reduction of BP when target organ damage is demonstrable or the functional precursor of target organ damage is present and still reversible generally reduces the risk for CV events. Note that we separate elevated BP (one manifestation of the disease) from hypertension (the disease)(Thomas et al., 2009).

2.1.2. Blood Pressure Categories

The five blood pressure ranges recognized by the American Heart Association are normal: Blood pressure values of less than 120 to 80 mmHg are considered in the normal range. The results fall into this category. Stick to heart-healthy habits such as a balanced diet and regular exercise.(T.unger, 2020).

Elevated: Elevated blood pressure is when readings consistently range from 120-129mmHg systolic and less than 80mmHg diastolic. People with elevated blood pressure are likely to develop high blood pressure unless steps are taken to control the condition. (T.unger, 2020).

Hypertension Stage 1: is when blood pressure consistently ranges from 130-139 systolic and 80-89mmHg diastolic. At this stage of high blood pressure, doctors are likely to prescribe life style changes and may consider adding blood pressure medication based on the risk of atherosclerotic cardiovascular disease (ASCVD), such as heart attack or stroke(T.unger, 2020).

Hypertension Stage 2: is when blood pressure consistently ranges at 140/90 mmHg or higher. At this stage of high blood pressure, doctors are likely to prescribe a combination of blood pressure medications and life style changes (T.unger, 2020).

Hypertensive Crisis: This stage of high blood pressure requires medical attention. The blood pressure readings suddenly exceed 180/120 mmHg, wait five minutes and then test the blood pressure again. The readings are still unusually high, contact the doctor immediately. The blood pressure is higher than 180/120 mmHg there are experiencing signs of possible organs damage such as chest pain, shortness of breath, change in vision or difficulty speaking (T.unger, 2020).

The World Health Organization has identified hypertension, or high blood pressure, as the leading cause of cardiovascular morality. The World Hypertension League (WHL), which is an organization of 85 national hypertension societies and leagues, recognized that more than 50% of the hypertensive populations worldwide are unaware of their condition. To address this problem, the WHL initiated a global awareness campaign on hypertension in 2005 and dedicated May 17 of each year as World Hypertension Day (WHD). In the last three years, more national societies have become involved in WHD and have been innovative in their efforts to get the message out to

the public. In 2007, there was record participation from 47 member countries of the WHL. During the week of WHD, all these countries – in partnership with their local governments, professional societies, nongovernmental organizations and private industries – promoted hypertension awareness among the public through several media and public rallies. Using mass media such as Internet and television, the message reached more than 250 million people. As the momentum picks up year after year, the WHL is confident that almost all the estimated 1.5 billion people affected by elevated blood pressure can be reached (Chockalingam, 2008).

High blood pressure is classified as either primary (essential) hypertension or secondary hypertension. About 90–95% of cases are primary, defined as high blood pressure due to non specific lifestyle and genetic factor. Lifestyle factors that increase the risk include excess salt in the diet, excess body weight, smoking, and alcohol use. The remaining 5–10% of cases is categorized as secondary high blood pressure, defined as high blood pressure due to an identifiable cause, such as chronic kidney disease, narrowing of the kidney arteries, an endocrine disorder, or the use of birth control pills (Poulter, Prabhakaran & Caulfield, 2015).

Hypertension or high blood pressure is a worldwide problem that affects approximately 15-20% of all adults (Wang et al, 2008).

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 disease and to be the cause of stroke (Jamaludin, 2013). 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 (Escobales et al., 2005). 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. Various antihypertensive drugs such as beta-blocking agents, hypertensive 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% (Jamaludin, 2013).

2.1.3 Primary or Essential hypertension

90% - 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 (Carretero et al., 2000). The cause of essential hypertension is still unknown but it is considered as the sum of interaction between genetic and multiple environmental factors (Jamaludin, 2013). Nutritional 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 (Carretero et al., 2000).Inherited blood pressure (Bp) known as blood pressure that are genetically determined, while hypertensingenic factors are factors that cause high blood pressure such as obesity, high alcohol and salt intake (Carretero et al., 2000).

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(Carretero et al., 2000).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(Florencio et al., 2004).Obesity also acknowledge as the main hypertension genic factor compared to high alcohol intake, high salt intake, stress, sedentary lifestyles, dyslipidemia, low potassium and low calcium intake(Carretero et al., 2000). 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 (Jamaludin, 2013). Obesity can cause insulin resistance, adult-onset diabetes mellitus, left ventricular hypertrophy, hyperlipidemia and atherosclerotic disease (Carretero et al., 2000).

2.1.4. Secondary hypertension

Secondary hypertension can be caused by medical conditions such as renal parenchyma disease, renal artery stenosis, hyperaldosteronism, or pheochromocytoma (Grossman et al., 2012). 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 no steroidal anti-inflammatory drugs (NSAIDs) increase blood pressure as well as will interfere in anti-hypertensive treatment, and abolish its effect (Grossman et al., 2012). 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(Grossman et al., 2012).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 (Grossman et al., 2012). Cold medicines such as pseudoephedrine hydrochloride that used for upper respiratory decongestant may elevate blood pressure in hypertensive patients (Grossman et al., 2012).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 (Seeman et al., 2005).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 stimulate 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 (Navar et al., 1997).

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 (Sherman, 2000). 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 enhance smooth muscle relaxation and maintains the blood vessel in the normal resting state (Kelm, 1990). 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 (American College of Sport Medicine, 2004). Endurance trained subjects, for example, have larger arterial lumen diameter in conduit arteries than untrained controls(Huonker,Halle & Keeul, 1996).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 (Tom Baster , 2004).

• Two types of endurance exercise effects are significant acute effects and chronic affects 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 normotensives 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 (Tom Baster , 2004).

•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 (Tom Baster , 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(Tom Baster , 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 of10 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(huynh.ll, et al, 2013).

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 (b/m) minus your age (Martin, 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 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 et al., 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 2diabetes, 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., 2010)

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 Rankin 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, 2013).

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 & M.A, 2004).

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, 2020). 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 normotensives subjects (Whelton 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 co morbidity in many metabolic syndrome cases. Moreover, prospective studies have suggested 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 & M.A, 2004). 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 (Mancia & Grassi, 2008).

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 nor epinephrine, 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(Driss et al., 2006).

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 bar reflex 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)(AMEIDA, 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(Marandi et al., 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 liter min^{-1} to >100 liter 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 (Chlif et al., 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 glycol sis 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 (Hudson, 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 vasodilators metabolites such as AMP, adenosine, H^+, K^+ and PO 3− 4 PO43 acting onpre-capillary sphincters, which override the neither 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.(Tanaka 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 (Ruddock, 2017).

2.13. Exercise prescriptions for hypertension

Recently published studies suggest that moderate –intensity physical activity may be effective in lowering blood pressure. Proposed mechanisms for the blood pressure –lowering effects of exercise include neurohumoral, vascular, and structural adaptations. Regular physical activity has been shown to reduce the risk of developing hypertension by 19% to 30%. Research also found that having low cardio respiratory fitness at middle age is associated with a 50% greater risk of developing hypertension.

In a recent statement on exercise and hypertension, the American College of Sports Medicine (ACSM) concluded that people with mild hypertension can expect both systolic and diastolic blood pressure to fall an average of 10 mmHg in response to regular aerobic exercise. The benefits of regular physical activity are seen quickly, with the first few weeks. With such a large portion of our population currently suffering from hypertension and other significant portion at risk for the disease, it is important t trainers and exercise professionals understand how to safely

and effectively create an exercise prescription for these individuals suggests exercise 3 to 5 day per week for 20 to 60 minutes at a moderate intensity (50%-90%HRmax) in order to effectively lower blood pressure. The core of an exercise prescription in this population should consist of aerobic activity, including but not limited to walking, jogging, cycling, and swimming. The evidence is conflicted in regards to strength training in this population. Some published data has suggested that weight training should be avoided in individuals with hypertension, since it causes such a spike in blood pressure. More recent studies have shown that there may be some additional benefit in hypertensive patients. Strength training is an important factor in increasing muscular strength and overall physical fitness. Therefore, once aerobic conditioning improves, add low-resistance, high repetition weight training in to the client's exercise prescription. During strength training, holding one's breath should be avoided since it can result in large fluctuations in blood pressure.

Physical activity has been shown to have a therapeutic role in the treatment of hypertension. As always, individuals who are currently hypertensive should receive medical clearance from their primary care physicians before starting an exercise program, and exercise prescriptions should be based on medical history and risk factor status as well as any antihypertensive medications your client may be taking. With the proper knowledge and program design skills, exercise professionals can play a crucial role in the fight against this silent killer (Jennifer Green, 2013)

2.14. Prevent and treatment of high blood pressure

The hypertension- exercise relationship

Epidemiologic studies suggest that the relationship between sedentary behavior and hypertension is so strong that the National Heart Foundation, the World Health Organization and International Society of Hypertension, the United States Joint National Committee on Detection, Evaluation and Treatment of High Blood Pressure, and the American College of Sport Medicine (ACSM) have all recommended increased physical activity as a first line intervention for preventing and treating patients with pre hypertension (systolic BP 120-139 mmHg and / or diastolic BP 80-89mmHg)(Baster-Brooks, 2005).

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.

.Two types of endurance exercise effects are significant –acute effects and chronic effects

-acute effects: there is an average reduction in BP of 5-7mmHg immediately after an exercise session .This is referred to as post exercise hypotension (PEH). While PEH occurs in both normotensives 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 (Baster-Brooks, 2005).

-chronic effects: the average blood pressure 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 drug therapy, the average decrease was an additional 2.6/1.8mmHg 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 (Baster-Brooks, 2005)

. Overall, resistance training has a evaporable 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 (Baster-Brooks, 2005)

Type of exercise

Rhythmical and aerobic exercise involving large muscle groups in the preferred treatment strategy (walking, running, cycling and swimming) for all hypertensive patients. Moderate intensity exercise (50-65% of maximum heart rate) on most days of the week for at least 30-60 minutes appears optimal. A brisk walking pace is moderate; jogging or running is vigorous. Resistance training can be prescribed as an adjunct to aerobic activity as this type of exercise helps maintain and build muscle mass, especially in an aging body. However, resistance exercise should not

serve as the primary exercise program as it does not have the same antihypertensive effects as aerobic exercise(Baster-Brooks, 2005).

Assessment before commencing exercise

Most pre hypertensive and grade 1 hypertensive patients can safely begin a moderate intensity exercise program without extensive medical screening. Patients with grade 2 hypertension and no signs of CVD must have their BP controlled before they begin an exercise an exercise program. Patients with risk factors for CVD and patients over 50 years of age will benefit from a stress test to determine how their heart responds to exercise. An exercise systolic BP higher than 220 mmHg or diastolic BP higher than100 mmHg is considered abnormal. Some with treated hypertension may also have an exaggerated BP response to exercise that is associated with increased with increased CVD risk. Such individuals require a cardiac evaluation followed by a training program designed and monitored by a certified clinical exercise physiologist (Baster-Brooks, 2005).

The clinical exercise physiologist should also design an ongoing aerobic based training program for the patient to pursue after achieving a minimal level of conditioning. While formal education and base conditioning is taking place, most patients can begin light moderate exercise such as walking. Note that beta blockers diminish the heart rate response to exercise, therefore, patients taking these agents should use the perceived level of exertion rather than target heart rate (Baster-Brooks, 2005).

Conclude that, although it can be difficult to motivate patients to exercise regularly, the benefits of exercise equate to the effects of drug treatment and should be vigorously encouraged. If the exercise program is designed correctly, it is quite safe for most hypertensive patients and also has other important health benefits relevant to their CVD risk factors. It is therefore important to prescribe exercise for patients who have hypertension, with the same consideration as prescribing any other effective treatment (Baster-Brooks, 2005).

2.15. Related study on hypertension

An evidence based literature analysis by the American College of Sports Medicine indicates that an isolated exercise session (acute effect) lowers BP an average of 5-7 mmHg. Depending upon the degree the patient’s BP has been normalized by drug therapy; regular aerobic exercise

significantly reduces BP the equivalent of 1 class of antihypertensive medication (chronic effect).For most hypertensive patients is quite safe. Caution is required for those over 50 years age, and those with established cardiovascular disease (CVD) (or at high CVD risk) and in these patients, the advance of a clinical exercise physiologist is recommended (Baster-Brooks, 2005).

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

This Chapter provides the frame work of the study _ Effect of 12 weeks' Aerobic exercise on selected physiological variables peoples with hypertension in Debre Markos town. The following section are included: area of the study, design of the study, sample and sampling technique, inclusion and exclusion, source of data, data collection instrument, methods and data collection procedure, training protocol and ethical considerations.

3.1 Area of the Study

Debre Markos is the town in North West Ethiopia. Located in the East Gojjam zone of Amhara Administrative region, this town has a latitude and longitude of 10°20′N 37°43′ E /10.333°N 37.717°E and an elevation 2,446 meters above sea level. It is the administrative centers of East Gojjam Zone. Debre Markos is found 299 Km North West of Addis Ababa, 270Km from Bahir Dar. From the Federal Democratic Republic of Ethiopia Central Statistical Agency in March 2014, this town has an estimated total population of 86,225, of whom 37,540 are men and 48,685 are women. In Debre Markos town most of peoples are poor culture for participating health related physical activities regularly.

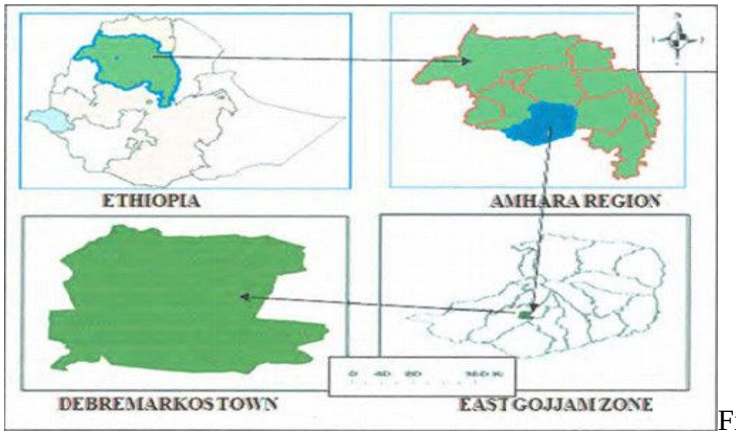
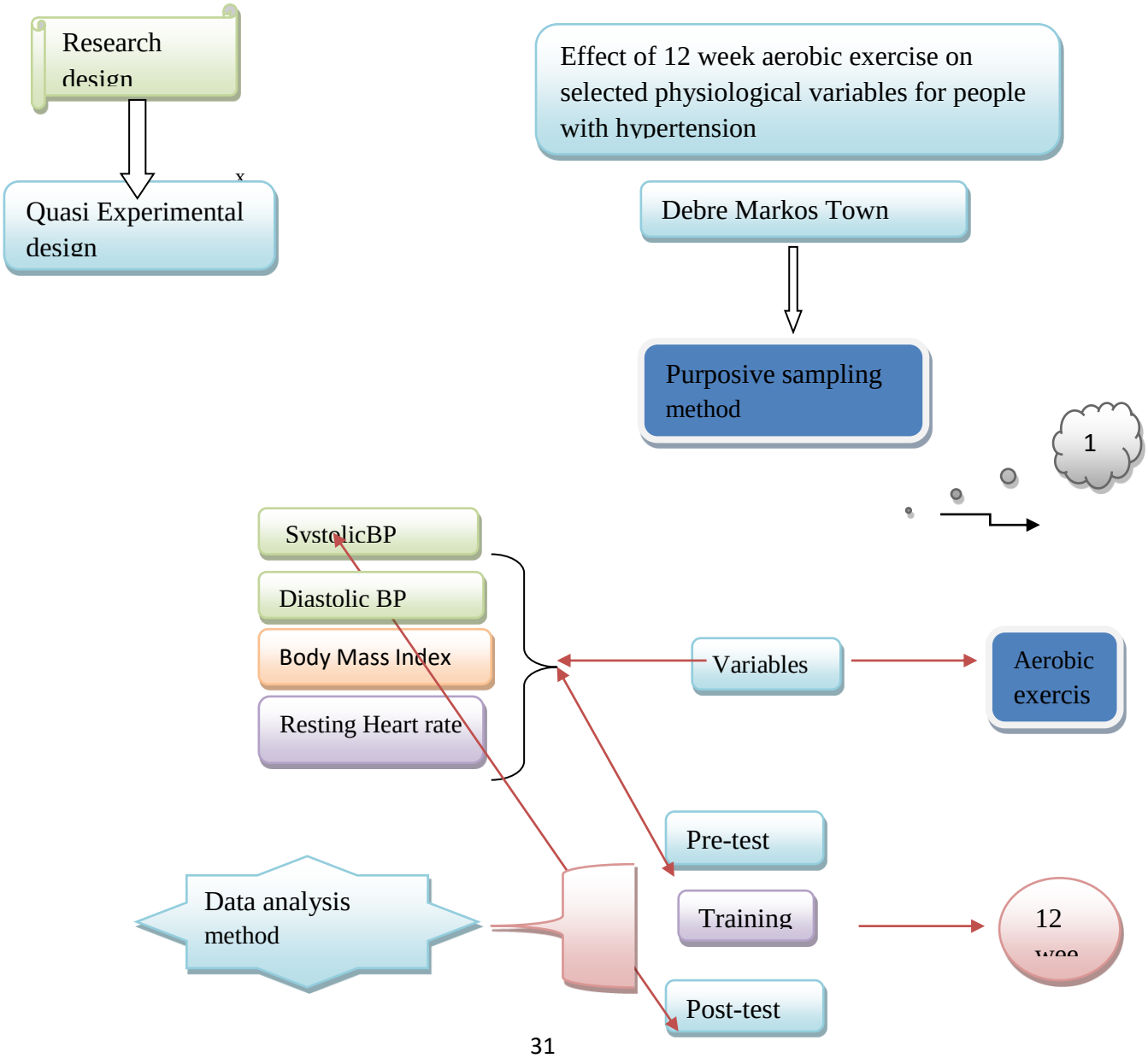


Fig 1 Area of the study

3.2. Research Design

This study has employed on quasi experimental design, study within 12 weeks of aerobic exercise on selected physiological variables i.e. systolic and diastolic blood pressure, Body Mass Index and resting heart rate for peoples with hypertension in Debre Markos town. There was no a control group in this study. In this study, a single experimental group was used for providing pretest and posttest in order to identify the effect of Aerobic exercise on selected physiological variables for people with hypertension.

RESEARCH DESIGN



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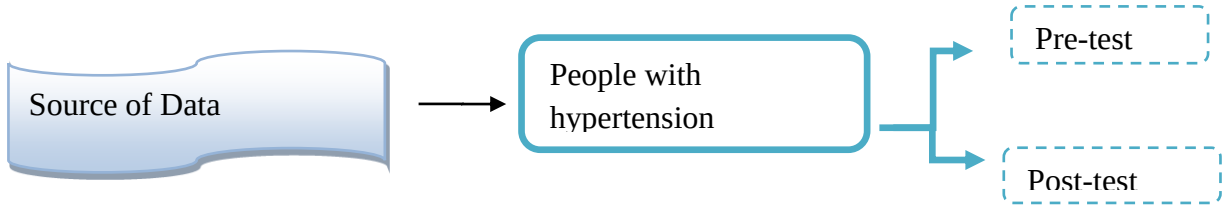

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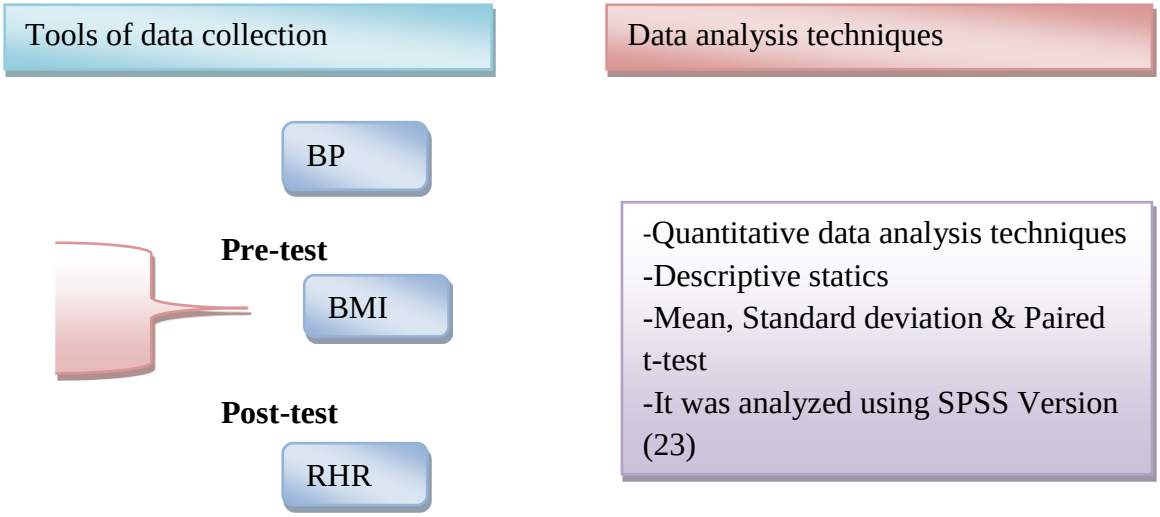

Fig. 2 Flow Chart

Table 1-The intervention schedule

Treatment	Aerobic exercise
Frequency	3 days/week
Total duration	12 weeks
Duration/session	30-60 minutes
Intensity	Low-moderate (109-164 b/m)
Exercise day	Tuesday, Thursday and Saturday

3.3. Samples size and Sampling Techniques

The sample populations of this study were selected by using purposive sampling method. They were all informed about the study and followed by signatures on voluntary participation forms. 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 17 male individuals who have been diagnosed hypertensive their age ranges from 36 - 42 years in Debre Markos town.

3.4. Inclusion and Exclusion Criteria

The Subjects who fulfill the health history questionnaires were included in this study. Individuals with chronic cardiac conditions or uncontrolled diabetes or other conditions that would be contraindicated for exercise testing and training were not admitted to the study. The subject whose systolic blood pressure (SBP) reading < 140 mmHg, diastolic blood pressure (DBP) reading <90 mmHg and resting heart rate reading <100 b/minute was included in this study. However, the patients whose systolic blood pressure reading ≥ 140 mmHg, diastolic blood pressure reading ≥ 90 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. The subject was not including participant in other regular physical exercise and sport.

3.5. Sources of data

To do this study the researcher used primary data sources to get adequate amount of information regarding the Effect of 12 week aerobic exercise on selected physiological variables for people with hypertension. So the primary data were taken from hypertensive patient's pre-test and post-test measurement throughout the training program (three months).

The participants of study were all male hypertensive patients of Debre Markos town communities selected from monthly treatment follow up in Debre Markos Referral Hospital. Systolic blood pressure between 120-140 mmHg diastolic blood pressure between 80-90 mmHg and pre

designed selected physiological variables test (measure resting heart rate and body mass index) and their age was 36 – 42.

3.6. Data Collection Methods and procedure

The investigator used a 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 and after physical training from the right arm by using blood pressure monitor (sphygmomanometer), in Debre Markos Referral hospital and some peoples, their house is far away from the hospital, rest in the hotel during three consecutive days during measurement. 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 underweight, 18.5-24.99 normal, 25-29.99 over weight, and > or = 30 obese.

For the first 4 weeks of training session, the researcher guided the patients to execute physical activities at low intensity of 109- 128 b/m, duration of 30 minutes and frequency of 3 times a week and for the second 4 weeks of training session, the patients conducted aerobic exercise at moderate intensity of 128-164 b/m, duration of 45 minutes and frequency of 3 times a week and the last 4 weeks of training session, at moderate intensity of 128-164 b/m, duration of 60 minutes and frequency of 3 times a week. The researcher applied the principles of progressions while executing aerobic exercises.

3.6.1. Test procedure

In order to evaluate the effects of 12 weeks aerobic exercise on selected physiological variables all pre -test measurements were done with in the first week prior to the commencement of the 12 week training program. Pre-test perform screening of the health risk and obtain information consent. Prepare forms and record basic information such as age, blood pressure, height, body weight and resting heart rate.

The participants performed enough warming up, cooling down and stretching exercise to all tests at the begging and at the end. Before testing, patients were given practice trials to become familiar

with the testing procedure. All tests were explained and demonstrated. Patients performed each test as per test procedure and the score were taken for this study. Moreover, each test procedure is discussed below.

3.6.2. Evaluate of Resting Blood Pressure

Purpose: to measure systolic and diastolic blood pressure

Equipment required: table, chair, sphygmomanometer and recording sheet

Procedure: The measurements of systolic and diastolic blood pressure 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. Some participant's house that away from the hospital are arrives in hotel during measuring days.

Fig3. Blood pressure measurement

3.6.3. Evaluate body composition

Body Mass Index

A relatively easy way to determine the extent of overweight or obesity is to use a person‘s body weight and height (Adopted from Mackenzie, 2005 101 performance evaluation test). Equipment needed to measure body composition by using the test BMI includes a scale and a tape measure. Proper positioning for measuring height (standard erect posture with the head and eyes in the Frankfurt horizontal plane) was needed; Height and weight typically were measured without shoes and in light indoor clothing. After measuring height and weight calculating BMI by dividing weight to height squared. Body weight was measured using weight scale measure. Height was measured with a tape meter. Finally, calculate the BMI by using the formula.

$$BMI = \frac{\text{weight}}{(\text{Height})^2}$$

3.6.4. Evaluate of resting heart rate

Purpose: to evaluate the recovery status and the development of aerobic fitness

Equipment required: recording sheets, stop watch

1. *Procedures*: 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

3.7. 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 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 23.

3.8. Training protocol

Table 2 Table of training protocol

Number of weeks	Phase	Aerobic exercise	Duration (minutes)	Recovery (seconds)	Intensity	Frequency (weeks)
1st to 4th	Phase 1	Causal, Brisk walk Slow dance Jogging	30 minutes	1 minute	Low (109- 128 b/m)	3 days/ week
5th to 8th	Phase 2	Circuit Training	45 minutes	45 seconds	Moderate (128-164)	3 days/week
9th to 12ve	Phase 3	Circuit Training	60 minutes	30 seconds	Moderate (128-164b/m)	3 days/week

Note: *Circuit training: Hiking with backpacking, Jogging, Race Walking, Aerobic dance, Easy Squat, Rope Jump*

3.9. Training Procedure

The overall number of training sessions during the experimental program: 36. The number of training sessions per week: three. Intensity: low to moderate. Number of weeks: 12. The duration of an individual training session: 30-60 min. The duration of an individual Aerobic exercise: 30-60 min. The structure of each individual workout encompassed: a warm-up, the main part and the cool-down. The warm-up lasted for 6 minutes. Each of the subjects independently monitored his own heart beat by counting the beats over a ten-second interval, and then by multiplying that number by six. The low-impact was: the Brisk Walking, Slow dance and Jogging for 30 minutes. The workouts used in the moderate-impact of Circuit exercise (Jogging, Race Walking, Aerobic dance, Easy Squat, Rope Jump) for 45-60 minutes used to increase intensity gradually. But not used the contents of the high-impact part. The cool-down part of the workout lasted for 4 minutes. During the dynamic stretch exercises the subjects relaxed in moderate tension in their bodies. Its contents: stretching exercises which simultaneously activated several body parts, and where each exercise was repeated three to four.

3.10. Ethical Considerations

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.

3.11. Data Quality Control

The investigator 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.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1. Overview

This chapter deals with the analysis of pre and post test data collected from selected participant (n= 17) under the study. The purpose of this study was to investigate the effect of three months of Aerobic exercise on selected physiological variables for people with hypertension in Debre Markos town.

The variables selected for this study were physiological variable such as systolic and diastolic blood pressure, body mass index and resting heart rate. Pre and post-test were conducted for the 17 participants on some selected physiological variables and the scores were recorded. Information of the participant in this research project was kept confidential. Records pertaining to this research were coded secretly in numbers and put in a secured storage area. The collected data were analyzed by t-test by using SPSS version 23. The results for each physiological variable are discussed below.

4.2. Analysis interpretation and discussion variables

4.2.1. Demographic/characteristics of study group

Table 3 Descriptive Statistics

Group	No	Age		weight (in kg)		Height (in meter)	
		Mean	Std	Mean	Std	Mean	Std
Subject	17	39.76	2.333	76.818	7.0715	1.6982	.06415

As shown from above Table (3) Descriptive characteristics of 17 study participants regarding to age, weight and height were the mean of age 39.76±2.333, the mean of weight 76.818±7.0715 and

the mean of height 1.6982±.06415, this shows that they are homogeneous group in terms of age, height and weight at the beginning of training.

Table 4 Descriptive data between pre and post-test of systolic blood pressure, diastolic blood pressure, body mass index and resting heart rate

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
SBP	Pre test systolic	137.12	17	1.364	.331
	Post test systolic	135.47	17	1.419	.344
DBP	Pre test diastolic	82.76	17	1.522	.369
	Post test diastolic	82.35	17	1.656	.402
BMI	Pretest body mass index	26.647	17	1.2546	.3043
	Posttest body mass index	25.900	17	1.1124	.2698
RHR	Pre test RHR	82.353	17	5.991	1.453
	Post test RHR	81.24	17	6.200	1.504

Note; SBP= systolic blood pressure, DBP= diastolic blood pressure, BMI= body mass index, RHR= resting heart rate.

A Paired sample t-test was conducted to evaluate the effect of 12 weeks aerobic exercise on physiological variables systolic blood pressure mean (pre test M=137.12, SD=1.364, post test M= 135.47, SD=1.419). According to the result, there was significant difference between pre and post test score.

A Paired sample t-test was conducted to examine the effect of 12 weeks aerobic exercise on physiological variables diastolic blood pressure mean (pre-test M=82.76, SD=1.522 post-test M= 82.35, SD=1.2546). According to the result, there was significant difference between pre and post test score.

A Paired sample t-test was conducted to examine the effect of aerobic exercise on physiological variables Body Mass Index mean (pre-test M=26.647, SD=1.2546 post-test M= 25.900, SD =1.1124). According to the result there was significant difference between pre and post test score. This means 12 weeks of aerobic exercise is significant effect on reduction of body mass index, by reducing body fat only.

A Paired sample t-test was conducted to examine the effect of aerobic exercise on physiological variables Resting Heart Rate mean (pre-test M=82.353, SD =5.991, post-test M= 81.24, SD =6.200). According to the result there was significant difference between pre and post test score.

Table 5 Pair sample t-test results on systolic blood pressure, diastolic blood pressure, body mass index and resting heart rate.

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
SBP	pretests – post test	1.647	1.618	.392	.815	2.479	4.197	16	.001
DBP	pretest- posttest	.412	.712	.173	.046	.778	2.384	16	.030
BMI	pretest- posttest	.747	.7738	.1877	.3492	1.1450	3.980	16	.001
RHR	pretest- posttest	1.294	1.724	.418	.408	2.18	3.096	16	.007

Note; SBP= systolic blood pressure, DBP= diastolic blood pressure, BMI= body mass index, RHR= resting heart rate.

A paired sample t-test was conducted to evaluate the effect of aerobic exercise on systolic blood pressure mean difference (*M=1.647, SD=1.618*), *t(16) = 4.197, p= .001 so p< 0.05)* ,then according to the result 12 week aerobic exercise were significantly effective on systolic blood pressure for people with hypertension. Because in this study, the hypertensive patients who

engaged in after programmed aerobic exercise showed change significantly reduced in systolic blood pressure than patient before engaged aerobic exercise program.

A paired sample t-test was conducted to measure the effect of aerobic exercise on diastolic blood pressure mean difference (*M*=.412, *SD*=.712*), t(16) = 2.384,p= .030 so p< 0.05),*then according to the result 12 week aerobic exercise were significantly effective on diastolic blood pressure for people with hypertension. Because in this study the hypertensive patients who engaged in after programmed aerobic exercise showed change significantly reduced in diastolic blood pressure than patient before engaged aerobic exercise program.

A paired sample t-test was conducted to test the effect of aerobic exercise on Body Mass Index mean difference (*M*=.747, *SD*=.7738), *t(16) = 3.98,p=.001 so p< 0.05),*then according to the result 12 week aerobic exercise were significantly effective onBody Mass Index for people with hypertension. Because in this study, the hypertensive patients who engaged in after programmed aerobic exercise showed change significantly reduced in body mass index than patient before engaged aerobic exercise program.

A paired sample t-test was conducted to measure the effect of aerobic exercise on Restring heart rate mean difference (*M*=1.294, *SD*=1.724*), t(16) = 3.096, p= .007 so p< 0.05),*then according to the result 12 week aerobic exercise were significantly effective onResting heart rate for people with hypertension. Because in this study, the hypertensive patients who engaged in after programmed aerobic exercise showed change significantly reduced in resting heart rate than patient before engaged aerobic exercise program.

4.3. Discussion

Purpose of this study was to find the effect of 12 weeks aerobic exercise on selected physiological variables for people with hypertension. To achieve the purpose of the study 17 male patients from Debre Markos town were selected as subjects and their age were 36-42 years there were experimented with low to moderate intensity exercise in twelve weeks.

The variables selected for the study were physiological variables: systolic blood pressure, diastolic blood pressure, body mass index and resting heart rate. The study was formulated as a complete group design consisting of a pre-test and post-test. The subjects (n= 17) were

participants (aerobic exercise. Pre-tests were conducted for 17 subjects on selected physiological variables. After the experiment period of twelve weeks posttest were conducted and the scores were recorded .The normality of the data were found through mean, standard deviation and the differences between initial and final scores in selected variables were subjected to statistical treatment using analysis of pair t-test to find out whether the mean differences were significant or not.

In case of systolic blood pressure

As indicate the result of this study there was significant difference in-between the pre to post test score when assessed systolic blood pressure. The result suggests that significantly reduced systolic blood pressure (MD = 1.647, SD = 1.618, t (16) = 4.197, p = 0.001), significant at 0.05 level of confidence. When we compare the mean score of participant before and after aerobic exercise with the mean score of after 12 weeks training, the mean difference value decreased by 1.647. This result indicated that effective reduction was observed on patients who engaged in twelve weeks aerobic exercise on systolic blood pressure. So, the formulated hypothesis that aerobic exercise has a significant effect on systolic blood pressure of patients was accepted at 0.05 level of confidence when assessed in systolic blood pressure. This indicates that aerobic exercise program proved to be a useful training modality for reducing of systolic blood pressure for peoples with hypertension. As the result the researcher accepted alternative hypothesis 1. And it is confirmed or by agreement to be in line with that of (Fagard & 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 et al ,, 2020) 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.

In the case of diastolic blood pressure

As indicated in the result part of this research the results of diastolic blood pressure show that there was significant reduction of difference in-between the pre to post test score when assessed

in diastolic blood pressure. The result suggests that significantly reduced diastolic blood pressure (MD = .412, SD = .712, t (16) = 2.384, p = 0.030), significant at 0.05 level of confidence. The reduction of group in pressure was due to the aerobic exercise in which they were engaged in. When compare the mean score before and after aerobic exercise with the mean score of after 12 weeks aerobic exercise, the mean difference value reduced by .412. This result indicated that effective reduce was observed on patients who engaged in twelve weeks aerobic exercise on diastolic blood pressure. So, the formulated hypotheses that aerobic exercise has a significant effect on diastolic blood pressure of patient's were accepted at 0.05 level of confidence. As the result the researcher accepted alternative hypothesis 2. This indicates that aerobic exercise program proved to be a useful exercise modality for reducing diastolic blood pressure. This result was in agreement to be in line with that of(Fagard & 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 et al ,, 2020) 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.

In the case body mass index

As indicate the result of this study there was significant reduction in-between the pre to post test score when assessed body mass index in body composition test. The result suggests that significantly reduction body mass index (MD =0.7471, SD =0.7739, t (16) = 3.98, p =0.001), significant level at0.05 of confidence. When we compare the mean score of group before aerobic exercise with the mean score of after 12 weeks training, the mean difference value .7471. This result indicated that effective reduced was observed on patients who engaged in twelve weeks aerobic exercise of body mass index. So, the formulated hypothesis that aerobic exercise has a significant effect on body mass index of patients were accepted at 0.05 level of confidence. When assessed in body mass index. As the result the researcher accepted alternative hypothesis 3. This result was agreement. 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.

In the case of resting heart rate

As indicated in the result part of this research the results of resting heart rate show that there was significant reduction of difference in-between the pre to post test score when assessed in resting heart rate. The result suggests that significantly reduced resting heart rate (MD = 1.294, SD = 1.724, t (16) = 3.096, p = 0.007), significant at 0.05 level of confidence. The reduction of group in pulse was due to the aerobic exercise in which they were engaged in. When compare the mean score before and after aerobic exercise with the mean score of after 12 weeks aerobic exercise, the mean difference value reduced by 1.294. This result indicated that effective reduce was observed on patients who engaged in twelve weeks aerobic exercise on resting heart rate. So, the formulated hypotheses that aerobic exercise has a significant effect on resting heart rate of patients were accepted at 0.05 level of confidence. As the result the researcher accepted alternative hypothesis 4. This indicates that aerobic exercise program proved to be a useful exercise modality for reducing resting heart rate. This result was in agreement with the findings of Meruna Bose (2012)found that the effect of short duration aerobic exercise in value of resting heart rate in stage 1 hypertensive after 6 weeks of aerobic training in hypertensive individuals. Additional result of a study conducted by (Odiango & Appl., 2020)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 pretest. This was an indication on aerobic exercise program was effective in improving subjects resting heart rate for hypertensive patients.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

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 Debre Markos town for three consecutive months of aerobic exercise training sessions. The mode 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. A total of 17 male hypertensive patients were involved in the study. The objectives were to demonstrate the overall effect of aerobic exercise on selected physiological variables 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 using of statistical packages of social science (SPSS) version 23.

To meet the objective of the study, systolic and diastolic blood pressure, body mass index and heart rate were measures 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 heat rate readings (measurements) were collected and analyzed for their reduction throughout 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 0.7471. Similarly, systolic, diastolic and

heart rate readings were resulted in weighted net reduction by 1.647 mmHg, .412 mmHg, and 1.294 b/minute, respectively.

Generally to lower and manage blood pressure, body weight and heart rate reading in hypertensive patients and maintain an improved health condition of the patients, it is essential for hypertensive patients to actively participate in regular aerobic exercise training sessions with a mean intensity of 50% VO2 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 East Gojjam, Debre Markos District Health Office 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 30-60 minutes per session at intensity of low to moderate, aerobic exercise performance in order to achieve reduction of systolic and diastolic blood pressure, body mass index and heart rate reading for hypertensive patients.
- Debre Markos District Sport Office, Professionals and Amateur sportsman’s should make a program to develop the attitude of the people to increase number of participants through physical exercise and arrange physical fitness program.

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POST GRADUATE PROGRAM

SPORT ACADEMY

APPENDIXES

APPENDIX A: Physical Health and Fitness Readiness Question

For Participants: This questionnaire is prepared to obtain information on the health status and physical activity readiness Subjects participating for the study please. Read the questions carefully and answer each one honestly by encircling it on the choice letter given and describing your condition in the space provided.

Thank you.

1. Do you have a recent physical injury such as bone, muscle and joint which will be serious by physical exercise? A. Yes B. No

If yes indicate the type of injury that you had_____

2. Do you have suffered with heart condition?

A. Yes B. No

3. 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

4. Have you ever felt pain in your chest when you do physical exercise? A. Yes B. No

5. Have you ever suffered from shortness of breath at rest or with mild exercise? A. Yes B. No

6. Is there any history of Coronary Heart Disease within your family? A. Yes B. No

7. Do you ever feel feint; have spells of dizziness or have you ever lost consciousness?

A. Yes B. No

8. Are you taking any prescription medicines recently? A. Yes B. No

If yes, name them below: - Name of drug Dosage_____
_____ _____ _____

9. Do you currently smoke? A. Yes B. No

10. Do you know your current level of s physical fitness? A. Yes B. No

11. Have you taken any health related physical fitness skill tests before? A. Yes B. No

12. Do you know any other reason why you should not participate in a program of physical Activity?

A. Yes B. No

If yes explain your Reason

here_____ ___
_____ __

I have read and understand the form and have given accurate information regarding to my current health status.

Signed (participant player) _____date_____

Signed (examiner) _____date_____

Source: htt://www.Barnes fitness.co.uk

APPENDIX –B: Descriptive data between pre and post test

Appendix Table 1 Descriptive data between pre and post-test of systolic blood pressure Paired Samples Statistics

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
SBP	SBP pre	137.12	17	1.364	.331
	SBP Post	135.47	17	1.419	.344

Note; SBP= systolic blood pressure, pre= pre test, post= post test

Appendix Table 2 Descriptive data between pre and post-test of diastolic blood pressurePaired Samples Statistics

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
DBP	DBP Pre	82.76	17	1.522	.369
	DBP Post	82.35	17	1.656	.402

Note; DBP= diastolic blood pressure, pre=pretest, post= post test

Appendix Table 3 descriptive data between pre and post-test of body mass index

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
BMI	BMI pre	26.647	17	1.2546	.3043
	BMI post	25.900	17	1.124	.2698

Note; BMI= body mass index, pre= pretest, post= post test

Appendix Table 4 descriptive data between pre and post-test of resting heart rate

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
RHR	RHR pre	82.53	17	5.991	1.453
	RHR post	81.24	17	6.200	1.504

Note; RHR= resting heart rate, pre= pretest, post= post test

Appendix Table 5 Pair sample t-test results on systolic blood pressure, diastolic blood pressure, body mass index and resting heart rate

Paired Samples Test

	Paired Differences					T	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
SBP pretests – post test	1.647	1.618	.392	0.815	2.479	4.197	16	.001
DBP pretest- posttest	.412	.712	.173	0.046	.778	2.384	16	.030
BMI pretest- posttest	.7471	.7739	.1877	.3492	1.1450	3.980	16	.001
RHR pretest- posttest	1.294	1.724	.418	0.408	2.180	3.096	16	.007

Note; SBP= *systolic blood pressure, BP= diastolic blood pressure, BMI= body mass index, RHR= resting heart rate*

APPENDIX-C: Daily Training Schedule of Three Month

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

Day	Type of exercise	Week One				Type of exercise	Week Two			
		Time	Rep	Dur.	Inte.		Time	Rep	Dur.	Inte.
Tu	Warming up Dynamic Stretching Casual Walking Cooling down	6min 4min 30min 4min	1x 1x 1x 1x	30 min.	109-128 b/m low intensity Continuous exe.	Warming up Dynamic Stretching Jogging with slow dance Cooling down	6min 4min 30mi 4min	1 x 1x 1x 1x	30 Min	109-128 b/m low intensity continuous exe
Th	Warming up Dynamic Stretching Brisk Walking Cooling down	6min 4min 30min 4min	1x 1x 1x 1x	30min	109-128 b/m of low intensity continuous exe.	Warming up Dynamic Stretching Jogging Cooling down	6min 4min 30min 4min	1x 1x 1x	30 Min	109-128 b/m of low intensity continuous exe.
Sa	Warming up Dynamic Stretching Brisk Walking with Uphill Walking Cooling down	6min 4min 30min. 4min	1x 1x 1x 1x	30min.	109-128 b/m of low intensity continuous exe.	Warming up Dynamic Stretching Light running With slow dance Cooling down	6min 4min 30min 4min	1x 1x 1x	30 Min	109-128 b/m of low intensity continuous exe.

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

Day	Type of exercise	Week Three					Week Four			
		Time	Rep.	Dur	Inte	Type of exercise	Time	Rep.	Dur.	Inte .
Tu	Warming up Dynamic Stretching Light running With aerobic dance Cooling down	6min 4min 30mi 4min	1x 1x 1x 1x	30min	109-128 b/m of low intensity continuous exe.	Warming up Dynamic Stretching Hiking with backpacking Cooling down	6min 4min 30mi 4min	1x 1x 1x 1x	30 Min	109-128 b/m of low intensity continuous exe.
Th	Warming up Dynamic Stretching Hiking Cooling down	6min 4min 30min 4min	1x 1x 1x 1x	30min	109-128 b/m of low intensity continuous exe.	Warming up Dynamic Stretching Hiking with brake walk Cooling down	6min 4min 30min 4min	1x 1x 1x 1x	30 Min	109-128 b/m of low intensity continuous exe.
Sa	Warming up Dynamic Stretching Hiking Cooling down	6min 4min 30min 4min	1x 1x 1x 1x	30min	109-128 b/m of low intensity continuous exe.	Warming up Dynamic Stretching Hiking with jogging Cooling down	6min 4min 30min 4min	1x 1x 1x 1x	30 Min	109-128 b/m of low intensity continuous exe.

Key: *Hiking with backpacking means holding their 2 liters drinking water.*

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

Day	Type of exercise	Week Five					Week Six			
		Time	Rep.	Dur	Inte.	Time	Time	Rep.	Dur.	Inte.
Tu	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 45min 4min	1x 1x 1x 1x	45min	128- 164 b/m of moderate intensity continuous exe.	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 45min 4min	1x 1x 1x	45 Min	128- 164 b/m of moderate intensity continuous exe.
Th	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 45min 4min	1x 1x 1x 1x	45min	128- 164 b/m of moderate intensity continuous exe.	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 45min 4min	1x 1x 1x 1x	45 Min	128- 164 b/m of moderate intensity continuous exe.
Sa	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 45min 4min	1x 1x 1x 1x	45 min	128- 164 b/m of moderate intensity continuous exe.	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 45min 4min	1x 1x 1x 1x	45 Min	128- 164 b/m of moderate intensity continuous exe.

Key: Circuit Training includes: Jogging, slow step aerobics, Aerobic dance,

Table 9 Daily training schedule of Week Seven and Week Eight

Day	Type of exercise	Week Seven					Week Eight			
		Time	Rep.	Dur	Inte.	Type of exercise	Time	Rep.	Dur.	Inte.
Tu	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 45min 4min	1x 1x 1x 1x	45min	128- 164 b/m of moderate intensity continuous exe.	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 45min 4min	1x 1x 1x	45 Min	128- 164 b/m of moderate intensity continuous exe.
Th	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 45min 4min	1x 1x 1x 1x	45min	128- 164 b/m of moderate intensity continuous exe.	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 45min 4min	1x 1x 1x 1x	45 Min	128- 164 b/m of moderate intensity continuous exe.
Sa	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 45min 4min	1x 1x 1x 1x	45 min	128- 164 b/m of moderate intensity continuous exe.	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 45min 4min	1x 1x 1x 1x	45 Min	128- 164 b/m of moderate intensity continuous exe.

Key: Circuit Training includes: Jogging, Slow step aerobics, Aerobic dance, Easy Squat

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

Day	Type of exercise	Week Nine				Type of exercise	Week Ten			
		Time	Rep.	Dur	Inte.		Time	Rep.	Dur.	Inte.
Tu	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 60min 4min	1x 1x 1x 1x	60min	128- 164 b/m of moderate intensity continuous exe.	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 60min 4min	1x 1x 1x	60 Min	128- 164 b/m of moderate intensity continuous exe.
Th	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 60min 4min	1x 1x 1x 1x	60min	128- 164 b/m of moderate intensity continuous exe.	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 60min 4min	1x 1x 1x 1x	60 Min	128- 164 b/m of moderate intensity continuous exe.
Sa	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 60min 4min	1x 1x 1x 1x	60min	128- 164 b/m of moderate intensity continuous exe.	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 60min 4min	1x 1x 1x 1x	60 Min	128- 164 b/m of moderate intensity continuous exe.

Key: Circuit Training includes: Jogging, Race Walking, Aerobic dance, Easy Squat, Rope Jump

Appendix Table11Daily training schedule of Eleven one and Week Twelve

Day	Type of exercise	Week Eleven					Week Twelve			
		Time	Rep.	Dur	Inte.	Type of exercise	Time	Rep.	Dur.	Inte.
Tu	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 60min 4min	1x 1x 1x 1x	60min	128- 164 b/m of moderate intensity continuous exe.	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 60min 4min	1x 1x 1x	60 Min	128- 164 b/m of moderate intensity continuous exe.
Th	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 60min 4min	1x 1x 1x 1x	60min	128- 164 b/m of moderate intensity continuous exe.	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 60min 4min	1x 1x 1x 1x	60 Min	128- 164 b/m of moderate intensity continuous exe.
Sa	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 60min 4min	1x 1x 1x 1x	60min	128- 164 b/m of moderate intensity continuous exe.	Warming up Dynamic Stretching Circuit training Cooling down	6min 5min 60min 4min	1x 1x 1x 1x	60 Min	128- 164 b/m of moderate intensity continuous exe.

Key: Circuit Training includes: Jogging, Race Walking, Aerobic dance, Easy Squat, Rope Jump

APPENDIX-D: Pre and post test score of the subject

Appendix Table 12 Pre and post test score of the subject

Pre test					Post test				
S.NO	**Systolic blood pressure**	**Diastolic blood pressure**	**Body mass index**	**Resting heart rate**	**S.NO**	**Systolic blood pressure**	**Diastolic blood pressure**	**Body mass Index**	**Resting heart rate**
GD1	135	84	26.5	89	GD1	134	83	24.8	88
GD2	137	83	27.2	76	GD2	136	83	26.8	73
GD3	138	81	26.4	80	GD3	135	80	25.9	79
GD4	137	82	25.6	84	GD4	136	82	24.8	84
GD5	138	83	26.2	78	GD5	137	82	25.8	76
GD6	138	82	25.4	84	GD6	133	82	25.3	80
GD7	136	80	26.8	79	GD7	135	79	26.6	79
GD8	134	82	25.8	81	GD8	136	82	25.6	80
GD9	137	84	25.7	78	GD9	135	83	25.5	77
GD10	139	83	25.9	84	GD10	137	82	24.8	87
GD11	138	85	26.5	79	GD11	136	85	24.3	75
GD12	139	84	25.2	76	GD12	137	85	24.9	77
GD13	136	82	26.6	84	GD13	133	81	26.2	82
GD14	137	83	28.1	87	GD14	135	82	27.8	86
GD15	138	80	26.4	94	GD15	138	81	25.8	92
GD16	138	84	30.0	75	GD16	134	83	27.2	73
GD17	136	85	28.7	95	GD17	136	85	28.2	93

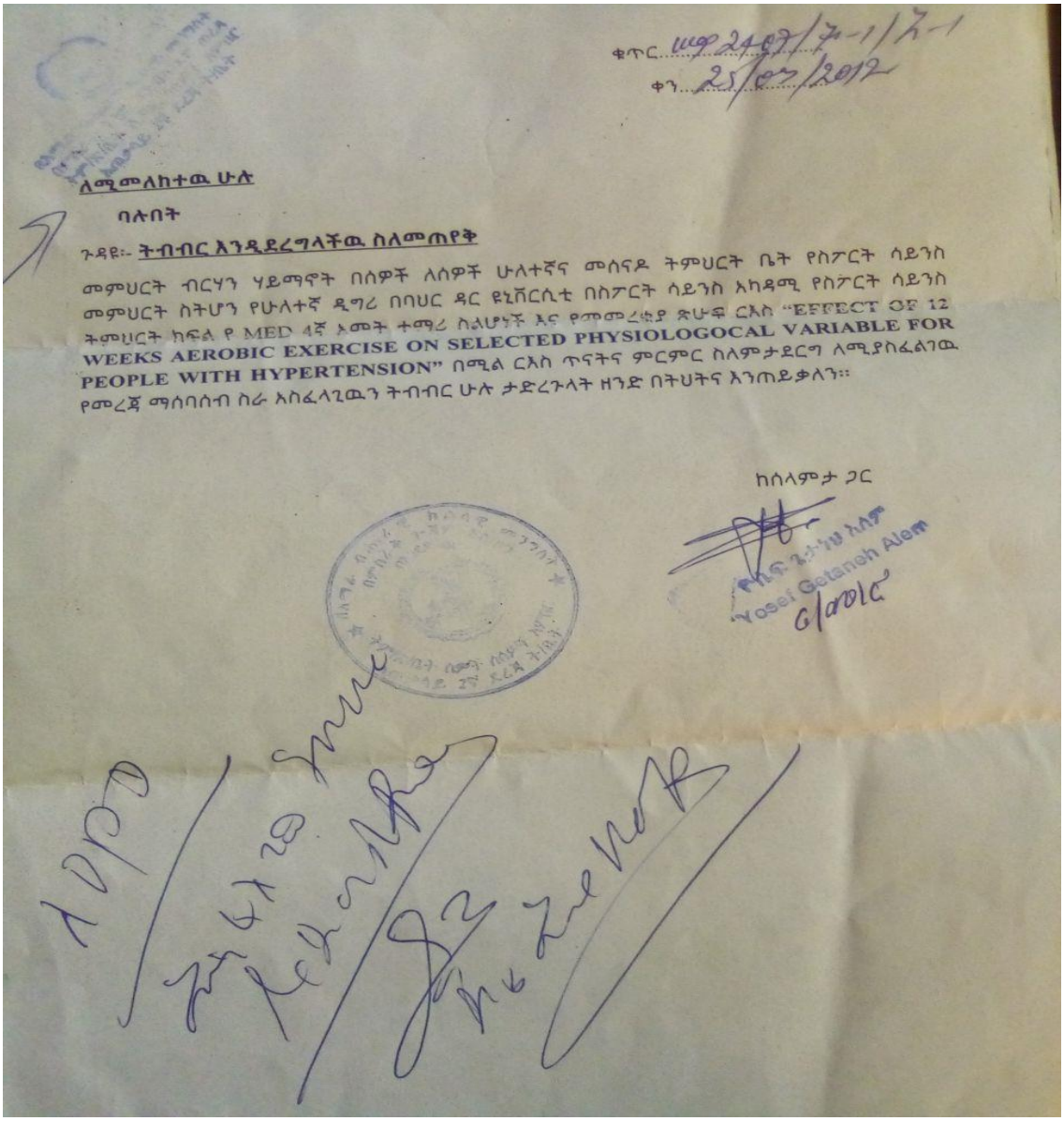
APPENDIX-E: Personal status of participant

Appendix Table 13 Personal status of participant table

No	Code	Sex	Age	Weight	Height
1	EG01	M	42	85.8	1.80
2	EG02	M	36	81.3	1.73
3	EG03	M	37	69.9	1.63
4	EG04	M	40	65.5	1.60
5	EG05	M	41	73.8	1.68
6	EG06	M	41	73.4	1.70
7	EG07	M	42	79	1.72
8	EG08	M	42	66	1.60
9	EG09	M	42	76.8	1.73
10	EG10	M	40	74.8	1.70
11	EG11	M	39	78	1.72
12	EG12	M	42	68.5	1.65
13	EG13	M	38	82.1	1.76
14	EG14	M	36	85.9	1.75
15	EG15	M	40	78.9	1.73
16	EG16	M	36	75.6	1.59
17	EG17	M	42	90.6	1.78

APPENDIX-FCollaboration letter

Appendix Figure 1: Collaboration letter



ቁጥር ሠዋ 24-07/ኑ-1/ኑ-1
ቀን 25/07/2012

ለሚመለከተዉ ሁሉ
ባሉበት

ጉዳዩ:- ትብብር እንዲደረግላችዉ ስለመጠየቅ

መምህርት ብርሃን ሃይማኖት በሰዎች ለሰዎች ሁለተኛና መሰናዶ ትምህርት ቤት የስፖርት ሳይንስ መምህርት ስትሆን የሁለተኛ ዲግሪ በባህር ዳር ዩኒቨርሲቲ በስፖርት ሳይንስ አካዳሚ የስፖርት ሳይንስ ትምህርት ክፍል የ MED 4ኛ ዓመት ተማሪ ስለሆነች እና የመመረቂያ ጽሁፍ ርእስ "EFFECT OF 12 WEEKS AEROBIC EXERCISE ON SELECTED PHYSIOLOGOCAL VARIABLE FOR PEOPLE WITH HYPERTENSION" በሚል ርእስ ጥናትና ምርምር ስለምታደርግ ለሚያስፈልገዉ የመረጃ ማሰባሰብ ስራ አስፈላጊዉን ትብብር ሁሉ ታድረጉላት ዘንድ በትህትና እንጠይቃለን።

ከሰላምታ ጋር
Yosef Getaneh Alem
G/ወ/ር

APPENDIX-G: Aerobic exercise

Appendix Figure: 2subject while to do Aerobic exercise