"EFFECTS OF 12 WEEKS OF AEROBIC EXERCISES PROGRAM ON WEIGHT LOSS OF SEDENTARY OVERWEIGHT WOMEN IN HARAR CITY, EASTERN ETHIOPIA"

MSc. THESIS

GOSAYE WONDYFRAW WORKU

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"EFFECTS OF 12 WEEKS OF AEROBIC EXERCISES PROGRAM ON WEIGHT LOSS OF SEDENTARY OVERWEIGHT WOMEN IN HARAR CITY, EASTERN ETHIOPIA"

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As Thesis Research Advisors, we hereby certify that we have read and evaluated this thesis entitled "**Effects of 12 weeks of aerobic exercises program on weight loss of sedentary overweight women in Harar city, eastern Ethiopia"** prepared by Mr Gosaye Wondyfraw Worku we recommend That it can be submitted as fulfilling the thesis requirement.

Shemelis Mekonnen (PhD)	_____	_____
Major Advisor	Signature	Date
Desta Enyew(PhD)	_____	_____
Co-Advisor	Signature	Date

As Member of the Board of Examiners of the Master of Science. Thesis open defense examination, we certify that we have read and evaluated the thesis prepared by Gosaye Wondyfraw Worku and examined the candidate. We recommend that the Thesis can be

accepted as fulfilling the thesis requirement for the Degree of Master of Science in Sport Medicine.

_____	_____	_____
Chairperson	Signature	Date
_____	_____	_____
Internal Examiner	Signature	Date
_____	_____	_____
External Examiner	Signature	Date

DEDICATION

Dedicated to My beloved mother, Tenaye Gebratsadik for nursing me with affection and love, and for her immense contribution in the success of my life.

STATEMENT OF THE AUTHOR

First, I declare that this thesis is my genuine work and that all sources of materials used for this thesis have been duly acknowledged. This thesis has been submitted in partial fulfillment of the requirements for Master of Science. Degree in Sport Science (Sport Medicine) at Haramaya University and is deposited at the University Library to be made available to borrowers under rules of the Library. I solemnly declare that this thesis is not submitted to any other institution anywhere for the award of any Academic Degree, Diploma, or Certificate. Brief quotations from this thesis are allowable without special permission, provided that accurate acknowledgement of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the Head of the Major Department or the Dean of the School of Graduate

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Name: Gosaye Wondyfraw Worku, **Signature:**_____

_____

Department: Sport Science

Place: Haramaya University, Haramaya

Date of Submission: _____

BIOGRAPHICAL SKETCH

The Author, Gosaye Wondyfraw Worku, was born in East Hararge zone, Harar City on July, 14 1992. He attended his Primary and secondary Education at Harar Ras Mokonnen Junior School and Harar Junior School, respectively. After he completed his of primary and secondary education, he joined Haramaya University for his BSc degree in the field of sport science. Then in 2013 he employed as sport expert in Harari Sports Commission. In March 2014, he joined Haramaya University to pursue his Master of Science Studies in Sport Medicine.

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ACRONYUMS AND ABBREVIATIONS

ACSM	American College of Sport Medicine
ANCOVA	Analysis of Covariance
BMR	Basal Metabolic Rate
BMI	Body Mass Index
CG	Control Group
CHD	Coronary Heart Disease
CVD	Cardio Vascular Disease
CSAE	Central Statics Agency of Ethiopia
CSA	Central Statistical Agency
CVE	Cardio Vascular Endurance
DREW	Dose Response To Exercise in Women
EG	Experimental Group
EI	Energy Intake
EIEE	Exercise Induced Energy Expenditure
ET	Exercise Training
HDL	High Density Lipoproteins
HF	Heat Failure
HRmax	Maximum Heart Rat
LBM	Lean Body Mass
LDL	Low Density Lipoproteins
MD	Mean Difference
PA	Physical Activities
PT	Pre-test
PoT	Post Test
RCTs	Randomized Controlled Trials
SD	Standard Deviation
STRRITDE	Studies of a Targeted Risk Reduction Intervention Through Defined Exercise
	Statistical Package for Social Sciences

SPSS	United States
US	Waist Circumference
WC	World Health Organization
WHO	Waist Hip Ratio
WHR	

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ABSTRACT

The general objective of this study was to investigate the effect of 12 weeks aerobics exercise program on weight loss of sedentary overweight women of Arab Ali Gymnasium users in Harar city. Eighty overweight human subjects whose BMI was 24.22 - 27.85 kg/m^{2}and age in between 25-35 years participated in this study. Forty overweight women participated in moderate intensity aerobics (~ 65-75% of HR max) physical training program for three consecutive months three days per week 60 minutes per day. PT and PoT tests were taken and analyzed accordingly. The training program included warming up, light stretching, brisk walking, running, cycling, and aerobics dance. The mean values of participants' age was 30.15 and 30.50 for control group and experimental group respectively. The mean values of participants' height was 164.95 and 164.75 for control group and experimental group respectively. The mean value of body weight before training was 72.15and 73.25 after

training for control group. The mean value of body weight before training was 71.20 and 67.15 after training for experimental group. The mean of body weight was increased by 1.52% for control group and 5.688% was reduced in experimental group throughout the study period. In the experimental group weight of body of the participants were reduced significantly due to aerobics training. In waist circumference test, the mean value of control group was increased but in experimental group waist circumference was decreased markedly. The mean difference showed that there was improvement in the EG. The EG was decreased 9.34% but 1.04% was increased for the CG The test measurements used to identify the improvements BW, BMI, and WC. Based on the findings, it was concluded that moderate intensity aerobics physical training program had a positive effect on body weight reduction and waist circumference reduction of the subjects.

***Key Words**: Aerobics training, body weight, Waist Circumference*

1. INTRODUCTION

This chapter includes background of the study, statement of the problem, scope of the study, significance of the study and objective of the study.

1.1. Back Ground of the Study

Overweight and obesity is a major public health problem worldwide. For example, the World Health Organization reported that the global prevalence of overweight and obesity in adults, defined as a body mass index (BMI)≥25 kg/m2 ,is approximately 2 billion, and by the year 2015, will increase to approximately 3 billion (George *et al*., 2012).Obesity is a major public health problem in the world. The number of obese peoples increases significantly, and developing countries are highly concerned (World Health Organization, 2010).

Overweight is associated with long-term ill health and reduced life quality; it has been recommended that effective weight loss strategies be developed. Although caloric restriction has been the major weight loss strategy, it has been shown that exercise programs designed for fat loss result in an increase in cardio respiratory fitness and a preservation of fat-free mass. Most exercise programs designed for weight loss have focused on steady-state exercise (SEE) of around 30min at a moderate intensity on most days of the week. Disappointingly, these kinds of exercise programs have led to little or no fat loss. Thus, what is needed is an exercise protocol that can be carried out by overweight, inactive individuals that more effectively induces fat loss. The increase of exercise capacities and physical fitness result in several health benefits (Vanhees *et al.,* 2007).

Aerobic-type training of between 225 and 420 min/week is recommended to those who wish to lose fat mass by increasing physical activity levels,(Swift *et al*., 2014) but very high intensity,

short duration training might also be effective.(Trapp *et al*., 2008).The Australian National Physical Activity Guidelines for Adults recommend more than 30 min of daily physical activity (Wiliam *et al*., 2016).Numerous studies have investigated the effects of exercise training, demonstrating significant improvements to CVD risk factors after aerobic exercise training. However, it is unclear whether health benefits are limited to aerobic training or if other exercise modalities such as resistance training or a combination are as effective or more effective in the overweight and obese (Suleen *et al*., 2012).

An excess of energy intake relative to energy expenditure is the central reason for the development of obesity. It occurs due to storage of excess energy as adipose tissue. As the incidence of obesity increases, the significant health and economic consequences also increase. Obesity, which has been linked to a variety of chronic diseases, results in almost 300000 deaths each year, and causes 117 billion dollars' worth of direct and indirect annual costs in the United States.(Ays *et al*., 2006). Aerobic exercise is a commonly prescribed method of weight management, with sustained increases in daily energy expenditure intended to promote energy deficit and weight loss. However, the regulation of energy balance is a dynamic process in which individual components of energy balance interact in a coordinated fashion. Consequently, adjustments in exercise induced energy expenditure (EIEE) may elicit compensatory changes in other components of energy balance that attenuate the prescribed energy deficit and subsequent weight loss. Indeed, compensatory changes in hunger and energy intake (EI) are commonly cited as reasons why exercise often produces modest weight loss (1.5 to 3.0 kg over 3 to 12 months) that is less than expected theoretically (Thomas *et al*., 2012)

Obesity is a major risk factor for many cardiovascular (CV) diseases such as coronary heart disease (CHD), heat failure (HF), stroke, ventricular dysfunction, and cardiac arrhythmias (Damos *et al*., 2014). Overweight and obesity is fundamentally caused by energy imbalance

between calories consumed and calories expended (Musa *et al*., 2013).Aerobic training (AT) comprises several modes of activities that primarily stress the aerobic energy system and produce a number of cardiovascular (CV) and respiratory adaptations that increase endurance. High levels of aerobic fitness are mandatory for endurance athletes such as cyclists, distance runners, athletes, and swimmers (Ratamess, 2012).

In the United States (US), an estimated 68% of adults are either overweight or obese. Fat accumulation and especially visceral fat (i.e., abdominal fat that surrounds the vital organs on the trunk and stomach area of the body) is associated with cardiovascular diseases type II diabetes, metabolic syndrome, excess weight, weakness, falls and fatigue (Joav *et al*., 2013).During exercise substrate metabolism primarily depends on exercise intensity, such that absolute rates of fat oxidation increase and then decline with increasing intensity, whereas rates of carbohydrate oxidation progressively increases with exercise intensity. This is known as the "crossover concept" of exercise substrate metabolism. The dynamics of fat oxidation with increasing exercise intensity can be depicted as a bell-shaped relationship (Pernille *et al*., 2015). The prevalence of overweight and obesity has increased to epidemic proportions in the industrialized world and it is now dramatically rising in low and middle income countries particularly in urban settings. It is well known that regular physical activity (PA) provides health benefits and it is considered an essential component of primary and secondary prevention form of metabolic- syndrome related pathologies. Recent experimental data suggests that subjects who increased their level of PA over time have a decreased mortality rate compared to those who were consistently unfit (Giani *et al*., 2015).

1.2. Statement of the Problem

Many research studies said that physical exercise was important for the development of all physical fitness and to keep ideal body weight. Now days because of sedentary life a lot of peoples were attacked by chronic disease as a result of overweight and obesity. Coronary heart

disease, hypertension, diabetes, and some other upcoming diseases are caused by overweigh problems. According to many research studies finding physical inactivity is one of the causes for development of chronic disease and poor fitness. Similarly, in Harar city people were living sedentary lifestyle due to poor culture of having regular physical exercise.

Physical fitness training was mandatory for every individual to maintain good health and to prevent body weight. Aerobic exercises was more vital to burn out extra calories that stored in human`s body. So aerobic exercise was very important to improve excess weight of body, aerobic capacity (cardiovascular endurance) as well as reduce the chance of being exposed to chronic diseases. However the main emphasis was on this issue. With this in mind the research was conduct to find out the "Effects of 12 weeks of aerobic exercises program on weight loss of sedentary overweight women in Harar city, Ethiopia".

Therefore this study was tried to answer the following research questions:-

1. What is the effect of aerobic exercise on body weight of sedentary overweight women?

2. Does the selected intensity aerobics exercise program make any change on body weight of research participants?

3. What is the effect of aerobics exercise on improvement of waist circumference for sedentary overweight women?

1.3. Scope of the Study

Scope of this study was on the Harar city sedentary overweight women of age ranges from 25-35 years old. This study was cover sedentary overweight women living in Harar city. The aim of this study was to assess the effect of aerobics exercise on reducing body weight of overweight sedentary women. Out of many aspects the variables that were addressed in this study was body weight and waist circumference, in reducing their fat.

1.4. Significance of the Study

Currently, enhancement of body weight efficiency is designed upon critical study of human physiology, modern way of feeding and scientific way of training based upon a new findings and principles of investigation. This study was highly concentrated on the effects of 12weeks aerobics exercise programs in improving bodyweight and waist circumference among sedentary overweight women in Harar city, but it does not mean that the outcome of this research is only restricted to Harar city sedentary overweight women.

This research will contribute in addressing the effects of 12weeks aerobics exercise program for gymnasium instructors, overweight women and managers to understand formulate and implement on designing effective strategies for aerobics exercise training program. The study also helps to develop our country's overweight and obese individuals to become health and physically fit as of the world class by improving their physical fitness. In addition, it will help for others as a research work for depth studies on the problem undertaken. The finding of the research may help as reference for researchers who will conduct advanced researches of exercise physiology particularly in aerobics exercise program effect.

1.5. Objective of the Study

1.5.1. General objective

The general objective of this study was to examine the effect of 12 weeks aerobic exercise program on weight loss of sedentary overweight women in Harar city.

1.5.2. Specific objectives

- To examine the effect of aerobic exercise on improvement of body weight of sedentary overweight women.
- To assess the effect of moderate intensity aerobic exercise program on weight loss of sedentary overweight women.
- To identify the effect of aerobics exercise program on waist circumference of Harar city sedentary overweight women.

2. LITERATURE REVIEW

This chapter includes overweight and obesity, body composition, components of health related physical fitness, health related physical fitness test , test for cardiovascular endurance, test for muscular strength ,test for muscular endurance , test for flexibility , test for body compositions, physical activity and the prevention of weight gain, aerobic exercise and its benefits, aerobic exercise, types of aerobic exercise, benefits of aerobic exercise, aerobic exercise intensity on weight loss, benefits of regular exercise, weight compensation for aerobic exercise training, effect of aerobic exercise on body composition, studies on aerobic exercise, weight loss from high volume aerobic exercise training without caloric restriction, weight loss from aerobic exercise at public health recommendation levels,exercise and weight maintenance, sedentary lifestyle and its effects, sedentary lifestyle,effects of sedentary life style,contributing effects of aerobic exercise intensity or resistance training on weight loss.

2.1. Overweight and Obesity

Although being overweight is what bothers most people, it is really the amount and location of fat (%BF, abdominal fat mass) that should be of concern. Excess weight can be caused by high levels of lean muscle mass, but additional muscle mass is beneficial. Except in rare instances, such as providing protection from the cold water for an English Channel swimmer or certain wasting diseases, excess fat is generally not beneficial. There are no universally agreed upon acceptable %BF standards. The most typically used normal values for young adults (20–29 yr) are 12–15% for males and 22–25% for females with an allowance of an additional 2% for each decade of age. Obesity is defined as +5% BF above the normal value (Kaminsky and Dwyer, 2006).

2.1.1. Body composition

Body composition is defined as the partitioning of body mass into FFM (weight or percentage) and fat mass (weight or percentage).Compartmentalizing the body into only fat and FFW (not water, mineral, protein, and fat) and using this two-compartment model to determine percent body fat (%BF) depends on the following assumptions:

1. The densities of the fat and the FFW are known and additive.

2. The densities of water, bone mineral, and protein that make up the FFW are known and are relatively constant from individual to individual.

3. The percentage of each fat-free component is relatively stable from individual to individual.

4. The individual being evaluated differs from the assumptions of the equation being used only in the amount of storage fat.

Skin folds

The most widely used anthropometric estimation of body size or composition involves the measurement of skin folds at selected sites. Skin folds (sometimes called fat folds) are the double thickness of the skin plus the adipose tissue between the parallel layers of the skin (Figure 7.4). Because skin thickness varies only slightly among individuals, skin fold measures generally indicate the thickness of the subcutaneous fat (Behnke and Wilmore, 1974). Technically, however, adipose tissue (and thus the subcutaneous fat fold) has both a fat component and a fat-free component. The fat-free component is composed of water, blood vessels, and nerves. As the fat content of the adipose tissue increases (as in obesity), the water content decreases (Roche, 1987). The use of skin fold thicknesses to estimate body composition is based on two assumptions. The first is that selected skin fold sites are representatives of the total subcutaneous adipose tissue mass. In general, evidence supports this assumption (Roche, 1987). The second assumption is that the subcutaneous tissue mass has a known relationship with total body fat. Table 7.2 shows the distribution of total body fat

and the relative percentages of each storage site for a reference male and a reference female 20–24 years old.

Body Mass Index

Mass Index (BMI) is a ratio of the total body weight to height. Several ratios have been proposed, but the one used most frequently is weight (in kilograms) divided by height (in meters) squared [WT ÷ HT^2 (kg.m−2)]. This ratio is also known as the Quetelet index (Brodie, 1988). Calculated BMI can then be compared against standard values to determine whether the individual has acceptable body weight, is overweight, or is obese

2.3.2. Components of Health Related Physical Fitness

Physical fitness is the ability to function effectively in physical work, training, and other activities and still have enough energy left over to handle any emergencies which may arise. The components of health related physical fitness are as follows:

Cardiovascular Endurance: the efficiency with which the body delivers oxygen and nutrients needed for muscular activity and transports waste products from the cells. Cardiovascular endurance, sometimes called cardio respiratory fitness, aerobic fitness, or aerobic capacity, is one of the basic components of physical fitness. Cardio respiratory fitness is a condition in which the body's cardiovascular (circulatory) and respiratory systems function together, especially during exercise or work, to ensure that adequate oxygen is supplied to the working muscles to produce energy. Cardio respiratory fitness is needed for prolonged, rhythmic use of the body's large muscle groups. A high level of cardio respiratory fitness permits continuous physical activity without a decline in performance and allows for rapid recovery following fatiguing physical activity.

Muscular Strength: refers to the force or tension that can be generated by a muscle or muscle group during one maximal effort (Physiology of Exercise: Responses and Adaptations, 2nd edition).

Muscular Endurance: the ability of a muscle or muscle group to perform repeated movements with a sub-maximal loads for extended periods of times (Gutin, 1980).

Flexibility: Flexibility is the degree to which body segments can move or be moved around a Joint. (Brown, 1986)

2.2. Health Related Physical Fitness Test

2.2.1. Test for Cardiovascular Endurance

Twelve minute run / walk test: This test objective is to measure the cardiovascular endurance of the participants. For this test the participants will run for 12 minutes, and the total distance covered will be recorded. The participants can walk also, though the participants will encouraged to push's them as hard as they could. The average distance for men is 2200-2399m for the age 20-29, 1900-2299m for the age 30-39, 1700-2099m for the age 40-49, 1600-1999m for the age 50. For the female 1800-2199m for the age 20-29, 1700-1999m for the age 30-39, 1500-1899m for the age of 40-49, 1400-1699m for the age 50.(Cooper, 1968)

2.2.2. Test for Muscular Strength

Push up test: The push-up test is a basic fitness test used by coaches, trainers and athletes to assess upper body fitness and to monitor progress during strength and fitness training. This test helps you compare your own upper body muscular endurance to others of your age and gender, and track your fitness program over time (sports medicine.about.com). Men should use the standard "military style" pushup position with only the hands and the toes touching the floor. Women have the additional option of using the "bent knee" position. To do this, kneel on the floor, hands on either side of the chest and keep you back straight. The average number of pushups for men is 19-34 for the age 17-19, 17-29 for the age 20-29, 13 24 for the age 30-39, 11-20 for the age 40-49, 9-17 for the age 50-59, 6-16 for the age 60-65 and for women's is 11-20 for the age 17-19, 12-22 for the age 20-29, 10-21 for the age 30-39, 8-17 for the age 40-49, 7-14 for the age 50-59, 5-12 for the age 60-65. (Golding *et al.,* 1986).

2.3.3. Test for Muscular Endurance

Sit up Test: The objective of this test is to measure abdominal muscular strength and endurance of the abdominals and hip-flexors, important in back support and core stability. For this test Subjects lays on her back on the mat with knee bent and feet about two feet apart. Her hands are placed on the back of the neck with the fingers interlocked. Elbows are retracted. Assistance data collector holds the subject ankles down, the heels being in contact with the mat at all times. The subject sits up, turning the trunk to the left and touching the right elbow to the left knee, returns to starting position, and then sits up turning the trunk to the right and touching the left elbow to the right knee. The maximum number of sit ups done within 30 seconds will be taken as her score. The average sit ups for female is 29-39 for the age 18-25, 25-28 for the age 26-35, 19-22 for the age 36-35,14-17 for the age 46-55,10-12 for the age 56-65, 11-13 for the age 65+. (Golding *et al*., 1986).

2.3.4. Test for Flexibility

Sit and reach test: This test measures the flexibility of the lower back and hamstring muscles. It involves sitting on the floor with legs out straight ahead. Feet (shoes ohm are placed with the soles flat against the box, shoulder-width apart. Both knees are held flat against the sit and reach apparatus by the tester. With hands on top of each other and palms facing down, the subject reaches forward along the measuring line as far as possible. After three practice reaches, the fourth reach is held for at least two seconds while the distance is recorded. Make sure there is no jerky movements and that the fingertips remain level and the legs flat. The score is recorded to the nearest centimeter as the distance before (negative) or beyond (positive) the toes. The average score for boys is between +0 to +5cm and girls is +1 to +10cm. (Wells and Dillon,1952)

2.2.5. Test for Body Compositions

Body mass index: BMI (Body Mass Index) is a measurement of body fat based on height and weight that applies to both men and women between the ages of 18 and 65 years. BMI can be used to indicate if you are overweight, obese, underweight or normal. A healthy BMI score is

between 20 and 25. A score below 20 indicates that you may be underweight; a value above 25 indicates that you may be overweight (www.bmi-calculator.net). BMI is just a guide - it does not accurately apply to elderly populations, pregnant women or very muscular athletes such as weight lifters. (WHO, 2012).

2.3. Physical Activity and the Prevention of Weight Gain

Changes in weight are affected by the amount of energy expended versus the amount of energy consumed (Thomaset *et al*., 2012). Therefore, if the energy expenditure remains low, but dietary consumption levels are in excess, weight gain will occur. Several researchers have argued that declines in physical activities in occupational and leisure settings (Fogelholm, 2000) may have an important role in the increase in obesity rates over the last 30+ years. Furthermore, many epidemiological studies suggest that physical activities have an important role in weight gain (Saris *et al*., 2003).

(Williams *et al*. 2007), using data from the National Health and Nutrition Examination Survey observed that low levels of self-reported recreational physical activities was associated with a 3-fold greater risk of major weight gain in men and almost a 4-fold in women. In a prospective study of 34,079 middle aged women (mean: 52.2 years). (Pulee *et al*., 2010). Observed that in women physical activities physical activities Author Manuscript physical activities Author Manuscript physical activities Author Manuscript in less than 7.5 metabolic equivalent hr/wk compared to women who participated in greater than (Saris *et al*., 2003) metabolic equivalent hr/wk (approximately 300 minutes/week of moderate physical activities).

Several studies using the aerobic centre longitudinal study database have observed that CRF level (Van *et al*., 2007) physical activities level and change in physical activities level 24 are inversely associated with future weight gain. Clearly, physical activities and CRF levels have an important role in weight gain for those at risk

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.

Aerobic exercise use large muscle group to increase heart rate. This causes faster and dipper breathing which maximize the oxygen in the blood. There are many studies which prove that cardiovascular endurance improved after aerobic exercise. Correctly performed aerobic exercise causes positive change in the body’s cardio respiratory system. During maximum aerobic exercise the trained individual has increased maximum oxygen consumption and is better able to process oxygen and fuel can provide more energy to working muscle. Aerobic capacity is the most widely accepted single indicator of one’s cardio respiratory fitness level and it is one of the best types of activity for training and maintaining allow percentage of body fat. (Probart *et al*., 1991)

2.4.2. Types of Aerobic Exercise

Any activity that uses large muscle groups, can be maintained continuously, and is rhythmical in nature can be regarded as an aerobic exercise. In general aerobic exercise requiring little skill to perform is more commonly recommended for adults to improve fitness. Aerobic exercise that require minimal skills and can be easily modified to accommodate individual physical fitness levels included brisk walking, leisure cycling, swimming, aqua aerobics and slow dancing. Aerobic exercises that are typical performed at higher intensity and, therefore, are

recommended for persons who exercise regularly included jogging, running, aerobics, stepping exercise, fast dancing and elliptical exercise. (Walter*et al*., 2010)

2.5. Benefits of Aerobic Exercise

The benefits of aerobic exercise are myriad. They include systemic changes such as reduced cholesterol and blood pressure, improved muscular endurance, reduced body fat, increased metabolism, to name a few. Aerobic activities strengthen the heart and lungs, making them more efficient and durable, improving quality and quantity of life. Exercise not only extends your life, but also gives you more energy to live it to the fullest. Aerobic exercise improves the strength of your bones, ligaments and tendons, allows your body to use fats and sugars more efficiently, burns lots of calories and plays an important role in reducing the onset and symptoms of aging and illness. Aerobic exercise reduces your risk of heart disease, vascular disease and diabetes and can help those trying to quit smoking by relieving cravings and improving lung function. Research has confirmed that aerobic exercise reduces stress and combats depression as it raises self-esteem and physical and wellness (Kathleen, 2006).Regular exercise causes your body to make adjustments that result in improved health and physical functioning. Continuing with regular exercise enables your body to maintain these benefits. Regularly doing the right types of aerobic exercise at the correct intensity, and for an appropriate duration, results in the most benefit. The benefits of aerobic exercise can be broadly categorized as either ‘fitness’ (physical capacity) or ‘health’. Fitness and health are linked, and most forms of aerobic exercise will help you achieve both. Regular aerobic exercise improves your cardiovascular fitness by increasing your capacity to use oxygen. It does this by increasing your heart’s capacity to send blood (and hence oxygen) to the muscles. This is mainly achieved through an increase in the size of the heart’s pumping chambers (ventricles), which means that your heart doesn’t have to beat as fast to deliver the same amount of blood.

This is evident in a slower resting heart rate, and a slower heart rate for the same exercise intensity. Regular aerobic exercise has been shown to reduce the risk of heart disease, high blood pressure, type 2 diabetes, colon cancer and breast cancer. It can lower blood pressure and improve your blood cholesterol by reducing the levels of LDL-cholesterol (so-called ‘bad’

cholesterol) and increasing the amount of HDL-cholesterol (so-called ‘good’ cholesterol). It can also reduce anxiety, stress and depression, as well as instilling a general sense of well-being. Regular aerobic exercise has even been shown to have the potential to increase your lifespan.

Low-impact aerobic exercise such as, swimming is valuable for improving general health and fitness in people who have arthritis or other conditions that limit their ability to do weight-bearing exercise. Importantly, whereas fitness tends to be quite specific, 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)

2.6. Aerobic Exercise Intensity on Weight Loss

Vigorous intensity aerobic has been shown to have enhanced health benefits for important risk factors, including visceral fat, measures of glucose/insulin metabolism (DiPietro *et al*., 2006) compared to moderate intensity aerobic training. In terms of weight change, when different intensities of aerobic exercise training are matched for caloric expenditure or aerobic training dose, both vigorous and moderate intensity aerobic exercise training result in similar amounts of weight loss. (O’Donovan *et al*., 2005) in resistance training of 64 obese men observed similar changes in weight following 6 months of moderate intensity (−1.1 kg) and high intensity (−0.5 kg) aerobic exercise training. In the study of (Kraus *et al*., 2002) observed similar weight loss in overweight/obese adults participating in 8 months of moderate (−0.6 kg) and high intensity (−0.2 kg) aerobic exercise training at the same exercise dose (14 kilocalories per kg per week). Vigorous intensity aerobic exercise training can contribute to greater weight loss if matched for session time compared to moderate intensity aerobic exercise training because the total energy expenditure is greater. Thus, if vigorous aerobic exercise training can be sustained and is enjoyable for the patient, the exercise program may induce additional health benefits and potentially increase the energy expenditure seen with exercise training (if replacing the exercise time of moderate intensity training).

2.7. Benefits of Regular Exercise

Exercise mode recommendations for specific health benefits remain unclear due to in large part to the sparse scientific data supporting this recommendation. Approximately two-thirds of United States adults are overweight or obese. Although professional organizations have historically focused exercise guidelines on endurance or aerobic training(at) for weight loss and maintenance (Jakicic *et al*.,2001), recent guidelines and position statements targeting body weight reduction and maintenance have suggested that resistance training may also be effective for reducing fat mass. In some cases guidelines may lead to misperceptions among clinicians, exercise professionals, and laypersons about the strength of the evidence regarding the effectiveness of resistance training for inducing weight and fat mass loss (Williams *et al.,* 2007) leading the reader to believe that resistance training has been conclusively shown to reduce fat mass. However, close examinations of the published literature reveals that randomized controlled trials are inconclusive on this point (Castneada *et al*., 2002).

2.8. Weight Compensation for Aerobic Exercise Training

Individuals who lose less weight than expected based on their training energy expenditure have been termed "weight compensators." Several studies have examined weight compensation after aerobic exercise training. (King *et al*., 2008) observed increased energy intake and increased fat intake in weight compensators compared to those that did not compensate for weight loss.

Using data from the (Church *et al*.,2009) examined weight compensation in postmenopausal women who were required to perform exercise training at 50%, 100% and 150% of public health recommendations, and restricted the analysis to those who were 85% compliant to exercise training. The authors observed that the most weight compensation (less weight loss achieved than predicted from exercise training alone) occurred in the women exercising at 150% of the recommended volume. In fact, the amount of actual weight loss achieved in women exercising at 50% (−1.4 kg) and 150% (−1.5 kg) of the physical activities recommendations were virtually identical to each other despite the greater level of energy weekly energy expenditure in the 150% groups.

(Thomas *et al*., 2012) performed an analysis of weight change from aerobic exercise training interventions, and concluded that the major factors limiting the expected weight loss from aerobic exercise training were dietary compensation and low aerobic exercise training dose. At the present time, evidence is limited to explain whether other factors of the energy balance equation, including compensatory changes in non-exercise physical activities (except for perhaps older adults), resting metabolic rate, movement efficiency, or changes in lean mass, are responsible for weight compensation with exercise training

2.9. Effect of Aerobic Exercise on Body Composition

Regular aerobic exercises reduce the body fat percentage without the loss of the muscle as well as important effect on anthropometric and hematologic level of obese and overweight women (Evrim *et al*., 2010). Aerobic exercise including walking, running, and swimming has been proven to be an effective way to lose weight; Body Composition Changes for over fat or borderline over fat people, regular aerobic exercise reduces body mass and body fat. Increases in fat free body mass also accompany a regular program of resistance training. Exercise only, or exercise combined with calorie restriction, reduces body fat more than fat lost with only dieting because exercise conserves the body's lean tissue mass (Katch *et al*., 2011).Cardiovascular endurance (CVE) is one of the most important measures of overall health. A person's level of cardiovascular endurance helps predict probability of disease, quality of life, and ability to react to acute physical and mental stress. For healthy individuals, higher cardiovascular endurance also indicates an elevated level of physical fitness. (Corbett, 2009)

2.10. Studies on Aerobic Exercise

(Selvam and Sudha 2008) conducted a study on selected effect of aerobic exercise on selected physiological variables among college girls. For this study aerobic exercise uses large muscle groups rhythmically and continuously and elevates the heart rate and breathing for a sustained period. Common examples include walking, jogging/running, swimming, rowing, stair climbing, bicycling, cross country skiing, step and dance exercise classes, roller skating, and

the more continuous forms of tennis, racquet ball and squash. To achieve this purpose, 60 girls were selected from Theivannai Ammal College for women, Villupuram. The age group of the subjects ranged between 18 to 20 years. The selected subjects were divided into two groups. The groups first trained for aerobic exercise. The training group underwent the training for 5 days in a week for eight weeks and group second acted as control group to make adjustments for differences in the initial means and test the adjusted post-test means for significant differences. The researcher used analysis of covariance (ANCOVA) for interpreting the results. The results for the study revealed that aerobic exercise had a significant effect in the improvement of the physiological variables such as resting pulse rate, breath holding time, vital capacity and respiratory rate.

(Selvalakshmi 2007) conducted a study on the effect of varied aerobic training programmes on obese women working in IT companies for the purpose of the study. For this study, the obese women were grouped into three namely, control, floor aerobic and step aerobics group. The collected data on the cardio respiratory parameters prior to and after 12 weeks of varied aerobics training were statistically analysed using analysis of covariance (ANCOVA) and result on vital capacity showed significant improvement due to varied aerobic exercises, as where no significant improvement was found in resting heart rate.

(Ozcan and Ozturk , 2011) in Mugale, Turkey conducted the study on the effect of twelve week aerobic exercise programme on health related physical fitness components and blood lipids in obese girls .The aim of the study was to investigate the effects of 12 week aerobic exercise program on health related fitness components and blood lipids in obese girls. In this study, a total of 40 girls were recruited as exercise group (n = 20) and control group (n = 19). Participants joined sessions for 60 min per day, 3 days per week for 12-week. There were significant differences in weight, body mass index (BMI), flexibility, sit-ups, hand grip for both hands , skin fold measurements (thigh, triceps, biceps, abdomen, super iliac, sub scapula, chest,

body fat percent, heart rate, high density lipoproteins (HDL), low density lipoproteins (LDL), total cholesterol, and triglyceride between pre-test and post test scores in the exercise group ($p<0.05$). It was concluded that regular aerobic exercise may affect health related fitness

components and blood lipids positively in girls. Furthermore, it may result in decreasing obesity in girls.(Mills and Mae 1994) conducted a study on the effect of low intensity aerobic exercise on muscle strength, flexibility and change of balance among sedentary elderly person. The purpose of this study was to determine the effects of a low intensity aerobic exercise program on muscle strength and flexibility of the lower extremities and balance among sedentary elderly persons. This pre and post-test quasi-experimental study consisted of 47 sedentary elderly subjects not engaged in regular exercise and living in metropolitan housing in south western Ohio. Convenience sampling was used with two apartment complexes randomly assigned to the experimental or comparison groups To prevent diffusion of treatment, subjects were assigned to these groups depending on their place of residence The 20 experimental subjects, with a mean age of 75.3, participated in eight weeks with low intensity of aerobic exercise while the comparison group (n=20), with a mean age of 74.8, maintained their usual level of activity for eight weeks.

Experimental subjects also did the exercise on their own between classes. The exercise group had significantly greater flexibility of the ankles and knee than the comparison group. No significant differences were found between the groups for muscle strength. Although balance and perception of balance were not significantly different between the groups; the experimental group improved their balance by 22.4% from pre-test.

(Arslan, 2011) conducted the study on the effects of an eight-week step-aerobic dance exercise programme on body composition parameters in middle-aged sedentary obese women in Aksaray Turkey .This study comprised an eight-week randomized controlled trial. For this study a total of 49 healthy sedentary obese women participated voluntarily. They were randomly divided into two groups: those undertaking a step-aerobic dance exercise programme (n=29) and a control group (n=20). The subjects took part in a step-aerobic dance exercise programme for one hour per day, three days a week for eight weeks. The subjects' Body Mass Index (BMI), weight, waist circumference, waist-hip ratio, four-site skin fold thickness, fat percentage, basal metabolic rate and lean body mass were assessed before and after the completion of the step-aerobic dance exercise programme.

After the eight weeks of the step-aerobic dance exercise programme, significant differences were found in the subjects' weight, BMI, body composition parameters, waist-hip ratio (WHR), waist circumference (WC), fat percentage, lean body mass (LBM) and basal metabolic rate (BMR) in the experimental group ($p<0.05$). There were no significant differences in the control group after the experiment in terms of the same measures ($P>0.05$) .The result of this study concluded that the step aerobic dance programme proved to be a useful exercise modality for weight loss and in terms of body composition. There was a clear response to the eight-week step aerobic dance programme in terms of central obesity in sedentary obese Turkish women.

2.11. Weight Loss from High Volume Aerobic Exercise Training without Caloric Restriction

Current ACSM recommendations state that exercise programs need to exceed 225 min/wk in order to possibly induce clinically significant weight loss.(Donnelly *et al*., 2009) Supervised ET studies which have demonstrated clinically significant weight loss with aerobic ET (without caloric restriction) have far exceeded the minimum levels of physical activity according to public health definitions.(Ross *et al*., 2000) observed an 8% weight loss in obese men after 12 weeks of aerobic ET with no alterations in dietary habits (daily exercise sessions of 700 kcal). In a different study, (Ross *et al*., 2004) observed a 6.8% weight loss in premenopausal women (BMI > 27) following 14 weeks of aerobic ET with an energy expenditure of 500 kcal per session. In the Midwest Exercise Trial, Donnelly, (n = 131) observed a 5.3% weight loss in men after 16 weeks of aerobic ET at approximately 2,000 kcal per week. In contrast, the women in the exercise group did not have a significant change in weight (0.7 kg) following the intervention, but the exercise program prevented the weight gain observed in the control group (2.9 kg). Thus, clinically significant weight loss is possible with aerobic ET without caloric restriction, but it requires a high ET volume. For the general population, these ET volumes may not be practical or sustainable.

2.12. Weight Loss from Aerobic Exercise at Public Health Recommendation Levels

Clinical trials of ET that report no weight loss or modest weight loss (<5 kg) still report numerous health benefits for overweight and obese adults with risk factors for disease. These benefits include improving CRF. (Johannsen *et al*., 2013) Weight loss as a result of aerobic ET is very heterogonous, and the overall response is related not only to total energy expenditure, but also compensatory changes in dietary caloric intake. (Thomas *et al*., 2012) Large randomized controlled trials (RCTs) which have evaluated the change in weight following aerobic ET programs consistent with PA recommendations have observed either no changes in weight or only modest weight loss. The following studies represent the strongest research design to evaluate changes in weight from aerobic ET as they have a large sample size of overweight or obese individuals at baseline, supervised ET sessions, strong adherence to their aerobic ET program, and comparison of weight change against a control group. The Dose Response to Exercise in Women (DREW) study (Church *et al*., 2007) (n = 464) observed no significant changes in body weight in postmenopausal women exercising at 50% (−0.4 kg), 100% (−2.2 kg) and 150% (−0.6 kg) of public health guidelines for 6 months despite greater than 89% adherence in all ET groups. The Inflammation and Exercise study (n = 129) (Church *et al*.,2010) observed no significant change in body weight (−0.4 kg) compared to the control group (0.1 kg) after 4 months of ET in adults with elevated C-reactive protein levels at baseline. The Studies of a Targeted Risk Reduction Intervention through Defined Exercise (STRRIDE) study (Kraus *et al*., 2002) (n = 84) observed significant, but minimal weight loss in those exercising at low amount/moderate intensity (−0.6 kg, 176 min/wk), low amount/high intensity (−0.2 kg, 117 min/wk), or high amount high intensity (−1.5 kg, 171 min/wk) following 6 months of aerobic ET. The Diabetes Aerobic and Resistance Exercise (DARE) study (Sigal *et al*., 2007) (n = 251) observed significant weight loss in the aerobic ET group (−0.74 kg) compared to the control group after 22 weeks of intervention in adults with T2DM. Thus, overweight and obese adults who adhere to an exercise program consistent with public health recommendations without a dietary plan involving caloric restriction can expect to experience weight loss in a range of no weight loss to approximately 2 kg. Clinicians should

caution their patients that the chances of substantial weight loss are unlikely at these ET levels without caloric restriction.(Donnelly *et al*., 2009)Regardless of the amount of weight loss, clinicians should emphasize that numerous health benefits occur in the absence of weight loss, and that maintenance of an active lifestyle will reduce the risk of future weight gain. (Fogelholm and, Kukkone, 2000)

Table 1 – Expected initial weight loss and possibly of producing clinically significant weight loss from different modalities of exercise training.

Modality	Weight Loss	Clinically Significant Weight Loss
Pedometer-based step goal	Range: 0–1 kg of weight loss	Unlikely
Aerobic exercise training only	Range: 0–2 kg of weight loss	Possible, but only with extremely high exercise volumes
Resistance training only	None	Unlikely
Aerobic and resistance training only	Range: 0–2 kg of weight loss	Possible, but only with extremely high volumes of aerobic exercise training
Caloric restriction combined with aerobic exercise training	Range: −9 kg to −13 kg	Possible

Source: (Damon *et al*., 2014)

2.13. Exercise and Weight Maintenance

The ACSM position stand on PA intervention strategies to promote weight loss and weight regain emphasizes the distinction between the minimum levels of PA to maintain health (150 min/wk) and higher levels of PA to prevent weight regain (200 min/wk). Therefore, obese individuals who have successfully lost weight require a substantial amount of PA to maintain this weight loss. As indicated in the ACSM position stand,(Donnelly *et al*., 2009)several major limitations to research of PA on weight regain exist including the observational and the retrospective nature of the existing literature from randomized trials.

However, several studies in this area deserve mentioning. Using data from a PA weight loss study,(Jakicic *et al*., 1999) observed a dose response between the amount of self reported PA per week and long-term success with weight loss at 18 months of intervention (composed of caloric restriction and ET). Adults who exercised greater than 200 min/wk (−13.1 kg) lost more weight compared to those who exercised between 150 and 199 min/wk (−8.5 kg), and those that exercised less than 150 min/wk (−3.5 kg). A different study by (Jakicic *et al*., 2003) observed similar findings in post hoc analyses of a weight loss intervention composed of both caloric restriction and exercise training in women. After 12 months of intervention, women with greater than 200 min/wk (13.6%) had maintained significantly greater percentage of weight loss compared to those who had exercised at 150–199 min/wk (9.5%), and less than 150 min/ wk (4.7%). Lastly, (Andersen et al., 1999) evaluated the effect of low fat diet (1200 kcal/day) in combination with either structured aerobic ET or lifestyle activity (patients were advised to increase their PA to recommended levels), and both groups lost approximately 8 kg of weight following 16 weeks of intervention.

Weight maintenance was monitored for 1 year after the intervention, and those who were the most active lost additional weight (1.9 kg) whereas the group that was the least active regained a substantial amount of weight (4.9 kg). These data suggest that PA has an important role in the amount of weight regain following successful weight loss. Clinicians should therefore advocate that their patients attempting to reduce recidivism after weight loss engage in PA levels above 200 min/wk. (Donnelly *et al*., 2009)

2.14. Sedentary Lifestyle and its Effects

2.14.1. Sedentary Lifestyle

A sedentary lifestyle is a type of lifestyle with no or irregular physical activity. It is commonly found in both the developed and developing world. Generally people who have a sedentary lifestyle spend time at the computer, watching TV, reading or sitting. They spend almost no time getting in any kind of physical activity and involve low levels of energy expenditure. (Marke *et al*., 2010)

2.15.2. Effects of Sedentary Life Style

A sedentary lifestyle and extended dose of sedentary behavior can result in dramatically increased metabolic risks and contribute too many preventable causes of death. (Hamburg *et al*., 2007). One of the main effects of sedentary lifestyles is becoming at high risk to diseases and illnesses, like ischemic heart attack and chronic hypertension. This is usually due to lack of exercise which will lead to increase in cholesterol level and blood pressure. Sedentary lifestyles can also cause deep vein thrombosis, which is a condition that involves a blood clot formed in one of your veins, usually in the legs. This may not be very disturbing at first, but it can be fatal once the clot dislodges and becomes an obstruction in the blood circulation of your heart and lungs. Another major effect of sedentary lifestyles is obesity.

Obesity can also lead to cardiovascular disorders, because of increased cholesterol level, and other neurological condition, such as stroke. This can also lead to even more medical condition such as fractures and muscle injury. The increase in weight of an obese person who seldom or does not exercise can make his bones prone to bone breakage. One fatal effect of this is when a broken part of the bone suddenly enters the bloodstream and becomes an obstruction to the blood circulation of the heart, lungs or brain. Low self-esteem can also happen if the person is disturbed by his increase in weight and body fat. Low energy level can also be one of the effects of sedentary lifestyles. Experts say that regular aerobic exercise can increase a person’s energy level and can help the body and mind become active. (http://www.noblepcs.com)

2.15. Contributing Effects of Aerobic Exercise Intensity or Resistance Training On Weight Loss?

Vigorous intensity aerobic ET has been shown to have enhanced health benefits for important risk factors, including visceral fat,(Irving *et al*., 2008) measures of glucose/insulin metabolism, and CRF,(O'Donovan *et al*., 2005) compared to moderate intensity aerobic ET. In terms of weight change, when different intensities of ET are matched for caloric expenditure or ET dose, both vigorous and moderate intensity aerobic ET result in similar amounts of weight loss. O'Donovan . in an RCT of 64 obese men observed similar changes in weight following 6 months of moderate intensity (−1.1 kg) and high intensity (−0.5 kg) aerobic ET. In the STRRIDE study,(Kraus *et al*.,2002) observed similar weight loss in overweight/obese adults participating in 8 months of moderate (−0.6 kg) and high intensity (−0.2 kg) aerobic ET at the same exercise dose (14 kcal per kg per week). Vigorous intensity aerobic ET can contribute to greater weight loss if matched for session time compared to moderate intensity aerobic ET because the total energy expenditure is greater. Thus, if vigorous aerobic ET can be sustained and is enjoyable for the patient, the exercise program may induce additional health benefits and potentially increase the energy expenditure seen with exercise training (if replacing the exercise time of moderate intensity training). Resistance ET and isometric exercises are important and sometimes overlooked aspects of an ET program that have many health benefits including increasing/maintaining muscular strength with aging (prevention of sarcopenia) and preserving bone mineral density. (Haskell *et al*., 2007) Although, resistance ET alone contributes to the reduction of body fat, the effect on overall weight loss is minimal. (Donnelly *et al*., 2009) In the Health Benefits of Aerobic and Resistance Training (HART-D) study, (Church *et al*., 2010) observed no significant change (−0.3 kg) in weight in the resistance ET group (n = 73) compared to a control group after the 9 month intervention. In the DARE trial, no significant difference was observed between the resistance ET group and the control group (0.3 kg). (n = 86) observed no significant change in weight (0.07 kg) following 8 months of intervention in the STRIDDE AT/RT study. (Bateman *et al*., 2011) Overall, little evidence exists that resistance training alone promotes weight loss.

3. MATERIALS AND METHODS

This chapter includes description of experimental site,study period, definition of variable, experimental design, source of data, study population, sampling size and sampling techniques, inclusion and exclusion criteria, data collection instrument, method and procedures of data collection, body weight, waist circumference description, aerobics training protocol, data quality control, methods of data analysis, ethical consideration.

3.1. Description of Study Area

The practical experiment was conducted at Harar city which is located in the Eastern Ethiopia 527km far from Addis Ababa. The experimental site is located at 42º 07’05’’`E longitude and 9º 18’49’’ N latitude and 1917m altitude above sea level in the Eastern Ethiopia. Based on the

2007 Census conducted by the Central Statistical Agency of Ethiopia (CSA). Harar has a total population of 183,415, of whom 92,316 were men and 91,099 women.

Harari lies 51 kilometers to the south east of Dire Dawa. It is located in the eastern wall of the Great Rift Valley looking over the vast Danakil desert to the north, the cattle rich savannahs to the south and fertile lands of the Harar mountains to the east. It lies between two rivers, tributaries of the Erer, on the southern edge of a vast plateau. The surrounding mountains divide the Great Rift valley from the plains of the Ogaden.The climate of the State is one of the most pleasant in the country. Temperature is even between 17.1°C-20.2°C throughout the year. The coolest season (18.7°C) which is between June-September, coincides with heavy rainsaccompanied by storms and strong electrical discharges. Theaverage annual intensity of precipitation is about 750-1,000 mm. The mean amount of rainfall over three years as registered 10years ago was 1,509 mm.This region is the only one in Ethiopia where the majority of its population lives in urban area: 99,368 or 54.18% of the population are urban inhabitants. With an estimated area of 311.25 square kilometers, this region has an estimated density of 589.05 people per square kilometer. For the entire region 46,169 households were counted, which results in an average for the Region of 3.9 persons to a household, with urban households having on average 3.4 and rural households 4.6 people. CSAE. (2004).The map of the Study Site is indicated on page 64.

3.2. Study Period

The study was carried out for three consecutive months From October 01, 2016 to January 01, 2017).

3.3. Definition of Variables

Aerobic Exercise- any activity that uses large muscle groups, can be maintained continuously, and is rhythmic in nature and it is a type of exercise that overloads the heart and lungs and causes them to work harder than at rest.

Obese- abnormal accumulation of body fat usually, 20% or more over an individual's ideal body weight.

Overweight- is abnormal or excessive fat accumulation that may impair health.

Sedentary Women- women doing a lot of sitting: not doing or involving much physical activity.

3.4. Experimental Design

In this research study the Pre- test and post-test randomized group experimental design was used. Eighty subjects were classified equally in to two groups randomly. Experimental group was involved in aerobics training program for 12 weeks. The control group was not participated on exercise because of to compare the effects of exercise with treatment group. Pre test and post-test were administered for both groups. Pre-post-test of body weight and waist circumference test was taken from both groups based on the standard testing protocol. Aerobics exercise training was delivered for 60 minutes and 3days in a week for 12 weeks of training period (Monday, Wednesday, Friday)with moderate intensity (55-69% Vo_2 max).

3.5. Source of Data

Both primary and secondary data were used in this research study. The primary data ware obtained from the experimental variables according to the designed parameters and secondary

data was obtained from different documents, journals, books, internet sources and unpublished booklets.

3.6. Study Population

Study population of women in Harar city was 92,000. There were four fitness centers in the city that has been giving service for overweight people to address their goals. From the mentioned fitness centers Arab Ali fitness center was selected because of its facilities. First, notice was posted for sedentary women in the city. Next, registration process was administered and 300 women were registered. Then the investigator was made subjects to fill physical activity readiness questionnaires to identify and reject subjects with health problems. Finally eighty subjects were selected from the total subjects and they were assigned in to two groups equally using systematic random sampling technique.

3.7. Sampling Size and Sampling Techniques

Purposive sampling and Simple random sampling techniques were used to specify study subjects. 300 volunteer overweight women filled the medical history questionnaire. The questionnaire was prepared with the aim of identifying whether they were free from cancer, heart disease, stroke and kidney problems. Additionally, injury statuses were used as one of selection criteria. 220 volunteers overweight women were rejected due to factors mentioned above. Finally eighty subjects were selected for study and they were assigned in to two groups equally using random sampling techniques. Those are experimental group and control group. This means forty for exercise group and forty for non-exercise group which used to compare with experimental group to measure the effect of aerobics exercise among the group.

3.8. Inclusion and Exclusion Criteria`

Eighty women those age ranges between 25 and 35 were used as a subject for the study. The participants should be free from any impairments, disability and chronic disease which members

of Harar city community and volunteer to respond to the designed study were included. Participants who were not eligible for the inclusive criteria were excluded. Women with different factors that affect their performance were excluded. Physical activity readiness questionnaire were used to include and exclude subjects.

3.9. Data Collection Instrument

The whole data collection were performed more of quantitatively and objectively. Machines of the gymnasium like treadmill, cycles, step up box; digital weighting machine and meter were used during research investigation. The use of these principal data collection instrument was intended to explore a range of quantitative information. The researcher was used writing pad is also used to record the data

3.10. Method and Procedures of Data Collection

The experimental test was strictly administered and standardized in terms of administration, organization and implementation conditions. Up on starting the training programs, pre-test was made. Then after the intervention the end of three months post-test were done.

3.10.1. Body Weight

Body weight test was taken using the digital weighting machine based on the administration protocol to know the initial base line and to observe the changes that was occurred in intervention. The height of subjects was taken using measuring tape.

Finally the body mass index was calculated as the following formula.

BMI= (W/H^2) where W= weight in kilogram, and H= height in $meter^2$

Adult Body Mass Index or BMI

Body Mass Index (BMI) is a person's weight in kilograms divided by the square of height in meters. A high BMI can be an indicator of high body fatness and having a low BMI can be an indicator of having too low body fatness. BMI can be used as a screening tool but is not diagnostic of the body fatness or health of an individual.

To calculate your BMI, see the BMI Calculator. Or determine your BMI by finding your height and weight in this BMI Index Chart 1.

If your BMI is less than 18.5, it falls within the underweight range.

If your BMI is 18.5 to 24.9, it falls within the normal or Healthy Weight range.

If your BMI is 25.0 to 29.9, it falls within the overweight range.

If your BMI is 30.0 or higher, it falls within the obese range.

3.10.2. Waist Circumference Description

Waist Circumference is a measurement taken around the abdomen at the level of the umbilicus (belly button). Health experts use waist circumference to screen patients for possible weight-related health problems. If your waist measurement is greater than the numbers indicated, your risk for weight-related health problems is higher than normal.

The accurate measurement of waist circumference is achieved by using the following techniques:-

Locate the top of the hip (iliac crest) and take the measurement just above this bony landmark, just where one finger can fit between the iliac crest and the lowest rib.Ensure that the tip measure is positioned horizontally, parallel to the floor.Measuring at a level just above the iliac crest, and positioned the tape of irrespective of whether umbilicus is above or below the tape, provides the correct waist circumference measurement and should correspond to the maximum

abdominal diameter. Ensure that the person is standing erect and has relaxed the abdominal muscle measurement is taken at the end of normal expiration.

Aim to have a snug but not tight a fit of the tape measure around your waist, do not make compressions in the skin with the tape measure.Accuracy can be approved by using a specially designed abdominal circumference tape measure. A constant-tension spring-loaded tape device reduces errors for over-enthusiastic tightening during measurement and improves accuracy and consistency of serial measurements.

The instrument we use to measure waist circumference is only meter.

Norm for waist circumference in adults		
Waist circumferences		
Risk category	Females	Males
Very low	<27.5 in (< 70cm)	<31.5 in (< 80cm)
Low	27.5-35.0 in(70-89cm)	31.5- 39.0 in (80-99cm)
High	35.5- 43.0 in (90-109cm)	39.5- 47.0 in (100-120cm)
Very high	>43.5 in (> 110 cm)	>47.0 in (>120 cm)

Source: Bray (2004).

3. 11. Aerobics Training Protocol

The selected subjects were participated on moderate intensity 55-69% HR max aerobics training program. The duration of the study was for three consecutive months from October, 2016-December, 2016. For the first two consecutive weeks the experimental groups of participants were involved in aerobics exercise with low intensity (~40-50% HRmax) as a physical preparation or readiness, but the rest ten weeks experimental group were engaged with moderate intensity training program. The training program consisted of different physical exercises such as warming up, light stretching, brisk walking, running, cycling, aerobics dance, sit ups, push up, steeps and others. The frequencies of the days were three times in a week (Monday, Wednesday and Friday) from 5pm-6pm in moderate intensity exercise training program.

3.12. Data Quality Control

The quality of the data was assured by giving pre training for the subjects during data collection by the investigator. The researcher will check the collected data for completeness and on spot corrective measures on the field was taken accordingly.

3.13. Methods of Data Analysis

Descriptive statistics will calculate the mean and standard deviations, in which the data was analyzed by SPSS version 20 statistical software package. It was analyzed through paired T-test. Level of significance less than 0.05 was considered.

3.14. Ethical Consideration

The study was deal with the ethical issues; it will heed for the privacy of research participants and make guarantees and confidentiality in risk of harm as a result of their participation. Therefore, the study was conducted according to Haramaya University rules,

regulations, policies and codes of ethics relating to research ethics. Ethical standards require that researcher should not impose participants in a situation where they might be at risk of physical or psychological harm as a result of their participation. This research study was approved by an Ethics Review Committee of the Haramaya University and Harar Campus to make sure it do not result any risk or harm to the participants of this study.

4. RESULTS AND DISCUSSIONS

4.1. Overview

This chapter deals with the results of this study and how they relate to the previous findings .the purpose of this study was to investigate the effects of 12 weeks of aerobic exercises program on weight loss of sedentary overweight women of Arab Ali Gymnasium users in Harar city. In this study, gymnasium experiments tests had been taken two times (pre and post). Under this two variables (body weight and waist circumference) and their components had been measured. The results of those variables are discussed as follows.

4.2. Demographic Characteristics of the Study Participants

A total of twenty (80) individuals, who were positively responded to the advertisement made. To obtain participants in the study were selected for the study. All selected individuals are Harar city overweight women completed moderate intensity aerobics training program. From the total number of the study subjects; no one was lost motivation to follow up training program properly and no one was dropped out. 100% the study subjects; follow up training properly. Almost all participants were beginners for physical exercise.

Table 1. The mean value of body weight, height, age and body mass index of both Control group and Experimental group**.**

Control group			Experimental group	
Var	Pre	Pot	Pre	Pot
Ag	30.15+2.032	30.15+2.032	30.50+2.926	30.50+2.926
Ht	1.64.95+2.320	1.64.95+2.320	164.75+2.915	163.30+3.246
Bw	72.15+1.847	73.25+2.677	71.20+1.682	67.15+1.791

BmI	26.10+.778	26.35+.921	25.70+.648	24.40+.672

Values are mean ± SD, PT= pre training test which was taken before training e, POT= posttest which is taken after 12th week of aerobics training, WT =Weight, HT =height, AG= age BMI=body mass index

As indicated in table 1, the mean values of participants' age was 30.15 and 30.50 for control group and experimental group respectively. The mean value of body weight before training was 72.15 and 73.25 after training for control group. The mean value of body weight before training was 71.20and 67.15after training for experimental group. The mean of body weight of was increased by 1.52% for control group and 5.688% was reduced experimental group throughout the study period. This result was consistent with the finding of Wills and his friends. The result of their investigation showed that Aerobic exercise was efficient method of exercise for losing body weight and body fat (Willis *et al*., 2012)

The aerobic exercise significantly reduced the body mass index and body weight, improved cardiovascular endurance, abdominal endurance/strength and flexibility of individual's. Similarly in a study conducted by (Hopkins *et al*., 1990), proved significant improvement in all functional fitness components of their participants including cardio respiratory endurance, strength/endurance, body agility, flexibility, body fat and balance was reported. This study was also corroborated by (Petrofsky *et al*., 2008) who did their study on the effect of aerobic dance and diet program on cardiovascular fitness, body composition, and weight loss in women. They reported a significant decrease in body weight, reduced waist girth and an improved cardiovascular function and general fitness

The mean value of body mass index (BMI) was increased from one test to another for control group. And more significant change distinguished decreased for the EG. The EG exhibited 5.05% decreased in BMI. This result was in agreement with the findings of (Leijssen *et al*., 2002) noted that aerobics exercise can be an important component of weight lose intervention and therefore, commonly included as part of comprehensive weight lose management program. Additionally, BMI was 0.95% increased recorded in the CG. .

The result also showed that the age and height was same throughout the study. Which indicates no significance difference was observed on age and height of participants. But it was taken to calculate body mass index.

Table 2. Mean values of Body weight (kg), Waist circumference (WC) of (CG) and (EG); at different occasions of training program.

Control group			Experimental group	
Var	PT	Pot	PT	Pot
Bwt	72.15+1.847	73.25+2.677	71.20+1.682	67.15+1.791
Wc	90.80+1.620	91.75+1.780	91.45+1.648	82.90+2.437

Values are mean + SD, CG= control group, EG= experimental group, PT= pre training test which is taken before training and PoT= post training test measured at the 12th week of training and BWT= body weight and WC= waist circumference. A positive mean difference was observed for experimental group. The rationale behind the decrease of body weight for experimental group was due to aerobics training they took in the gymnasium.

The mean value of body weight before training was 72.15and 73.25after training for control group. The mean value of body weight before training was 71.20and 67.15after training for experimental group. The mean of body weight was increased by 1.52% for control group and 5.688% was reduced in experimental group throughout the study period. In the experimental group weight of body of the participants were reduced significantly due to aerobics training. This result was consistent with the finding of Wills and his friends. The result of their investigation showed that Aerobic exercise was efficient method of exercise for losing body weight and body fat (Willis *et al*., 2012).This result was also agreed with finding of Arsan. He pointed out eight weeks step aerobic dance exercise significantly decreased body composition

parameter of middle aged sedentary obese women (Arslan, 2011) Aerobic exercise including walking, running, and swimming has been proven to be an effective way to lose weight.

In waist circumference test, the mean value of control group was increased but in experimental group waist circumference was decreased markedly. The mean difference showed that there was improvement in the EG. The EG was decreased 9.34% but 1.04% was increased for the CG.

Table 3: The mean difference value and significance level of each test results in both EG and CG

Dependent variable	Para I	Para ii	MD(II-I)		Sig	
			EG	CG	EG	CG
Body weight (kg)	PT	POT	4.050	1.100	.000	.000
BMI (kg/m2)	PT	POT	-1.300	.250	.000	0.16
Waist circumference(WC)	PT	POT	-8.550	.950	.000	.000

MD=mean difference PT = pre training test which was taken before resistance training, WC= Waist Circumference, POT= posttest which is taken after 12^{th} week of aerobic exercise training. WT =Weight, BMI=body mass index

Table 3: showed the overall result of each test. it includes the mean difference from one test to another and the significance of posttests in reference to the pretests. Body weight and waist circumference were reduced in experimental group. More significant improvement was recorded in the experimental group. In all other parameters except BMI of the control group all parameters showed remarkable change. This was due to the aerobics exercise training

engaged in. however, more significant change in the EG was an evident for the positive effect of aerobics exercise on body weight and waist circumference.

5. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Summary

The purpose of this study was to find out the effect of aerobic exercise on reducing body weight of sedentary overweight women in Harar city communities.

- To achieve the purpose of this study 80 sedentary female and grouped into experimental and control group equally to compare the effects of the given exercise.

- Both groups were selected from which age ranges 25-35years old. The exercise program was designed for 12 weeks, three times per week with 60 minute duration and moderate intensity.

- Each session was divided again in to warming up, main part (aerobic exercise stretching) and cooling down phase. The data collected from the study was analyzed using SPSS version 20 software .The paired sample t-test was used for this study.

- The mean values of participants' age was 30.15 and 30.50 for control group and experimental group respectively. The mean values of participants' height was 164.95 and 164.75 for control group and experimental group respectively.

- The mean value of body weight before training was 72.15and 73.25 after training for control group. The mean value of body weight before training was 71.20 and 67.15 after training for experimental group. The mean of body weight was increased by 1.52% for control group and 5.688% was reduced in experimental group throughout the study period.

- In the experimental group weight of body of the participants were reduced significantly due to aerobics training. In waist circumference test, the mean value of control group was increased but in experimental group waist circumference was decreased markedly. The mean difference showed that there was improvement in the EG. The EG was decreased 9.34% but 1.04% was increased for the CG The test measurements used to identify the improvements BW, BMI, and WC.

- Based on the analysis made, at the end of the program it was observed that body weight, waist circumference and BMI reduced significantly for exercise group (Experimental). But control group was increased in the measured parameters. The reduction of the experimental group in the measured variables was due to the given exercise training program and highly significant change was observed in improvement of body weight, waist circumference, and body mass index for experimental group.

5.2. Conclusions

Depending on the major findings of this study, the following points were stated as a conclusion:

- All parameters clearly showed that the better test results were recorded in post training than pre training. This indicates that moderate intensity aerobics exercise training program were effective for the reduction of body weight and waist circumference for overweight and obese women.

- Continuing participating in moderate intensity aerobics physical training program had the ability to reduce body weight, waist circumference and body mass index.

- In general, this findings clearly noted that moderate intensity aerobics exercise training program has a significant effect on the reduction of body weight, waist circumference and body mass index that resulted following the accumulation of excessive fat in the body.

3.3. Recommendations

Depending on the major findings of this study, the following points were stated as a Recommendations

- The findings of the study showed that a 12 week aerobic exercise program can have a significant effect on body weight reduction and waist circumference improvement for overweight people. Based on the findings, the following recommendations are made:

- It is highly expected from professionals of sport science, and related fields to guide and educate on the importance and value of aerobic exercise on reduction of body weight for health benefits.

- In view of the benefits of aerobic exercises, educational authorities may consider inclusion of this exercise as a part of the physical education program for all university students

- Since aerobic exercise require no equipment or minimal equipment. Sedentary female's community may be encouraged to undergo this type of exercise training regularly for physical fitness improvement.

- The government and private organizations should introduce one hour aerobic exercise program three times weekly for their staff which may help in improving work force and efficiency among workers

- The government should create a forum for seminar and workshop on various aerobic exercise programs and their importance and benefit to health.

- Individuals need to participate in regular physical activities to promote health related fitness. This can help to reduce the possibility of obesity, overweight and improves cardiovascular endurance, muscular strength/endurance and flexibility.

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7. APPENDICES

Appendix I: Health History and Physical Readiness Questionnaires

This questionnaire will be applied to obtain information on health status and physical readiness of the trainers participating for research study entitled "Effects of 12 Weeks of Aerobic Exercises Program on Weight Loss of Sedentary Overweight Women in Harar City, Eastern Ethiopia"

The information will be kept strictly confidential.

General information

Sex F Age---------- phone----------

Weight ---------- kg Height----------m

For participants; please read the following questions carefully and indicate your correct response for each question by encircling on the choice letter given below. Common sense your best guide when you answer this questions.

1. Has your doctor ever said that you have a heart condition and that you should only do physical activity until you recommended doing so?

A. Yes B. No

2. Do you feel pain in your chest when you do physical activity?

A. Yes B. No

3. In the past months have you had chest pain when you were not doing physical activity?

A. Yes B. No

4. Do you lose your balance because of dizziness or do you ever lose consciousness?

A. Yes B. No

5. Do you have bone or joint problem that could be made worse by a change in your physical activity?

A. Yes B. No

6. Is your doctor currently prescribing for blood pressure or heart problem?

A. yes B. No

7. Do you know of any other reason why you should not do physical activity?

A. Yes B. No

8. Has a medical doctor ever diagnosed you with a chronic disease, such as coronary heart disease, coronary artery disease, hypertension, diabetes? (If yes, please explain------?

A. Yes B. No

Client's full name----------Trainer's name----------

Client's signature; ----------Trainer's name----------

Date; ----------

Source: American College of Sport Medicine ,1997

Appendix II: Consent to participate voluntarily in this research study

Researcher's Name: - Gosaye Wondyfraw

Supervisor's Name: Shemelis Mekonnen (PhD)

Desta Enyew (PhD)

Thesis title: Effects of 12 Weeks of Aerobic Exercises Program on Weight Loss of Sedentary Overweight Women in Harar City, Eastern Ethiopia

Purpose of the study:

Purpose of this study is to examine the effect of post supplementation of whey protein on body weight and muscle strength of male sport science students using 12 weeks regular resistance exercise.

Procedure and duration

You are being asked to participate in this research study as described below. All this like research study carried out are governed by the regulations for research on human beings. These regulations require that the researcher should obtain a signed agreement (consent) from you to participate in this research project.

The researcher had explained to you in detail the purpose of the project, the procedures to be used, the potential benefits and the possible risks of participation in this study. You can ask the researcher any questions that you may have about the study, and expect to receive satisfactory answers regarding the same. A basic explanation of the project is summarized below. After discussion, if you agree to participate in the study, please sign this form in the presence of the researcher. You may discontinue at any time from the study if you choose to do so.

Risks and benefits

The risks of this research study are small. While administering the tests and during training session you may experience localized muscle fatigue in your muscles. You might feel some muscle soreness and fatigue during and after the cessation of the exercise tests and training but we do not expect any unusual risks as a direct result of this study. If any unexpected physical injury occurs, appropriate first aid will be provided, but no financial compensations will be given.

Confidentiality:

The information obtained about you will be kept in confidence, although you are free to release it to your own physician. The information will be used only for scientific purposes without identifying you as an individual.

Rights:

Participation for this study is fully voluntary. You have the right to declare to participate or not in this study. If you decide to participate, you have the right to withdraw from the study at any time and this will not label you for any loss of benefits which you otherwise are entitled. You do not have to answer any question that you do not want to answer.

Contacts address:

If there is any questions or enquires any time about the study or the procedures, please contact:

Gosaye Wondyfraw Worku at (+251913875691) or

E-mail: **gosiboyone@gmail.comIf** you have any questions on your rights as a research subject, you can call the Institutional Research Ethics Review Committee (IRERC) at (+251) 256-66-18-99 or P.O.BOX 235, Harar, for information

Appendix III: Paired sample t test results of each parameter

1. Paired t test results of body weight

	Tests	Mean	Md	SD	Se	Lower Bound	Upper Bound	T value
Cg	Pt-pot	72.15-73.15	1.100	1.194	.189	.718	1.482	5.827
Eg	Pt-pot	71.20-67.15	-4.050	.749	.118	-4.290	-3.810	-34.182

2. Paired t test results of BMI

	Tests	Mean	Md	SD	Se	Lower Bound	Upper bound	T value
Cg	Pt-pot	26.10-26.35	.250	.630	.100	.048	.452	2.508
Eg	Pt-pot	25.70-24.40	-1.300	.464	0.73	-1.448	-1.152	-17.716

3. Paired t test results of Waist Circumference

	Tests	Mean	Md	SD	SE	Lower Bound	Upper Bound	T value
Cg	Pt-pot	90.80-91.75	.950	.749	.118	.710	1.190	8.018
Eg	Pt-pot	91.45-82.90	-8.550	2.364	.374	-9.307	-7.794	-22.877

Appendix IV: Description of Aerobic Exercises Program

Aerobic Exercise

Aerobic exercise helps strengthen your heart and lungs. Factors that affect aerobic exercise include how often you perform aerobic activity, the amount of time you spend at each session and the intensity (or percentage) of your maximum heart rate. Perform aerobic exercise:

- 3–5 times per week
- 20–60 minutes each time
- at 60–85 percent of your maximum heart rate, OR
- At 50–60 percent of your maximum heart rate if you are just starting an exercise program or have a heart condition At first, 3 times per week, for 20 minutes, at 60 percent of your heart rate may be enough activity for you. As your conditioning improves, increase the number of days per week, and the time and intensity of your exercise. (Sharon et al.,2011)

Maximum Heart Rate

A person's heart rate is the measure of heart beats per minute. Your maximum heart rate is the heart rate you should reach when exercising at a maximal exertion level. To calculate your maximum heart rate, subtract your age from 220. For example, if you are 30 years old, your maximum heart rate is 190: (220 – 30 = 190)

Target Heart Rate

Target heart rate is 50–85 percent of your maximum heart rate. Exercising within your target heart rate zone allows you to maximize your cardio respiratory fitness level. For example, if your maximum heart rate is 190, then the lower-end of your target heart rate zone is 95 heart beats per minute (0.50 x 190 = 95).

If you are just starting an exercise program, or if you have a heart condition, your physician may recommend you begin exercising at 50–60 percent of your maximum heart rate. If you have been active, and do not have a heart condition, exercising at 60–65 percent of your maximum heart rate may be a good place to begin. Once the target heart rate you choose becomes too easy for you, incrementally increase your target heart rate to the upper-end (85 percent) of your target heart rate zone (0.85 x 190 = 162 heartbeats per minute).

Determining your target heart rate requires periodic measuring. The best way to measure your heart rate is to purchase a heart rate monitor. The price of a good heart rate monitor can range from $30 – $100, but is worth the investment. They can be found at most sporting goods stores. (Sharon et al.,2011)

Exercise Intensity Levels

Use this information to determine the appropriate level for you. There are three levels of exercise intensity: low intensity, medium intensity, and high intensity. The intensity level of exercise determines your stage of exercise, and the amount of calories you burn each time. Identifying the appropriate exercise intensity level will help you determine the type of exercises you should perform. (Sharon et al.,2011)

Low Intensity:

For: beginners; those with a heart condition; those weighing over 250 pounds; or those new to medi fast To exercise at a low intensity level, your target heart rate should be 50–65 percent of your maximum heart rate. To calculate your maximum heart rate, subtract your age from 220. For example, if you are 30 years old, your maximum heart rate is 190 (220 – 30 = 190). If you choose to exercise at 50 percent of your maximum heart rate, your target heart rate would be 95 heartbeats per minute (0.50 x 190 = 95). If you choose to exercise at 65 percent of your maximum heart rate, your target heart rate would be 124 heartbeats per minute (0.65 x 190 = 124).Depending on your weight low-intensity exercise will burn an average of 2.5 calories per minute.Begin incorporating low-intensity exercises for at least 20 minutes a day, 3–4 days a week. Gradually work your way up to the next exercise level (medium-intensity). There are many low-intensity exercise options, including: (Sharon et al.,2011)

- Gardening (raking leaves, pulling weeds, light shoveling, etc.)
- Housework (vacuuming, sweeping/mopping, cleaning windows, etc.)
- Walking

- Painting
- Washing the car

Medium Intensity:

For individuals comfortable with beginning a more active exercise program Exercising at a medium-intensity level requires the use of large muscle groups (such as the back, chest, legs, and buttocks). At a medium-intensity level, exercisers work at 65–75 percent of their maximum heart rate. To calculate your maximum heart rate, subtract your age from 220.For example, if you are 30 years old, your maximum heart rate is 190 (220 – 30 = 190). At a medium-intensity level, you should exercise anywhere between 124–143 beats per minute (0.65 x 190 = 124; 0.75 x 190 = 143).

Medium-intensity exercise burns an average of 7.5 calories per minute depending on your weight.There are a wide variety of medium-intensity exercises you can do on a regular basis. These exercises are not only beneficial for losing weight – they also help prevent heart disease, lower blood pressure, reduce the risk of developing diabetes, and improve psychological well being. Once you have become comfortable working out at a low-intensity level, incorporate medium-intensity exercises at least 3–4 days per week. Begin with a comfortable time frame of 15–20 minutes per day, and gradually work your way up to at least 45 minutes a day, 4–5 days per week. Examples of medium-intensity exercises include: (Sharon et al.,2011)

- Brisk walking
- Bicycling
- Sports (tennis, basketball, swimming, etc.)
- Dancing (square dancing, salsa, swing, etc.)

- Hiking

High Intensity:

For regular exercisers (currently in Maintenance) looking to step things up High-intensity exercise is not for beginners or anyone just starting the Medifast program. These exercises are recommended for individuals who exercise daily, and have either hit a plateau or are looking for something more intense to incorporate into their exercise routine. At a high intensity exercise level, you are exercising at 75–85 percent of your maximum heart rate. To calculate your maximum heart rate, subtract your age from 220. For example, if you are 30 years old, your maximum heart rate is 190 (220 – 30 = 190). At a high-intensity level, you should exercise anywhere between 143–162 beats per minute (0.75 x 190 = 143; 0.85 x 190 = 162). High-intensity exercise burns an average of 14.3 calories per minute depending on your weight.Many exercisers will alternate high-intensity workouts into their weekly schedule. These exercises are also helpful to those who have hit plateaus in their exercise routine and have stopped losing weight. If you exercise at a medium-intensity level 4–5 days a week, you may want to try including small amounts of high-intensity exercises. Examples of high-intensity exercises include: (Sharon et al.,2011)

- Running
- riskly climbing stairs
- High-level aerobics class
- Spinning
- Jumping rope
- Strength/Weight training

Warm Up and Cool Down

Intense exercises should include a warm-up and a cool-down period. Warm-up and cool-down should be 5–10 minutes each, and include a low-level activity such as walking. After warming up and cooling down, it is important to incorporate a series of stretches. Each stretch should be held slowly for 20–30 seconds (without bouncing), and include each major muscle group challenged during the workout. (Sharon et al.,2011)

Appendix V: Session Plan for Twelve Weeks (Three Months) Of Experimental Study

1st Month(October,2016) training sdchedule for **Group-II** participants (EG).

- **Duration :** 60 min/session
- **Intensity of Exercise:** low intensity (~40-50%HRmax) for the first two consecutive weeks, then moderate intensity (~60-65%HRmax) for the restof ten weeks.
- **objective**: To create physiological adaptation, confidence and awareness of the training.

Day	Types of aerobics training	Time	No Ex	Sets	Weeks							
					1st week		**2nd week**		**3rd week**		**4th week**	
					Rep	**Rest**	**Rep**	**Rest**	**Rep**	**Rest**	**Rep**	**Rest**
Mon	Warming up (walking, jogging etc.)	10m										
	Light stretch	10m	6	1	6x1	30s	6x1	30s	6x2	30s	6x2	30s
	Brisk walking on treadmill speed 5mph level 6%	10m	Walk	1	1	30s	1	30s	1	30s	1	30s
	Cycling	10m	1	1	1	30s	1	30s	1	30s	1	30s
	Sit ups	10m	1	1	1x8	30s	1x8	30s	1x12	30s	1x12	30s
	Cooling down	10m										
Tues	**Resting period**											
Wed	Warming up	10m										

	Light stretch	10m	7	1	7x1	30s	7x1	30s	7x2	30s	7x2	30s
	Sit ups	15m	1	1	1x1	30s	1x10	30s	1x15	30s	1x15	30s
	Steps	15m	1	2	1x15	30s	1x15	30s	1x20	30s	1x20	30s
	Cooling down	10m										
Thu	**Rest period**											
Fri	Warming up	10m										
	Light stretch	10m	7	1	7x1	30s	7x1	30s	7x1	30s	7x1	30s
	Steps	10m	1	1	1x20	30s	1x20	30s	1x25	30s	5x25	30s
	Running on treadmill	10m	Run	1	1	30s	1	30s	1	30s	1	30s
	Cycling	10m	1	1	1	30s	1	30s	1	30s	1	30s
	Cooling down	10m										
Sat	**Rest period**											
Sun	**Rest period**											

2nd Month (November2016) Exercise Plan for **Group-II** participants (EG).

- **Duration :**60 min/session
- **Intensity of Exercises**: moderate intensity (~65-75%HRmax) for the rest ten weeks.
- **Objective:** for body weight reduction.

Day	Types of aerobics training	Time	No of exe.	Sets	Weeks							
					1st week		**2nd week**		**3rd week**		**4th week**	
					Rep	**Rest**	**Rep**	**Rest**	**Rep**	**Rest**	**Rep**	**Rest**
Mon	Warming up (walking, jogging etc.)	10m										
	Light stretch	10m	8	1	8x1	30s	8x1	30s	8x1	30s	8x1	30s
	Brisk walking on treadmill speed 5mph level 6%	10m	Walk	1	1	30s	1	30s	1	30s	1	30s
	Cycling	10m	1	2	1	30s	1	30s	1	30s	1	30s
	Sit ups	10m	1	1	1x12	30s	1x12	30s	1x12	30s	1x12	30s
	Cooling down	1om										
Tues	**Resting period**											
Wed	Warming up	10m										
	Light stretch	10m	6	1	6x3	30s	6x3	30s	6x3	30s	6x3	30
	Sit ups	15m	1	1	1x15	30s	1x15	30s	1x15	30s	1x15	30s
	Steps	15m	1	3	1x12	30s	1x12	30s	1x12	30s	1x12	30s
	Cooling down	10m										
Thu	**Rest period**											
Fri	Warming up	10m										
	Light stretch	10m	9	1	9x1	30s ec	9x1	30s ec	9x1	30s	9x1	30s
	Steps	10m	1	3	1x15	30s	1x15	30s	1x15	30s	1x15	30s

						ec		ec				
	Running on treadmill	10m	Run	1	1	30s ec	1	30s ec	1	30s	1	30s
	Weight free exercise	10m	4	1	4x6	30s ec	4x6	30s ec	4x6	30s	4x6	30s
	Cooling down	10m										
Sat	**Rest period**											
Sun	**Rest period**											

3rd Month (December, 2016) Exercise Plan for **Group-II** participants (EG).

- **Duration :** 60 min/session

- **Intensity of Exercise :**moderate intensity (~65-75%HRmax) for the rest ten weeks.
- **Objective:** for body weight reduction.

Day	Types of aerobics training	Time	No of exe.	Sets	Weeks							
					1st week		**2nd week**		**3rd week**		**4th week**	
					Rep	**Rest**	**Rep**	**Rest**	**Rep**	**Rest**	**Rep**	**Rest**
Mon	Warming up (walking, jogging etc.)	10m										
	Weight free exercise	10m	5	3	5x6	30s	5x6	30s	5x6	30s	5x6	30s
	Aerobics dance	20m	Dance	1	1	30s	1	30s	1	30s	1	30s
	Light stretch	10m	10	2	10x2	30s	10x2	30s	10x2	30s	10x2	30s
	Cooling down	10m										
Tues	**Resting period**											
Wed	Warming up	10m										
	Brisk walking on treadmill speed 5mph level 6%	20m	1	1	1	30s	1	30s	1	30s	1	30s
	Sit ups	10m	1	1	1x20	30s	1x20	30s	1x20	30s	1x20	30s
	Steps	10m	1	2	1x20	30s	1x20	30s	1x20	30s	1x20	30s
	Cooling down	10m										
Thu	**Rest period**											
Fri	Warming up	10m										

	Light stretch	10m	12	2	12x2	30s	12x2	30s	12x2	30s	12x2	30s
	Steps	10m	1	3	15x2	30s	15x2	30s	15x2	30s	15x2	30s
	A e r o b i c s dance	20m	D a nce	1	1	30s	1	30s	1	30s	1	30s
	Cooling down	10m										
Sat	**Rest period**											
Sun	**Rest period**											

Source: Daniel k.,2015

Appendix VI: Raw Data Test Recording Sheet

Group I

Control Group										
	B/w		**Ht**		**w/c**		**Age**		**BMI**	
	Pt	Pot	PT	Pot	Pt	Pot	Pt	Pot	Pt	Pot
S 1	74	75	1.65	1.65	90	91	30	30	27.18	27.54
S 2	71	73	1.63	1.63	92	94	29	29	26.72	27.47
S 3	73	74	1.65	1.65	91	91	28	28	26.81	27.18
S 4	69	70	1.65	1.65	89	90	31	31	25.34	25.71
S 5	71	73	1.67	1.67	93	95	34	34	25.45	26.17
S 6	75	77	1.66	1.66	90	92	30	30	27.21	27.94
S 7	69	69	1.65	1.65	89	90	29	29	25.34	25.34
S 8	70	68	1.61	1.61	89	90	32	32	27.00	26.23
S 9	75	77	1.65	1.65	90	91	30	30	27.54	28.28
S 10	74	75	1.67	1.67	89	90	29	29	26.53	26.89
S 11	71	70	1.65	1.65	89	89	33	33	26.07	25.71
S 12	74	77	1.63	1.63	92	91	27	27	27.85	28.98
S 13	73	73	1.69	1.69	93	93	32	32	25.55	25.55
S 14	72	74	1.66	1.66	94	95	28	28	26.12	26.85
S 15	74	76	1.67	1.67	90	91	34	34	26.53	27.25
S 16	73	75	1.68	1.68	93	94	31	31	25.86	26.57
S 17	72	73	1.65	1.65	89	90	29	29	26.44	26.81
S 18	72	74	1.66	1.66	91	93	30	30	26.12	26.85
S 19	70	70	1.60	1.60	91	92	27	27	27.34	27.34

S 20	71	72	1.61	1.61	92	93	30	30	27.39	27.77
S 21	74	75	1.65	1.65	90	91	30	30	27.18	27.54
S 22	71	73	1.63	1.63	92	94	29	29	26.72	27.47
S 23	73	74	1.65	1.65	91	91	28	28	26.81	27.18
S 24	69	70	1.65	1.65	89	90	31	31	25.34	25.71
S 25	71	73	1.67	1.67	93	95	34	34	25.45	26.17
S 26	75	77	1.66	1.66	90	92	30	30	27.21	27.94
S 27	69	69	1.65	1.65	89	90	29	29	25.34	25.34
S 28	70	68	1.61	1.61	89	90	32	32	27.00	26.23
S 29	75	77	1.65	1.65	90	91	30	30	27.54	28.28
S 30	74	75	1.67	1.67	89	90	29	29	26.53	26.89
S 31	71	70	1.65	1.65	89	89	33	33	26.07	25.71
S 32	74	77	1.63	1.63	92	91	27	27	27.85	28.98
S 33	73	73	1.69	1.69	93	93	32	32	25.55	25.55
S 34	72	74	1.66	1.66	94	95	28	28	26.12	26.85
S 35	74	76	1.67	1.67	90	91	34	34	26.53	27.25
S 36	73	75	1.68	1.68	93	94	31	31	25.86	26.57
S 37	72	73	1.65	1.65	89	90	29	29	26.44	26.81
S 38	72	74	1.66	1.66	91	93	30	30	26.12	26.85
S 39	70	70	1.60	1.60	91	92	27	27	27.34	27.34
S 40	71	72	1.61	1.61	92	93	30	30	27.39	27.77

Group II

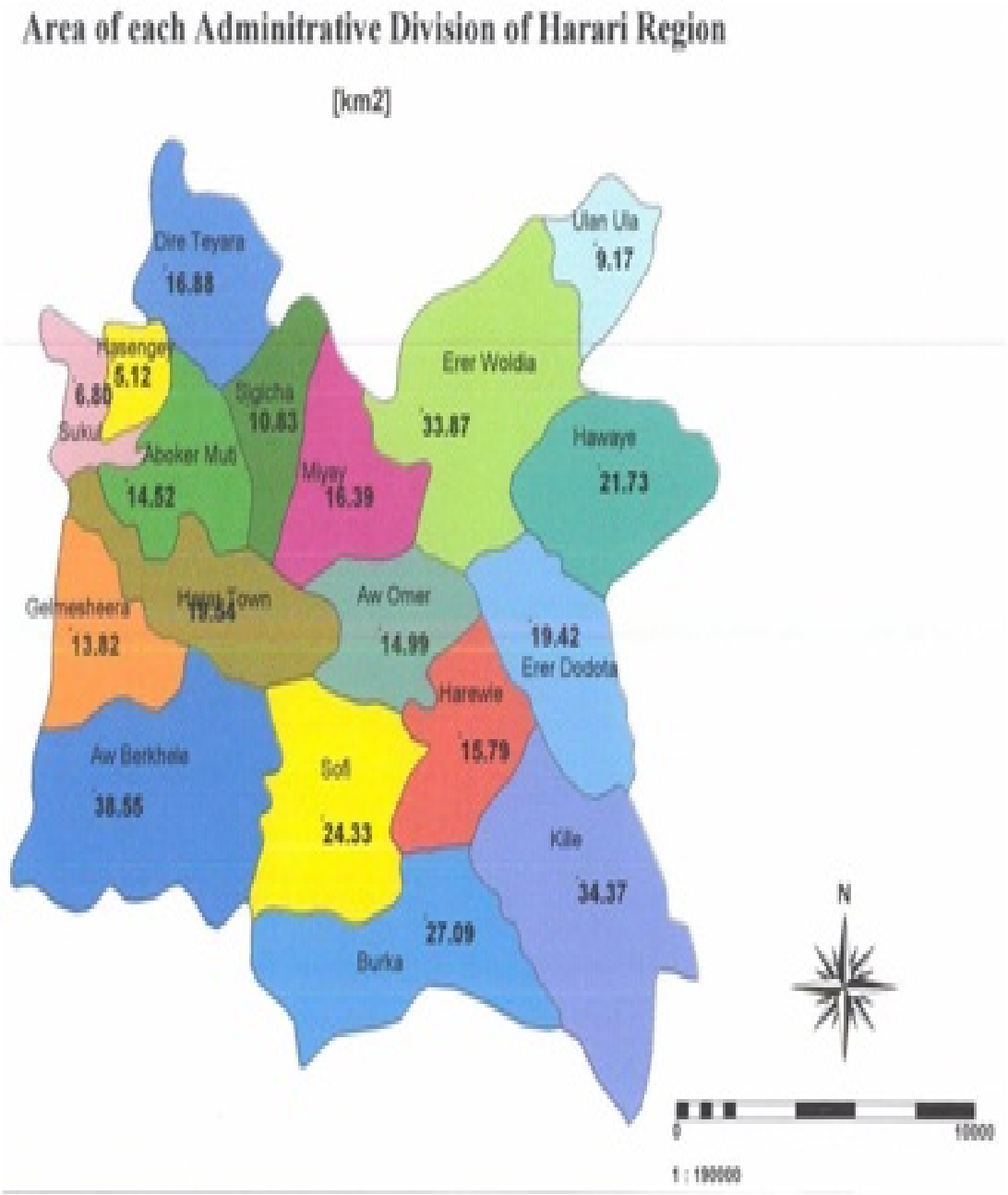
Experimental Group										
	B/w		**Ht**		**w/c**		**Age**		**BMI**	
	Pt	Pot	Pt	Pot	Pt	Pot	Pt	Pot	Pt	Pot
S 01	70	66	1.63	1.63	92	85	27	27	26.34	24.84
S 02	73	70	1.64	1.64	90	81	26	26	27.14	26.02
S 03	70	66	1.65	1.65	93	83	30	30	25.71	24.24
S 04	69	65	1.63	1.63	89	81	28	28	25.97	24.46
S 05	74	70	1.68	1.68	93	85	32	32	26.21	24.80

S 06	71	67	1.66	1.66	90	80	30	30	25.76	24.46
S 07	70	65	1.63	1.63	94	83	29	29	26.34	24.46
S 08	72	68	1.68	1.68	91	85	31	31	25.51	24.09
S 09	72	67	1.67	1.67	92	84	29	29	25.81	24.02
S 010	70	66	1.65	1.65	92	86	27	27	25.71	24.24
S 011	69	64	1.60	1.60	93	81	33	33	26.95	25
S 012	70	67	1.62	1.62	89	83	34	34	26.67	25.52
S 013	70	65	1.63	1.63	94	83	34	34	26.34	24.46
S 014	73	69	1.67	1.67	92	82	32	32	26.17	24.74
S 015	70	67	1.60	1.60	89	80	30	30	27.34	26.17
S 016	73	68	1.68	1.68	93	82	34	34	25.86	24.09
S 017	73	68	1.67	1.67	92	90	30	30	26.17	24.38
S 018	69	66	1.60	1.60	91	83	25	25	26.95	25.78
S 019	74	70	1.70	1.70	91	80	35	35	25.60	24.22
S 020	72	69	1.66	1.66	89	81	34	34	26.12	25.03
S 021	70	66	1.63	1.63	92	85	27	27	26.34	24.84
S 022	73	70	1.64	1.64	90	81	26	26	27.14	26.02
S 023	70	66	1.65	1.65	93	83	30	30	25.71	24.24
S 024	69	65	1.63	1.63	89	81	28	28	25.97	24.46
S 025	74	70	1.68	1.68	93	85	32	32	26.21	24.80
S 026	71	67	1.66	1.66	90	80	30	30	25.76	24.46
S 027	70	65	1.63	1.63	94	83	29	29	26.34	24.46
S 028	72	68	1.68	1.68	91	85	31	31	25.51	24.09
S 029	72	67	1.67	1.67	92	84	29	29	25.81	24.02
S 030	70	66	1.65	1.65	92	86	27	27	25.71	24.24
S 031	69	64	1.60	1.60	93	81	33	33	26.95	25
S 032	70	67	1.62	1.62	89	83	34	34	26.67	25.52
S 033	70	65	1.63	1.63	94	83	34	34	26.34	24.46
S 034	73	69	1.67	1.67	92	82	32	32	26.17	24.74
S 035	70	67	1.60	1.60	89	80	30	30	27.34	26.17
S 036	73	68	1.68	1.68	93	82	34	34	25.86	24.09
S 037	73	68	1.67	1.67	92	90	30	30	26.17	24.38
S 038	69	66	1.60	1.60	91	83	25	25	26.95	25.78
S 039	74	70	1.70	1.70	91	80	35	35	25.60	24.22

S 040	72	69	1.66	1.66	89	81	34	34	26.12	25.03

Pt= pre training, pot= post test, BW = body weight, WC= waist circumference, HT =height, Age= age, BMI= body mass index

Figure 1. Map of the Study Site


Area of each Adminitrative Division of Harari Region
[km2]
Dire Teyara
16.88
Ulan Ula
9.17
Hasengev
5.12
6.80
Suku
Sigicha
10.83
Aboker Muti
14.52
Miyay
16.39
Erer Woldia
33.87
Hawaye
21.73
Gelmesheera
13.82
Aw Omer
14.99
19.42
Erer Dodota
Harewie
16.79
Aw Berkhele
38.55
Sofi
24.33
Kile
34.37
27.09
Burka
N
0
10000
1 : 100000

Source: -Central Statistical Agency of Ethiopia CSA (2004).