EFFECTS OF CIRCUIT TRAINING PROGRAM ON PHYSICAL FITNESS AMONG FEMALE STUDENTS: ALIBO HIGH SCHOOL HORO GUDURU WOLLEGA ZONE (OROMIA REGION)

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This is to certify that the thesis prepared by Kasahun Aga, entitled*: effects of circuit training program on physical fitness among female students: Alibo high school Horo Guduru wollega zone (oromia region)* and submitted in partial fulfillment of the requirements for the degree masters of education (teaching physical education) complies with the regulations of the university and meets the accepted standards with respect to originality and quality.

Signed the Examining committee

Internal Examiner_____signature _____date_____

External Examiner_____ signature _____date_____

Advisor _____signature_____date_____

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LIST OF ABBREVIATIONSAND ACRONYMS

ACSM	American College of Sport Medicine
ACTRG	Activity Counseling Trial Research Group
CHD	Coronary Heart Disease
CRE	Cardio Respiratory Endurance
CVD	Cardio vascular diseases
FIT	Frequency Intensity and Time
HPE	Health and Physical Education
ME	Muscular Endurance
MHT	Maximum Heart Rate
MS	Muscular Strength
NASPE	National Association for Sport and Physical Education
USDA	United state Department of Agriculture
USDHHS	United state Department of Health and Human Services

ABSTRACT

This study attempted to explore effects of circuit training program on selected physical fitness variables of female students. Purposive sampling technique was used to select 24 novice female students on intervention and comparison group aged15 to 16 years from grade 9 students. The main objective of the study was to investigate the effect of circuit training program on selected physical fitness variables of Alibo high School female students Horo Guduru Wollega Zone in Oromia Regional state. Those subjects under this study took part in experimental design pre and post test on both group from October 1/02/2015 to December 30/04/ 2016, 2 days per week for 3 months and 40 minutes prerecession. The physical fitness variables selected for the study were: cardio respiratory endurance (1.6 km run in minutes), muscular endurance (sit-ups reps/60 seconds), muscular strength (modified push-ups reps/30 seconds), power (standing long jump in meter) and agility (4x10 m shuttle run in seconds).Data were analyzed by using SPSS paired samples t- test with pair wise comparison of means at 95% confidence interval. The results indicated that there were significantly improvements in performance on selected physical fitness variables due to the effects of circuit training with active rest ($p < 0.05$).This study confirmed that circuit training with active rest was significant to improve the physical fitness variables. The main finding of the study was novice female students have discovered positive outcomes towards physical fitness variables. The study also illustrates that health and fitness level of participants can be improved as a result of circuit training program.

***Key words*:** circuit training on: *cardio respiratory endurance, muscular strength, muscular endurance, power and agility*

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

Physical education is one of the subjects which are offered at the primary and high school education level of Ethiopia. It provides with both theoretical and practical activity which are accompanied by physical exercises or skill development. The aim of this practical field of study is to produce students who are physical, mentally, emotionally and socially fit citizen through the medium off physical activity that have been selected with the view of realizing this outcomes.

Concept of physical fitness is as old as humankind. Throughout the history of mankind physical fitness has been considered an essential element of everyday life. The ancient people were mainly dependent upon their individual strength, vigor and vitality for physical survival. This involved mastery of some basic skill like strength, speed, endurance, agility for running, jumping, climbing and other skills employed in hunting for their livings.

Over the past four decades, there has been an increase in the prevalence of overweight and physical fitness deterioration in adult across all genders, ages and racial/ethnic groups (Ichinohe et al. 2004).The negative effects of degraded physical fitness on both the individual and society are serious and multi-dimensional. It can cause many risk factors to health including coronary heart disease, certain forms of cancer, diabetes, hypertension, stroke, gall bladder diseases, osteoarthritis, respiratory problems, gout and is associated with increases in all-cause mortality (Cataldo 1999

Fitness, physical activity behavior and motor skill development are important components of the physical education curriculum and are potentially indicators of child health. Physical fitness in children and adolescents has also been linked to positive health outcomes in adults. Moreover, motor skills can be used for talent identification to predict sporting success in children. Previous research has demonstrated the positive effects of four-weeks after school program addressing motor skills and fitness can have in young

children. Therefore, encouraging motor skill and fitness development in young children is likely to have substantial benefits on health outcomes and potentially subsequent sporting success in children (Grice, 2003; Kvaavik*et al.*, 2009; Matvienko and Iradge, 2009 and Lloyd *et al*., 2010).

There is considerable epidemiological evidence that regular physical activity is protective against cardiovascular disease. It enhances mental health and can prevent or revolutionize some of the complications of conditions such as diabetes and osteoporosis. Exercising has been associated with many health benefits in women, including reduced risks of overall mortality, cardiovascular disease, diabetes, osteoporosis, obesity, colon cancer, mental illness and may also protect against female reproductive cancers (Berlin and Colditz, 1990; Helmrich*et al.,* 19`91; Weyerer and Kupfer, 1994 and USDHHS, 1996).

Circuit training is simply defined as a series of physically, resistance-based and aerobic activities, separated by short defined time period to complete each station. Circuit training is a method of fitness training that is designed to develop general, all-round physical and cardiovascular fitness. It is based on sound anatomical, kinesiological and physiological principles designed to increase strength, power, flexibility, quickness and cardiovascular endurance. Circuit training provides a strenuous workout entirely suited to an individual's specific needs, existing capacity and rate of adjustment to progressive vigorous exercises. They also stressed the principles of overload and progression. It consists of a series of exercises arranged in order and designed to develop general fitness, physical fitness and/or skill-related fitness specific to a particular sport, depending on the exercises chosen. The great advantage of circuit training is that depending on the exercises chosen, it can be used to develop strength, power, muscular endurance, agility, aerobic endurance and anaerobic endurance (the ability to work without burning oxygen for an extended period of time; top class 800m runners can work an-aerobically for approximately 90 seconds) in a limited time and limited space. It can also involve large numbers of Participants in a relatively small space and participants of different fitness levels can train to get her. The basic assumption underlying circuit training is that improvement takes place either by doing the same amount of work in a shorter period of time or by doing more work in a given time. It utilizes three variables of load, repetition

and time and this places it on an advantage over other training methods. The circuit training program is given in the form of number of exercises for different body parts in single circuit training. Single circuit training may involve the exercise for various fitness components (Scholich, 1990; Howell and Morford, 1998; Hockey, 1981). These variables are as follows:

Cardio respiratory endurance: sometimes known as cardiovascular fitness, cardio respiratory fitness, aerobic fitness or aerobic capacity. It is a health-related component of physical fitness that relates to the ability of the circulatory and respiratory systems to supply oxygen during continuous physical activity. Such as 1.6 kilometer run or walking, 12 minutes run or walking. It improves oxygen transport and leads to a more efficient use of oxygen by way of an increased density of capillaries, myoglobin concentration, number and size of mitochondria and greater activity of oxidative enzymes within the mitochondria (USDHHS, 1996 and Thomas *et al.,* 2009).

Muscular endurance: For true assessment of muscular endurance it would be necessary to test each major muscle group of the body. Lab and field tests of muscular endurance are similar and are based on the number of repetitions that can be performed by the specific muscle group being tested (repetitions of push-ups or abdominal curls-ups). Muscular endurance can be measured as isometric ally (static contractions) or isotonic ally (dynamiccontractions).http://www.fitness.gov/publications/digests/digest_mar2000.Html.

Strength is like flexibility and muscular endurance, specific in nature. For true assessment it would be necessary to test each major muscle group of the body. Lab and field tests are similar and involve the assessment of one repetition maximum (the maximum amount of resistance you can overcome one time). Strength can also be assessed using dynamometers. Strength can be measured isometric ally (static contractions) or isotonic ally (dynamic contractions).Pull up, trunk-lift, pulling heavy object, weight lifting, standing broad jump and so on are examples of exercises for strength.http://www.fitness.gov/publications/digests/digest_mar2000.html

Power is considered to be a combination of strength and speed. It has also been defined as the ability to exert muscle force quickly. For this reason some consider it to be a combination of skill and health related physical fitness. Power includes putting the shot and vertical jumping. But, there are many different types of power and total assessment would require many different tests. http: // www. fitness. Gov /publications/digests/ digests. mar 2000.html

Agility is common as screening tests among sports teams. A shuttle or zigzag run is examples of exercises that develop agility. Critical periods of development for agility occur between the ages of 9 and 12 years old, with complexity and specificity beginning around the ages of 16 to 17 years. An athlete that displays good agility will most likely possess other qualities such as, dynamic balance, spatial awareness, rhythm, as well as visual processing. So while agility can be simply defined as an ability to quickly stop and re-start motion, there is a high degree of complexity to this motor skill (Drabik, 1996; Jason and Vescovi, 2009).

1.2. Statement of the Problem

Physical Education is a very functional subject, where the main tool is one's own body. Physical education is very public, and thus it is a visible arena for both girls and boys (Clarke, 2006). Some pupils feel this kind of open display of abilities rewarding, while others have negative feelings. This is true especially among teenage girls, who face conflicts with "desirable and appropriate female and feminine appearance" (Clarke, 2006; Gorely, Holroyd & Kirk, 2003).

Now a day, physical exercise is the best therapy that treats people without giving medication. Especially those suffer from chronic diseases, depression and constant worry. Although many studies believe that regular physical activity can give health benefits by positively affecting body composition, immune system and musculoskeletal development for males and females. But the reality in Alibo high School in Oromia Region shows the value of exercise has been known neither theoretically nor practically. Due to this, they are not beneficial from regular physical activity and easily at risk to many health

problems (mentally-they thought physical activity is the work of male, physically- they were weak, socially-they lost the chance to contact people and psychologically-took themselves as inferior). Thus, this research study was under taken by the investigator to provide them the idea about circuit training program for improvement of physical fitness (cardio respiratory fitness, muscular endurance, muscular strength, power and agility). Source:

Based on the above reason, the research was designed to answer the following research questions:

1. What is the effect of circuit training program on muscular endurance and strength development?

2. What changes the circuit training program will bring in cardio respiratory fitness and power on female students?

3. What is significance of circuit training program on participants in enhancing agility fitness variables?

1.3. Significance of the Study

The main aim of this study was to analyze the effect of circuit training program on selected physical fitness variables (cardio respiratory endurance, muscular strength, muscular endurance, agility and power) of Alibo high School, grade nine female students with 30 second rest at between each station. The outcome of this research helped other rural area with similar environmental conditions (lifestyle behaviors, personal attributes, physical and social environment) to improve their physical fitness level. In addition this study intended to signify the following importance:-

- It helps to give concepts for the next researchers. And to give information for physical education curriculum designers.
- It helps to know the selected physical fitness level of Alibo High School female students.

- It helps to analyze the effects of circuit training program on selected physical fitness variables with moderate intensity.

1.3. Objective of the Study

1.3.1. General objective

- The general objective of this study was to investigate the effect of circuit training program on selected physical fitness variables of Alibo High School female students in Horo Guduru Wollega Zone of oromia regional state.

The specific objective of the study is:

- To study physical fithess components in Alibohigh school female students.
- To observe changes induced by performing circuit training on cardio respiratory endurance and power on Alibo high school female students.
- To measure selected physical fitness of Alibo students.
- To find out the methods of developing physical fitness quality.

1.4. Delimitation of the study

The study was delimited to Alibo High school female students in Horo Guduru Wollaga Zone. The data was collected from intervention and comparison groups. The study was delimited to circuit training; such as cardio resparatoryendurance, muscular endurance, Muscular strength, Power and Agility.

1.5. Limitation of the study

While conducting this study the researcher encountered three limited factors. Those are shortage of the day per a week and financial in adequate with the major future that influencing approaching the study more deeply and The second waswillingness of the student in this study, wastage of the period because of different condition absent of the students from class and shortage of reference materials which were done in that school and lack of experienced teacher and lack of comprehensive local previous research literature in the area.

1.6. Definition of key terms

Circuit training - is simply defined as a series of physically, resistance-based and aerobic activities, separated by short defined time period to complete each station. (Grice 2003).

Physical Fitness- is defined as a condition in which an individual has enough energy to avoid fatigues and enjoy life (NASPE 2009).

Cardiovascular endurance- is the ability of the heart, blood vessels, and respiratory system to work efficiently delivering oxygen to the muscles for an extended period of time ([USDHHS] 1996).

Muscular strength- is the ability of muscles to exert force (contract).

Muscular endurance is the ability to exert force over an extended period (contract repeatedly). Endurance postpones the onset of fatigue so that activity can be performed for lengthy periods ([USDHHS] 1996).

Power- is the ability to transfer energy explosively into force. It is a combination of strength and speed ([USDHHS], 1996).

Agility- is the ability to stop, start and change the direction of the body or body parts rapidly under control (Baechle1994).

Isotonic:-A muscle contraction with relatively constant (USDHHS).1996).

Isometric: - A muscle contraction with no change in muscle length.(USDHHS).1996

Isokinetic: - A muscle contraction with a constant speed of contraction.(USDHHS).1996

Concentric:- A muscle contrition with over all shortening.(USDHHS).1996

Ecentric: - A muscle contraction with over all muscle lengthening.(USDHHS).1996

CHAPTER TWO: LITERATURE REVIEW

This chapter deals with concept of physical education, meaning of circuit training, components of physical fitness. That means health related such as cardio respiratory endurances, muscular strength, and muscular endurance. And skill related physical fitness like agility and power, physical activity and health, regular physical activity and health, physical fitness and uses of physical fitness and relation of physical activity and physical fitness.

2.1. The Concept of Physical Education

Concept of physical fitness is as old as humankind. Throughout the history of mankind physical fitness has been considered an essential element of everyday life. The ancient people were mainly dependent upon their individual strength, vigor and vitality for physical survival. This involved mastery of some basic skill like strength, speed, endurance, agility for running, jumping, climbing and other skills employed in hunting for their livings. Over the past four decades, there has been an increase in the prevalence of overweight and physical fitness deterioration in adult across all genders, ages and racial/ethnic groups (Ichinohe et al. 2004).The negative effects of degraded physical fitness on both the individual and society are serious and multi-dimensional. It can cause many risk factors to health including coronary heart disease, certain forms of cancer, diabetes, hypertension, stroke, gall bladder diseases, osteoarthritis, respiratory problems, and gout and is associated with increases in all-cause mortality (Cataldo, 1999). In adults, relationship among physical activity, health related fitness, and health are fairly well established (Boucherd and Shepherd 1994). Low levels of physical activity and cardio-respiratory fitness are both associated with higher risk of all cause and disease specific mortality (Thune et al. 1998).Physical fitness is the ability to perform daily activities willingly and actively. Physical fitness includes not only components of sports but those of health as well. Regular physical activity prevents or limits weight gain, and gain in body mass index (BMI) (Kyle et al. 2000)

2.2. Circuit Training

Circuit training was originally developed in 1953 by Morgan and Anderson in England at the University of Leeds (Sorani, 1966). The original purpose of circuit training was to allow individuals to work out at their own level of intensity while still working out together as a group. An original circuit was made up of nine to twelve stations. An individual would work out at a station for a set period of time before moving on to the next station with little or no rest. Traditionally, a fifteen second to three minute aerobic station will be added between works out stations. This kept the aerobic system pumping and ready to go so that the individual burns fatter during their work out. Another variation of this that has been used in the past is having a group run around a gym or open area in a circle, with a trainer calling out bodyweight exercises at intervals. (http://www.workout-x.com).

Marcinik*et al.*, (1985).First selected 43 navy men aged 32.1 years and assigned to one of three exercise training protocols: circuit weight training performed at either 40 or 60% of determined one-repetition maximum strength or aerobic/calisthenics training. During the 10 weeks study, each exercise group participated in three training sessions per week performed on alternate days. The results of this study indicate that dynamic strength (both upper and lower) increased for the aerobic/circuit weight training groups but not for the aerobic/calisthenics group. With the exception of bench press endurance for the aerobic/calisthenics group, all groups showed significant increases in muscular endurance and stamina. No significant changes were seen in static strength or flexibility in any of the groups.

Marcinik*et al.,(* 1985).Secondly selected 87 male navy personnel aged 19.8 years receiving basic training at the recruit training command. One company of recruits (N=41) participated in an experimental aerobic/circuit weight training program at 70% of determined one-repetition maximum. A second company (N=46) received the standard navy recruit physical training program (aerobic/calisthenics training). During the 8 weeks study, both groups participated in an identical running program performed three times per week on alternate days. Additionally, aerobic/circuit weight training participants

completed two circuits (1circuit=15 exercises) three times per weeks on alternate days to running. Study findings show the experimental aerobic/circuit weight training program produced significantly greater dynamic muscular strength and muscular endurance changes than the standard aerobic/ calisthenics program. Recruits following the standard training program showed decrements in several muscular strength and muscular endurance measures.

2.2.1. Benefit of circuit training on physical fitness variable

There have been numerous studies on circuit training and its effects on the body. Studies showed that circuit training met the qualifications for an effective muscular workout, cardiovascular workout and this exercise method is the most effective method for increasing muscular endurance. Studies have also shown that circuit training for women is the most effective method of exercise that, when combined with diet, was helping them lose weight and keep it off long term. Today, circuit training is completed by individuals and groups, men and women alike. The exercise method is trained as being the most effective way to build explosive power for sports of all types, including fighting styles. It is also considered the best way to improve muscle strength and endurance which is important for today's athlete. (http://www.workout-x.com).

There were many benefits to using circuit training in your exercise program. These benefits stem from the fact that you were moving continuously throughout your workout. You were enjoying the benefits of strength training as well as the benefits of cardiovascular fitness. One of the major benefits of circuit training was that it was versatile. You can include whatever exercises you want in your circuit training. This means that you can work with what you have instead of forcing the need for exercise machines and expensive weight sets. You can use your own body weight, dumbbells, medicine balls or simple tools like jump ropes. Circuit training can include from 6 to 15 stations, depending on your personal work out goals and your level of fitness prior to starting this type of training. Variability also allows for the individual to keep from becoming bored with their fitness training. This keeps people interested in their work out

routines and makes them less likely to stop before reaching their fitness goals. Additionally, variability means that you can easily choose exercises based on your fitness level. This makes circuit training ideal for beginners and expert strength trainers alike. Circuit training serves athletes as a way to keep their body fit and generally conditioned without the stress of in season sports. This way you can keep yourself conditioned and in good physical shape even on the off season. (http://www.workout-x.com).

Additionally, if you do suffer an injury you can simply remove that type of exercise from your circuit and replace it with something you are physically capable of doing. For example, if you sprain an ankle, you can take jumping rope out of the circuit and add in some bench presses until your injury is healed. This way you can continue to get a work out and nurse your injury at the same time. http://www.workout-x.com.

2.3. Objective of Physical fitness development

The long term, overall objective of physical education program is to maintain and improve the health of human beings. This refers to all aspects of health including physical, mental, social, and emotional. It applies to all individual, regardless of race, color, economic students, and creed and national origin.

Physical development objective help build big muscles and develop the human organic system. (Organic refers to the digestive, circulatory, excretory, heart regulatory, respiratory and other systems of the human body)As Charles Bucher (1993, page 27) stated as in his book it results in the ability to sustain adaptive efforts, to recover, and to rest fatigue this objective also as physical fitness, physical conditioning organic development or biological development is concerned with increasing the capacity of the body for movement.

The short term and long term physiological and psychological benefits of physical fitness and exercise are well documented. This section will define the components of physical fitness and review current research across all of these components. Physical fitness is divided into three components: health-related, skill-related, and physiologic components. The health related components of physical fitness are cardiovascular endurance, muscular

strength, muscular endurance, flexibility, and body composition. The physiologic components of fitness are metabolic fitness, morphologic fitness, and bone integrity. The skill related components of physical fitness are speed, power, agility, coordination, balance, and reaction time (Whaley 2006, 3). These definitions of the physical fitness components come from the American College of Sports Medicine (ACSM), the largest sports medicine and exercise science organization in the world and widely accepted as the standard for information and reference in sports medicine. Crossfit.com is an on-line fitness community that has become extremely popular for its daily workouts based on a concept of functional movements that are constantly varied and performed at high intensity. Cross fit emphasizes the importance of functional fitness and has modified the ACSM definitions of skill and health related components of fitness to arrive at the components of functional fitness: cardiovascular endurance, stamina, strength, flexibility, power, speed, coordination, accuracy, 23 agility and balance. The Cross fit information was obtained during a two-day certification course conducted at Ft. Leavenworth, KS in December 2008 and is also available at www.crossfit.com.

A sustained physical fitness program has many long term benefits. Regular physical activity results in a stronger heart muscle than a sedentary lifestyle. A stronger 9 heart is capable of a greater stroke volume which means with each beat of the heart, more oxygen carrying blood reaches the body (Corbin 2008, 65).A higher stroke volume reduces the number of beats per minute (bpm) required by the heart. A person with a high stroke volume will, therefore, have a lower resting heart rate (RHR). An individual's maximum heart rate (MHR) is largely dependent on his age which can roughly be determined with the equation: 220 – age = MHR. The difference between an individual RHR and MHR is considered the heart rate reserve (HRR). The HRR is an indicator of an individual's capacity for work (Fahey 2007, 73). An individual's work capacity is further determined by his maximal oxygen consumption (VO2max). VO2max is a measure of the endurance capacity of the cardiovascular system and the muscular system and is influenced by genetics, gender, fitness status, and age (Powers 2006, 89; Fahey 2007, 64). The increased blood flow caused by increased fitness levels can also increase blood and oxygen flow to the brain increasing mental capacity. Increased blood flow to the skin

increases the amount of sweat produced and reduces the time before onset of sweating thus reducing core body temperature. Increases in total blood flow increases endothelium function resulting in better control of blood pressure and increases in nitric oxide secretion (Johnson 1980, 817). The increase in nitric oxide secretion positively affects energy levels (Fahey 2007, 65).

In addition to the physiological advantages of exercise, individuals can experience many psychological and emotional benefits from physical training.

2.4. Components of Physical Fitness

Fitness is defined as a condition in which an individual has enough energy to avoid fatigues and enjoy life. Physical fitness is divided into health and skill related physical fitness. Skill - related physical fitness are fitness types which enhance one's performance in sport settings. Health - related physical fitness is the ability to become and stay physically healthy. It also focuses on factors that promote optimum health and prevent the onset of disease and problems associated with in activity (National Association for Sport and Physical Education (NASPE, 2009)).

Agility and power are skill-related physical fitness components which are basic skills in performing different sport activities in speed, acceleration, changing direction, jumping and weight lifting. Cardio respiratory endurance, muscular strength and muscular endurance are health- related physical fitness components. The level of Cardio respiratory endurance, muscular strength and muscular endurance affects an individual's ability to perform daily functions and various physical activities throughout the entire life of an individual. They also assist in preventing chronic diseases, injuries and osteoporosis. Students need to maintain their Cardio respiratory endurance, muscular strength and muscular endurance to be elite sport women and preventing themselves from chronic diseases as well as to maintain their health. They also need to be agile, speedy and power full to apply their skill in a proper way (American College of sport medicine, 2003 (ACSM, 2003)).

2.4.1. Cardio respiratory endurance

Cardio Respiratory Endurance is the ability of the heart, lungs and blood vessels to deliver oxygen to working muscles and tissues as well as, the ability of those muscles and tissues to utilize oxygen. It can be measured by using a number of methods such as 1.6 km run and VO_2Max (Chris, 2011).

2.4.2. Muscular endurance

Muscular endurance refers to the ability of the muscle to work over an extended period of time without fatigue. Performing push-ups and sit ups or crunches for one minute is commonly used in fitness testing of muscular endurance. In training setting muscular strength and muscular endurance can go in line. According to the research conducted on the effects of strength training on endurance capacity of top level endurance athletes, strength training can lead to enhanced long-term and short-term endurance capacity both in well trained individuals and highly trained top-level endurance athletes, especially when high-volume, heavy-resistance strength training protocols are applied (Aagaard and Andersen, 2010).

2.4.3. Muscular strength

Muscular strength refers to the maximum amount of force a muscle can exert against an opposing force. Fitness testing usually consists of one-time maximum lift using weights, bench press and leg press. Muscular strength and performance have direct relationship. According to the research result conducted on the skeletal muscle mass and muscle strength in relation to lower extremity performance of older men and women suggest that low muscle

Strength, but not low muscle mass is associated with poor physical function (Paul *et al.*, 2000).

2.4.4. Agility

Agility refers to a person's ability to move their body quickly and easily change direction with maintaining balance. Enhanced agility also help to improve performance in basic

activities of daily living and even assist in the prevention of some types of injuries, especially fall. It recommended that agility drills must be trained progressively and slowly with an emphasis on techniques mastery, before learning the speed of movements and adding complex variations, such as open or non programmed agility training. Moreover, sports men needs agility for best performance. This research used 4x10 m shuttle run as a parameter for assessing trainee's agility (Dawes, 2008).

2.4.5. Power

Power is a combination of strength and speed as well as a measurement of an ability to exert force at higher speeds. It is the product of the force exerted on an object and the velocity of the object in the direction in which the force is exerted. Understanding power capacity and how it can be created is one of the primary keys to optimizing athletic performance. Power is the capacity to do a given amount of work as rapidly as possible. It includes the elements of strength and speed. Speed is the ability to apply force rapidly when snatching, cleaning, throwing or sprinting. There are a few lifts that qualify as an evaluation for power is the Olympic style lifts: the snatch, push jerk and the power clean (Baechle, 1994; O'Shea, 1999).

2.5. Physical activity and health

Physical activity of moderate intensity has been recommended for health and well-being since the time of Hippocrates (460–370 BC). The Greek physician Hippocrates, the `father of medicine`, advised that "Eating alone will not keep a man well; he must also identified that physical activity is a major modifiable risk factor in the reduction of mortality and morbidity of many chronic diseases (USDHHS, 1996; Armstrong, Bauman& Davies, 2000). Since the 1970´s a number of studies regarding the benefits of physical activity, the health benefits of regular physical activity (aerobic exercise) have been affirmed and summarized in reports from governmental and non-governmental organizations. U.S. Surgeon General (USDHHS, 1996), U.S. National Institutes of Health1996), U.S. Centers for Disease Control and Prevention (Pate et al., 1995), American College of Sports Medicine-ACSM (Pate et al., 1995), American Heart

Association (Blair&McCloy, 1993) have concluded that regular physical activity is associated with important health benefits.

U.S. Surgeon General Report that summarized the current consensus regarding the health benefits of physical activity concluded the following (USDHHS, 1996):

People of all ages, both male and female, benefit from regular physical activity.

Significant health benefits can be obtained by including a moderate amount of physical activity (e.g., 30 minutes of brisk walking or raking leaves, 15 minutes of running, or 45 minutes of playing volleyball) on most, if not all, days of the week. Through a modest increase in daily activity, most Americans can improve their health and quality of life.

2.6. Regular Physical Activity and Physical Fitness

2.6.1. Regular physical activity

Exercise is a subcategory of physical activity which defined as a physical activity that is planned, structured, repetitive and purposive in the sense that intended for improvement or maintenance of physical fitness. Modern exercise physiology, however, distinguishes between acute and chronic exercise, where acute exercise refers to a single bout of physical activity and chronic exercise to repeated performance of acute exercise. Chronic exercise is also known as habitual physical exercise, physical training or just training (Caspersen*et al.*, 1985; Tipton and Franklin, 2006).

Regular physical activity and exercising have many beneficial effects on health and were key factors in primary and secondary prevention of health problems, chronic diseases and age-related loss of functional capacity. However, beyond the age of 40 the amount and intensity of physical activity or specific sport activities decreases and sedentary behavior increases with adverse effects on health, physical fitness and motor performance. Physical activity is only on many factors that may affect the growing child and that a significant amount of knowledge on the effects of physical activity on the developing organism is derived by extrapolation from studies of experimental animals. The evaluations of physical growth have relied on application of anthropometric techniques

(Bailey*et al*., 1978; WHO, 2004; Hagstromer*et al*., 2007; USDHHS, 2010; Helakorpi*et al*., 2010 and Warburton *et al*., 2010).

2.7. Physical fitness

Physical fitness can broadly be defined as the ability to carry out daily tasks with vigor and alertness, without undue fatigue and with ample energy to enjoy leisure-time pursuits as well as to meet unexpected emergencies. It is a set of attributes that people have or achieve that relate to the ability to perform physical activity. It has two types' health-related physical fitness and skill-related physical fitness. Health-related physical fitness relates to functional health in which all students can improve their health status through daily physical activity. It is one of the few areas where all students can succeed regardless of ability levels and genetic limitations. It includes cardio respiratory endurance, muscular strength and endurance, flexibility and body composition. These components are usually associated with disease prevention, health promotion and typically the aspects of fitness considered most important to monitor. On the other hand, skill-related physical fitness refers to physical performance related to athletic ability or it is performance oriented and influenced by genetic traits and abilities. It includes agility, speed and power which are important for the acquisition of motor skills and for participation in sports and recreational activities. Both types of physical fitness have been related to general health and well being in children (Powell *et al*., 1989; USDHHS, 1996 and Eiberg*et al*., 2005).

2.8. Use of physical fitness

The Governor‘s Council on Physical Fitness and Nutrition believes that regular physical activity is one of the most important things Iowans can do for their health. It can help: Control weight, Reduce the risk of cardiovascular disease , Improve core strength, Contribute to productivity in the classroom and worksite , Reduce the risk for type two diabetes,

Reduce the risk for some cancers, Improve bone and muscle strength , Contribute to mental health and mood ,For older Iowans it can prevent falls and increase independence(http://www.healthyiowa.gov/fitness.aspx)

2.9. Relationship of physical activity and physical fitness

Many people assume that physical activity and physical fitness are directly related but they actually represent very different things. Physical activity is a behavior while physical fitness is a trait or characteristic. Physical activity will contribute to physical fitness the relationships are not as strong as many would expect. There are a variety of other factors that influence levels of physical fitness and many are outside of a person's control (environment, heredity and rate of maturation). The relationship between physical activity and obesity is also not as high as would be expected (especially among children). Physical inactivity can lead to obesity but it is equally plausible that obesity leads to inactivity. The current consensus is that physical activity and physical fitness is reciprocally related (bi-directional arrow) and that they exert independent effects on health. This implies that a person needs to be physically active even if they have reasonable levels of fitness. Individuals with low levels of fitness can also obtain health benefits by remaining physically active. Because some of the factors influencing fitness are out of a person's control are genetics and rate of maturation which emphasis should be placed on being physically active (USDHHS, 1996).

2.10. The view on physical fitness assessment

Historically, physical fitness assessments for children and adolescents have been a mainstay of the physical education curriculum. If used correctly, fitness assessments can enhance instruction of fitness concepts, provide diagnosis of fitness needs for individual exercise prescription, facilitate fitness goal-setting and self-monitoring skills, and promote fitness knowledge and self-testing skills (Whitehead et al., 1990). However, there are many factors other than physical activity that can influence a child‘s performance on physical fitness tests (e.g., maturation, heredity, predisposition / trainability and body composition). An overemphasis on fitness testing in the curriculum can send the wrong message to children about physical activity. For example, some children may get discouraged in physical education if they score poorly on fitness tests despite being physically active. Alternately, children may incorrectly believe that they don‘t need to be active if their fitness levels are in the healthy fitness zone. Studies have

demonstrated that negative feedback from fitness testing can lead to reduction in a child‘s level of intrinsic motivation toward physical activity (Whitehead & Corbin, 1991). These concerns have caused many experts to question the continued emphasis on physical fitness testing in the curriculum (Kemper &van Mechelen, 1996).

Recently, there has been a conceptual shift in the physical education field toward the promotion of physical activity. While fitness is still a desirable outcome, more emphasis is being placed on promoting the behavior of physical activity.

For example, in the current National Association for 35 Sport and Physical Education (NASPE) definition of a physically educated person, three of the five components refer specifically to physical activity (NASPE, 1995). In addition to having good skills and reasonable levels of fitness, a physically educated person participates in regular activity, knows the benefits of participation and values the contribution activity can make to a healthy lifestyle.

Incorporating physical activity assessments into the curriculum allows for better instruction on physical activity concepts and avoids some of the problems associated with fitness testing. An additional benefit is that by emphasizing a behavior, all children can be successful.

Many people assume that physical activity and physical fitness are directly related, but they actually represent very different things. Physical activity is a behavior, while physical fitness is a characteristic. While physical activity will contribute to physical fitness, the relationship is not as strong as one would expect. There are a variety of other factors that influence levels of physical fitness and many are beyond a person‘s control.
The relationship between physical inactivity and obesity is also not as high as would be expected (especially among children). Even if a relationship is present, it is not clear that it is a causal factor. Physical inactivity can lead to obesity, but it is equally plausible that obesity leads to inactivity. The current consensus is that physical activity and physical fitness is reciprocally related (bi-directional arrow) and that they exert independent effects on health. This implies that a person needs to be physically active even if they have reasonable levels of fitness. Individuals with low levels of fitness can also obtain

health benefits by remaining physically active. Because some of the factors influencing fitness are beyond a person‘s control (e.g. genetics and rate of maturation), emphasis should be placed on being physically active. The model presented above is useful in understanding the relationships between physical activity, physical fitness and health (Corbin, 2001) the complex relationships among physical activity, physical fitness, health wellness and etc. Source: Adapted from Bouchard et al., 1990 .2 Trends in activity choice throughout adolescence

Declines in physical activity in adolescence are predominantly in vigorous activities and non-organized sports (Bradley, McMurray, Harrell, & Deng, 2000; Caspersen et al, 2000; Van Mechelen et al., 2000). The decline in non-organized sports is evident by the reduced numbers of adolescents found playing playground games or sports and games in local parks. As participation in non-organized sports decreases, participation in organized sports becomes even more important to overall activity level. As behavioral patterns with regard to organized sport are established early (Engstom, 1991), it is important that involvement in organized sports begin in pre-adolescence. This is particularly important for girls as girls ‘team sports, which are common in middle school, tend to drop off in high school (Bradley et al., 2000). In a study into the activity choices of 656 girls and boys tracked from ages 9-15 years in the United States, girls reported more social and sedentary activities with age. Girls aged 12–15 years reported mostly sedentary activities, with talking becoming the girls ‘primary leisure activity at 12 years of age (Bradley et al., 2000). In boys, there was a sharp increase in sedentary behavior at ages 12-15 years,

2.11. Physical activity and rural women

Fewer than 15% of women are active enough to achieve a risk reduction from Coronary Heart Disease (CHD). Women have reported barriers to exercising that include lack of self-efficacy (situation-specific confidence in one’s ability), social support, time and social interaction during exercise. Women respond differently than men to programs aimed at increasing exercise. For example, in the Activity Counseling Trial Research Group (ACTRG), which focused on increasing self-efficacy and social support, the intervention was effective in women but not in men. The gender-based difference in the

effectiveness of ACTRG highlights the need to design programs specifically for women (Neis*et al*., 1998; ACTRG, 2001; Eyler and Vest, 2002).

Rural women face additional challenges to initiating and maintaining an exercise program. In comparison to urban and suburban women, rural women have lower educational levels, higher rates of unemployment, and higher rates of poverty. Rural communities have fewer medical, governmental and economic resources, including exercise facilities, compared to urban and sub urban communities (Rogers, 1997; Casper *et al*., 2000 and USDA, 2001a, 2001b).

Rural women head large, multi generational households and live in homes that are isolated from their neighbors (Bushy, 1993). Rural culture relies on traditional gender roles in which the burden of caring for family members, neighbors in need and community needs falls to the female head of the house. Rural women increasingly work outside the home, frequently requiring long commutes, yet rural culture still demands that women fulfill traditional female roles. These demographic and geographic characteristics of rural life create hardships for rural women attempting to fit exercise into their lives.

Rural women have reported a greater lack of role models, social support and a greater burden from care giving duties compared to urban and suburban women (Wilcox *et al*., 2000). These data were not obtained in response to attempting to fit exercise into daily life, but do provide context and point to differences between rural women and their urban and suburban counterparts. It is crucial to appreciate issues germane to rural women trying to adopt an exercise program as well as their responses to an exercise intervention to inform the development of appropriate exercise intervention

2.12. Physical Education Programs

From an educational standpoint, it is imperative that standards be established that will guide the physical development of children and youth throughout their years of formal schooling. Effective physical education programs should set clear expectations of students, specifically designed as age appropriate. Expectations should not only cover the development of motor skills, they should include aspects of the cognitive and affective domains as well. Those in charge of setting standards, such as those implemented in

South Carolina (South Carolina Department of Education, 2004), should be applauded for showing a commitment to the overall health of their children.

In South Carolina, seven different standards must be met if an individual is to be considered physically educated. All standards are addressed at each grade level, though each is modified so that it is age appropriate. In addition, all standards at each grade level are given an example of assessment that are used to monitor student learning and development. For example, physical education standard number one states that students should be able to demonstrate competency in many movement forms and proficiency in a few movement forms. The standard is then modified for age appropriateness so that, in preschool and kindergarten, the standard specifies that students should be able to display most fundamental movement patterns (e.g., throwing, receiving, jumping, and striking) in simple conditions and demonstrate control of the varied use of these patterns.

Each standard includes several benchmarks so that student learning can be monitored. An example of a benchmark for preschool and kindergarten is: the student will travel with control forward, backward, and sideways using a variety of locomotors patterns and change directions quickly. In addition to the benchmarks, an example of assessment is given which includes teacher observation along with criteria for assessment of the movement patterns. If the task is to demonstrate a locomotors skill (e.g., slide, hop, skip, or gallop), the teacher assesses the task and 42 three points are given if the student demonstrates each pattern at a level of mature form. If the student demonstrates the beginnings of each pattern but it is not fully developed, two points are given. Finally, one point is given if there is no evidence that the student can demonstrate the pattern at the time. This is just one example of the format used for students in the state at each grade level. The South Carolina Department of Education (2004) website provides further information regarding effective physical education programs and a complete list of state standards. It is of utmost importance that all educational systems adopt these kinds of standards and make a more concerted effort to hold educators accountable for teaching and measuring them. These issues will be addressed later in the paper.

2.13. Age-appropriate Activities

As educators and parents consider how to help children develop the five health-related fitness components it is important to consider the age-appropriateness of activities. Obviously, one would not expect a young child in the first or second grade to participate in the same type of muscular strength and endurance training as a senior in high school. It is necessary to develop exercise prescriptions for both the elementary, middle grades, and secondary levels. The goal of the prescriptions is to increase the activity level of all students to at least 60 minutes per day by suggesting activities which students can engage in outside of the classroom. Within this prescription, detailed instructions must be given for activities that are age appropriate for the development of each health-related fitness component; students can chart the time spent engaged in the various activities for their math classes and write about their exercise in their language arts classes. It is important to consider that fitness activities need to be made fun for children or they will not want to participate. For most individuals, giving a direct command to go out and run two laps will not be an interesting activity in which to participate.

In the area of cardiovascular endurance some fun activities for elementary age and middle school students might include: flag tag, a 15-minute fun circuit, or a family fun walk. In a game of flag tag, each student puts a flag in their back pocket. On the signal the students begin chasing others around the designated area, attempting to grab as many flags as they can. At the end of 1 minute, stop the game; the person with the most scarves is declared the winner for that round. The 15-minute fun circuit includes stations for jump rope, jumping over a hoop, jumping jacks, and mountain climbers. Adding music to the fun circuit makes the activity even more appealing. The family fun walk is an activity that can take place at home. With the family, students are 43 encouraged to take a brisk 20- minute walk throughout the neighborhood. A list of items to be found along the walk can be compiled to make the walk into a scavenger hunt type of activity.

For middle grade or secondary age students, flag tag can be modified into rollerblade flag tag. The same directions would apply with the exception that the students are rollerblading instead of jogging. Jumping rope is another cardiovascular activity that

older students can enjoy. Creating task cards and routines as well as setting the activity to music is an excellent way to engage students in a cardiovascular workout. It is also important to consider that basic activities such as jogging, walking, swimming, and aerobic dance are also considered excellent activities for people of all ages that promote cardiovascular endurance.

When most people think of muscular strength and endurance training, they immediately think of weight training in the weight room. However, educators should be aware that weight training is not a feasible activity for younger children. There are many activities that students of all ages can engage in without ever entering a weight room facility. For elementary age children, activities like tug-of-war, push-up routines, and the use of a stability ball can all assist in the development of muscular strength and endurance. Middle school and secondary level students can also use the stability balls, yet they may also safely begin workouts within the weight room environment. It is crucial for educators and parents to understand that teaching proper technique as well having proper supervision are key elements in a successful weight lifting program.

Body composition can be developed through a variety of activities. The stability ball can be used to perform sit-ups and crunches for students of all age levels. Each activity can be modified to fit the ability level of all students. For example, level one would consist of sitting on top of the ball, lying back and performing a certain number of sit-ups. In level two, there is a slight increase in the difficulty of the task. At this level, the student slides down the ball with their back at a slight angle. The student then attempts to perform the set number of sit-ups. Level three would be the most difficult. The student would lie down with their back on the ground, and their legs on top of the ball while performing the sit-ups. Older students can also use weight training as a method of developing body composition. Educators and parents need to also consider the importance of proper diet along with these methods of exercise when attempting to develop body composition.

The development of flexibility is mainly acquired through stretching programs. Stretches can be categorized on a continuum from static (no motion) to ballistic (rapid motion) (Kurz, 1994). Static stretching involves stretching a muscle to the farthest point and

holding the stretch. Isometric 44 stretching is a type of static stretching which involves resistance of muscle groups through the tensing of the muscles. This type of stretching is considered one of the best ways to increase flexibility. Passive stretching is sometimes referred to as relaxed stretching. During a passive stretch, an individual would assume a position and hold it using another part of the body, a partner, or an apparatus of some type. This type of stretching is good for cooling down after a workout because it helps to reduce muscle fatigue and soreness. Active stretching includes assuming a position and holding it there with no assistance other than using the strength of your agonist muscles. Active stretches are usually very difficult to hold for more than ten seconds and should not be held any more than fifteen seconds. One would find this type of stretching in an activity such as yoga. Dynamic stretching involves moving parts of one‘s body and gradually increasing reach, speed of movement, or both. Dynamic stretching can be useful as part of a warm-up for an aerobic workout. Ballistic stretching uses the momentum of a moving body part or limb in an attempt to force it beyond its normal range of motion. This type of stretching is not considered useful and it has also been known to lead to injury.

As mentioned earlier, any physical activity designed for young children needs to be made fun. Although stretching routines can be very monotonous, they can be made more exciting for young children by simply adding music and giving each stretch a unique name.

2.14. Sport-related injury

In order for prevention programmed to successfully reduce the incidence of sports-related injuries in children and adolescents, a good understanding of the factors placing young athletes at risk is necessary. Traditionally, these risk factors have been broken down into extrinsic factors (those that are external to the athlete, such as weather) and intrinsic ones (those that are inherent to the athlete, such as gender). Extrinsic risk factors typically include sport played, position within that sport, sport-specific rules, level and duration of play, playing surface, type and quality of protective equipment, coaching quality and experience and environmental factors such as weather and season. Frequently cited

intrinsic risk factors include gender, age, physiological maturation level, anatomical alignment, physical fitness level, flexibility , strength, muscle–tendon imbalances, joint stability, coordination, prospective skill level, nutrition status, history of previous injury and psychological and social factors.

Looking more closely at these lists of risk factors for injury, it is clear that some are potentially modifiable. Of the extrinsic factors, for example, sports-related factors such as rules, playing surface and equipment may all be modified to better ensure the safety of the child athlete. However, some extrinsic factors that place young athletes at risk for injury are non-modified.

Indeed, the choice of sport itself may pose a risk. Interestingly, the three sports most frequently associated with injury in boys are hockey, basketball and football. Girls are most at risk participating in gymnastics, basketball and soccer. Intrinsic risk factors, too, may be either modifiable or not. Non-modifiable risk factors include gender (boys are more likely to be injured participating in sport), left-handedness, age and history of previous injury. Importantly, many risk factors inherent to the young athlete are potentially modifiable. Fatigue (a surrogate for inadequate physical fitness) increases the risk of injuries in hockey players and baseball pitchers. Early evidence in support of the relationship between poor physical fitness and activity-related injury came from investigation of army trainees; history of inactivity, higher body mass index (BMI) and low aerobic fitness were all believed to contribute to physical-training-related injuries in this population In fact, there are good data demonstrating that youth with increased BMIs have a significantly higher risk of sustaining a sports-related injury than their normal-weight peers. In a review of the available literature on obesity and injury, McHugh reported that in 11 of the 13 studies included in his analysis, a higher BMI and/or a high percentage of body fat was associated with an increased risk of sports-related injury (specifically ankle sprains, medial collateral ligament tears and dental injuries). The reported increases in injury risk ranged from 1.4 to 3.9 times the risk identified for the normal-weight control groups. Proposed mechanisms for this finding in overweight and obese children include poor postural control (leading to problems with balance and coordination), poor physical fitness (associated with muscle fatigue and subsequent

injury) and low pre-participation physical activity levels (associated with impaired neuromuscular and motor learning). Additionally modifiable intrinsic risk factors include strength, muscle–tendon imbalances, joint stability, coordination and pro-prospective skill level. It is these factors that have been targeted with initial success in the prevention of noncontact ACL injuries in young female athletes

Final Summary

Concept of physical fitness is as old as humankind. Throughout the history of mankind physical fitness has been considered an essential element of everyday life. The ancient people were mainly dependent upon their individual strength, vigor and vitality for physical survival. This involved mastery of some basic skill like strength, speed, endurance, agility for running, jumping, climbing and other skills employed in hunting for their livings. Over the past four decades, there has been an increase in the prevalence of overweight and physical fitness deterioration in adult across all genders, ages and racial/ethnic groups (Ichinohe et al. 2004). Circuit training was originally developed in 1953 by Morgan and Anderson in England at the University of Leeds (Sorani, 1966). The original purpose of circuit training was to allow individuals to work out at their own level of intensity while still working out together as a group. An original circuit was made up of nine to twelve stations. An individual would work out at a station for a set period of time before moving on to the next station with little or no rest. Traditionally, a fifteen second to three minute aerobic station will be added between works out stations. This kept the aerobic system pumping and ready to go so that the individual burns fatter during their work out. Another variation of this that has been used in the past is having a group run around a gym or open area in a circle, with a trainer calling out bodyweight exercises at intervals. (http://www.workout-x.com). Fewer than 15% of women are active enough to achieve a risk reduction from Coronary Heart Disease (CHD). Women have reported barriers to exercising that include lack of self-efficacy (situation-specific confidence in one’s ability), social support, time and social interaction during exercise. Women respond differently than men to programs aimed at increasing exercise. For

example, in the Activity Counseling Trial Research Group (ACTRG), which focused on increasing self-efficacy and social support, the intervention was effective in women but not in men. The gender-based difference in the effectiveness of ACTRG highlights the need to design programs specifically for women (Neis*et al.*, 1998; ACTRG, 2001; Eyler and Vest, 2002).

CHAPTER THREE: RESEARCH METHODOLOGY

This chapter deals with effect of circuit training program on muscular endurance and strength development, what changes the circuit training program will bring in cardio respiratory fitness and power on female students, what is significance of circuit training program on participants in enhancing agility fitness variables, research methods, research site and population, sampling and sampling method, source of data, research procedure and procedure of data collection, exercise training protocol, method of data analysis, validity and reliability of instrument, ethical issues and code of conduct.

3.1. Research Methods

As stated in chapter one the objective of this study is to investigate the effect of circuit training program on selected physical fitness variable of Alibo high school female students in Horo Guduru Wollega Zone in oromia region. In order to achieve the intended objective quantitative method is chosen, this research was quasi experiment because true experiment impossible. The data collected from pre test result and post test result of the female student result of health related and skill related and from assistant teacher.

3.2. The research site and population

The study was conducted western part of oromia regional state at Horo Guduru Wallaga zone in jaraga jarte woreda of Alibo high School from October1/02/2015 to December30/04/2015. This woreda is found in the northern parts of Horo Guduru zone. This School is located in the Northern part of Jarte city and the distance of the school is 16 km in Alibo Village. The topography of this village was almost Plato and with suitable temperature and comfortable for farming. Alibo high School is the only high school in the Northern part of Jarte which contains grade nine and ten. In 2016, there were held in 1995. This school contains; 400 male's students and 300 female's students, total 700

students are in grade nine and ten. Out of those 300 female students142 are in grade nine. And Alibo high school has two male health and physical education teachers.

3.3. Sampling and Sampling Methods

Purposive sampling was used to select the subjects from grade nine novice female students aged 15 - 16 years old. Based on these criteria 30 female students registered after the researcher informed them to register for circuit training program and 30 of them filled personal healthy history questionnaires. These questionnaires were prepared to identify whether they were free from diseases such as diabetes, stroke, musculoskeletal injury, hypertension and cardio vascular disease (CVD).Six out of thirty (30) novice female students were rejected due to health problem. Therefore, study was carried out with twenty-four (24) subjects in intervention groups. While the total numbers of participants in both groups are 48 females.

But in comparison group there is no health question. I use us 24 students. As a chance: there are24 female students in grade 9^{th} E.

3.4. Source of Data

The data used for this study were collected from the students that means from intervention group and comparison group design measurements for fitness (cardio respiratory endurance, muscular endurance, muscular strength, power and agility) two times in terms of pre test and post test2 days per a week in 12 weeks from October1/02-Decsember 30/04/2015. To score the result of the trainer: It takes two days to test their score. The teacher take short training how to test: when it starts how to start, about the instrument, how to observe the students, about protocol of the students, duration of the day of training frequency of training and session of the trainers as much as possible.

3.5. Research Procedure

The design for the study was Intervention groups and comparison groups designed pre and post test of the two groups: from October to December in 2016.

Table3. 1.The study design layout

Treatments	Circuit training exercise
Frequency	2days/week
Total duration	12 weeks
Duration /session	40 minutes
Intensity	55-70%HR_{max}
Exercise days	Tuesday (morning), and Thursday (morning)
Time of training	Morning (9:20-10:00 A. m); Morning 10:15-10:55A. m).

In this study exercise training was done in circuit with instructions and supervisions of researcher and assistants. The training was given in 55 - 70% intensity by the investigator for 12-weeks 2 days per week for 40 minutes. Training session was started with warm up exercises for 8 minutes, workout for 18 minutes; Cool down activities for 5 minutes and total active rest among each station for 9 minutes. Pre post tests were given on selected physical fitness parameters such as cardio respiratory endurance, muscular endurance, muscular strength, power and agility.

3.6. Method and Procedure for Data Collection

All measurements and data were collected by quantitative method through appropriate selected physical fitness variables such as cardio respiratory endurance (1.6 km run), muscular endurance (60 seconds sit-ups), muscular strength (30 seconds modified push-ups), power (standing long jump in meter) and agility (4x10 m shuttle run in seconds). The data were recorded by the investigator with help of assistants. The experimental field test and exercise procedure were strictly administered and standardized in terms of administration, organization and implementation conditions using work loads of mainly

cardio respiratory endurance, muscular strength, muscular endurance, power and agility exercises. Pre and post tests were taken for all measurements: in both groups. That means in intervention and comparison groups of grade 9^{th} female students. Source: www.brainmac.co.

3.7. Exercise Training Protocol

The selected subjects were assigned in intervention and comparison groups .The warm up activities consisted: Running on the spot, arm circling, skipping jump, astride jumping, one knee raising and pressing to the chest with assistance of hands (lift/ press/ lower), through vault in threes, free walking, kicking out-stretched hand with one foot every third step and back pushing. All subjects were divided into 6 groups with 4 members in each group. There were 6 stations where each group was assigned for circuit training. Each group worked at each station for 60 seconds with 30 seconds of active recovery time before proceed to the next station by doing push up, knee push up, wide push up, lateral speed drill, sit up, high knee sprint, squat trust, twist sit up, abdominal crunch, jumping jacks and treadmills which develop upper, middle, lower and total body region. The subjects were moved to the station in a clockwise direction as soon as the recovery time was over; they were required to go through the 6 stations. During the recovery periods, subjects engaged in breathing exercises. Standing or walking around as the program progresses. At the end of the circuit training program, subjects were cool-down by jogging, walking and static stretching.

3.8. Methods of Data Analysis

Data were analyzed using computerized statistical package software (SPSS) version 20.0. The paired t-test was used to compare the preened post training tests of data. All comparisons were made at ($p< 0.05$) level of significance.

3.9. Experimental Measurements

1.6 kilometer run: Completed distance of 1.6 kilometer run was used to measure cardio respiratory endurance. The participants got adequate warm-up time to reduce the chances of injury. On the command of investigator they started at steady pace that could be maintained for the whole distance. As the finish line approached, they ran as fast as possible. Stop or lie down was foul. The minimum time in seconds were recorded as participants score. Source: www.brainmac.co.uk.

60 seconds sit ups: completed number of sit ups reps/60 seconds was used to measure the muscular endurance of abdominal. For this test the participants were asked to take the supine position with back on the floor and raises knees to approximately 90 degrees. The hands were placed beside ears without locking the fingers together. They completed as many sit-ups as possible in 60 seconds. Each sit-up started with the back on the floor and the body raised up to the 90 degrees position. The total number of sit-ups successfully completed in 60 seconds was taken as participants score. Source: www.brainmac.co.uk.

30 seconds modified push- ups: completed number of modified push- ups reps/30 seconds was used to measure the muscular strength of upper body. The chair placed against wall to prevent slide during the test. For this test, every participant lied on the back with arms by their sides and the soles of the feet against the chair. Then, the position of their elbows was marked with chalk that used as the position for the feet when carrying out this modified push-ups. They started modified push-ups by standing behind the marked line and leaned forward to place their arms on the front chair with approximately shoulder width apart. It ensured that their body and legs form a straight line and the arms and torso were at approximate right angles. As the time started, they perform as many push-ups as they could do in 30 seconds. A push-up is counted only if their chest touched the chair and the arms returned to a straight position. When the chest did not touch the seat and the arms were not fully returned to a straight position, push-ups were not counted. A number of push-ups successfully completed in the time period were taken as result. Source: www.brainmac.co.uk.

Standing long jump in meter: the distance covered in standing long jump was used to measure the power of the legs. For this test, participants kept all parts of the feet just behind the take-off line. Then, without moving the feet, swung the arms back, bent the knees and moved the body forward to perform a standing long jump. They landed with both feet together and continued moving forward. Participants were suppose to land both feet together and continued moving forward then, the distance from the take-off line to the heels landed mark was measured by measuring tape. They performed the test again if they fell backwards. The distance in meters from the take-off line to the heels was taken as result. Source: www.brainmac.co.uk.

4x10 m shuttle run: four completed number of shuttles on 10 m shuttle run course was used to measure agility. Participants began this test behind the start line in a push-up position with the forehead on the start line; on the 'go' signal they moved as quickly as possible to touch the opposite line: then returned to touch the start line, and again touch the opposite line. And finish by turning to sprint back across the start line. Starting before the 'go' signal was foul and each line must be touched with the fingers, except for the finishing line as the shuttles were completed. Time to the nearest 0.1 of a second to complete the shuttles was taken as participants result**.** Source: www.brainmac.co.uk.

3.10. Ethical Issues and Code of conduct

Ethical standards require that researcher should not put participants in a situation where they might be at risk of harm as a result of their participation. The harm may be physical or psychological. All of the participants were having clear information about the purpose of the study and gave a signed agreement to participate in this study and there were free from different disease.

CHAPTER FOUR: DATA ANALYSIS AND RESULTS

This chapter deals data analyses; students physical fitness pre-test result of health related, students physical fitness pre-test result of skill related, students physical fitness post-test result of health related, Students physical fitness post-test result of skill related, students physical fitness result (comparison of health related and skill related. To investigate the effect of circuit training program on selected physical fitness variables of Alibo high School female students in Horo Guduru Wollega Zoneof Oromia Region. The circuit training program was given to them for 12 weeks 2days/week for 40 minutes. The selected physical fitness variables were measured two times: before and at the end of training program: on Intervention group and Comparison group. The variables which were measuring for the study were such as cardio respiratory endurance, muscular strength and endurance, agility and power. The data was analyzed through paired t-test. Those variables can be divided in to two categories. Health related and skill related physical fitness; Health related were: cardio respiratory endurance, muscular strength, and muscular endurance. While skill related are agility and power. The results for each variable are discussed as follow:

4.1 Students' Physical Fitness Pre-Test Results (health related) of the two groups

In table 2 bellow shows pre test result of Intervention group and Comparison group on health related physical fitness variables such as cardio respiratory endurance(m), muscular strength(rep/30second) and muscular endurance(re/60second

Table 4.1: Health Related Physical Fitness Pre-Test Result of the intervention comparison Groups

Groups		Per-test			
	Dependent Variables	Mean	SD	t-value	Sig.
Intervention	CRE	9.52	0.89	2.54	0.014
	MS	7.17	2.42	3.65	0.001
	ME	25.16	5.14	2.71	0.009
Comparison	CRE	9.74	0.63	0.24	0.805
	MS	7.00	2.28	0.12	0.899
	ME	25.52	5.31	1.56	0.123

Note CRE=cardio respiratory endurance, MS=muscular strength, ME=muscular endurance, $p < .05$* = *Significant and the data in the form of Mean* ± *SD*

As stated in the above (Table 2) showed that the pre test result in health related performance on cardio respiratory endurance, muscular strength and endurance of the female students.

The pre test of intervention group and pre of comparison group test mean value pre test of cardio respiratory endurance was 9.52 and 9.74 when we compare the mean difference of intervention and comparison group there is no difference. Before training there is no change between those groups.

The pretest of intervention group and comparison test result mean value of muscular endurance was 25.16, and 25.52. This also shows the similarity of the two groups.

The pretest of\ intervention group and pre of comparison group test mean value for pre test of cardio respiratory endurance was 7.17 and 7.00 when we compare the mean difference of intervention and comparison group there is no difference.

4.2. Students pre test results on skill related physical fitness of two groups

In the bellow table 3 shows pre test result of Intervention groups and Comparison groups on skill related physical fitness variables such Agility (second) and Power (meter).

Table4.2: Skill related physical fitness pre- test result of the intervention and comparison groups

Groups		Pre-test			
	Dependent Variables	Mean	SD	t-value	Sig.
Intervention	Agility	12.86	0.406	1.80	0.000
	Power	1.54	0.12	3.39	0.001
Comparison	Agility	12.89	0.37	0.48	0.926
	Power	1.57	0.13	1.34	0.185

Note < .05, * = Significant *and the data in the form of Mean ± SD*

As indicated in table 3, the result of Agility and power are skill related physical fitness is listed. The mean score value of pre test result of intervention and comparison of Agility was 12.86 and 12.89 which shows similarity result score of female students. And the mean score value of Power on pre test result mean value of intervention group and comparison group was (1.54, and 1.57). Therefore, we expect during pre test of skill related fitness of intervention and comparison groups there is no mean difference in both groups. This shows they are at caution health level according to the standard rating scale seen in the appendix table 5.

4.3. Students physical fitness post results on health related of two groups

In the bellow table 4 the results of the paired t-test analyses related to the interpretation of the total health related fitness scores for the students' toward their circuit training is listed within mean and standard deviation for each of the variable by using rating scales

after (post) training. So the high mean score indicates that the highest degrees of fitness improvement on muscular strength and muscular endurance. But not in cardio respiratory endurance. The results are presented as follow

Table4.3: Health Related Physical Fitness Post-Test Result of the intervention and comparison groups.

Groups		Post-test			
	Dependent Variables	Mean	SD	t-value	Sig.
Intervention	CRE	8.93	0.68	2.54	0.014
	MS	9.71	2.38	3.65	0.001
	ME	28.64	3.60	2.71	0.009
Comparison	CRE	9.69	0.61	0.24	0.805
	MS	7.08	2.24	0.12	0.899
	ME	23.45	3.62	1.56	0.123

Note CRE=cardio respiratory endurance, MS=muscular strength, ME=muscular endurance, $p < .05$* = Significant and the data in the form of Mean ± SD

M=mean SD= standard deviation

The data (Table 4) showed that there was significantly improvement in performance on cardio respiratory endurance, muscular strength and endurance of the female students. The rationale behind the improvement in performance was due to circuit training program which was conducted for 2 days per a week in 12weeks.

The post of intervention group and post of comparison group after training test mean values for cardio respiratory endurance was 8.93 and 9.69 respectively.

The post of intervention group and post of comparison group test mean value for muscular strength was 9.71 and 7.08.

Alike, two above variables muscular endurance also showed improvement in performance from the one group to the other groups or from comparison to intervention groups. The post test of intervention groups and post of comparison test mean value of muscular endurance was 28.64 and 23.45.In this variables there is also improvement.

4.4. Students post results of skill related physical fitness in both groups.

In the bellow table 5 the results of the paired t-test analyses related to the interpretation of the total skill related fitness scores for the students' toward their circuit training is listed within mean and standard deviation for each of the variable by using rating scales after (post) training. So the high mean score indicates that the highest degrees of fitness improvement in power. But in agility the low mean value shows improvement. The results are presented as follow:

Table 4.4: Skill related physical fitness post- test result of the two groups

Groups		Pre-test			
	Dependent Variables	Mean	SD	t-value	Sig.
Intervention	Agility	12.86	0.406	1.80	0.000
	Power	1.54	0.12	3.39	0.001
Comparison	Agility	12.89	0.37	0.48	0.926
	Power	1.57	0.13	1.34	0.185

Note < .05, * = Significant *and the data in the form of Mean ± SD*

As indicated in table 5, there was significantly improvement in performance on agility and power of female students from pre to post tests in intervention group test and comparison group. In agility the post test result mean value for interventional group to comparison group were 12.14 and 12.90.

Alike agility there was significantly improvement in the power of participants. The post of intervention group and post training test mean values of comparison group were (1.65 and 1.53) .this shows improvement of the fitness.

4.5. Students test result of pre and post on two groups of Health Related Physical Fitness

In the bellow table 6 the results of the paired t-test analyses related to the interpretation of the total skill related fitness scores for the students' toward their circuit training is listed within mean and standard deviation for each of the variable by using rating scales before and after training. Rather than cardio respiratory endurance, the high mean score indicates that the highest degrees of fitness improvement. The results are presented as follow

Table 4.5: Health related physical fitness pre and post test of intervention and comparison groups in one place.

Groups		Pre-test		Post-test			
	Dependent Variables	Mean	SD	Mean	SD	t-value	Sig.
Intervention	CRE	9.52	0.89	8.93	0.68	2.54	0.014
	MS	7.17	2.42	9.71	2.38	3.65	0.001
	ME	25.16	5.14	28.64	3.60	2.71	0.009
Comparison	CRE	9.74	0.63	9.69	0.61	0.24	0.805
	MS	7.00	2.28	7.08	2.24	0.12	0.899
	M	25.52	5.31	23.45	3.62	1.56	0.123

Note- CRE=cardio respiratory endurance, MS=muscular strength, ME=muscular endurance, $p < .05$* = *Significant and the data in the form of Mean* ± *SD*

The data (Table 6) showed that there was significantly improvement in performance on cardio respiratory endurance, muscular strength and endurance of the female students. The rationale behind the improvement in performance was due to circuit training program which was conducted for 12 weeks.

The pre of intervention group and pre and post of comparison group during training test mean values for cardio respiratory endurance was 9.52, 9.74 and 9.69 respectively. This showed that the novice female students were at hazardous health level according to the standard (Appendix Table 2) for their age category. Therefore, they must work hard to improve their performance capacity immediately; if not, they may suffer an injury and long-term damage. The post test mean value of cardio respiratory endurance of intervention grous was (8.93) indicated that they were at caution health level. But, there was progressive improvement of cardio respiratory endurance throughout the training due to circuit training program. This result was supported by the study of Newport and Laliberte (2001). They concluded that appropriate physical activity could build cardiovascular fitness in all types of people. Adaption to exercise include increased heart rate, deep respiration, improved ventilation ratios in the lungs; increase in heart size and rate which lead to cover the given distance in minimum time. These factors combined with metabolic muscular changes improve the effectiveness of responses to exercise which in turn increases performance (ACSM, 1995).

Insel*et al.* (2001) concluded in their study that cardio-respiratory endurance depends on the ability of the lungs to deliver oxygen from the environment to the bloodstream; the hearts capacity to pump blood; an ability of the nervous system and blood vessels to regulate blood flow; the muscles capacity to generate power and capability of the body's chemical systems to use oxygen and process fuels for exercise.

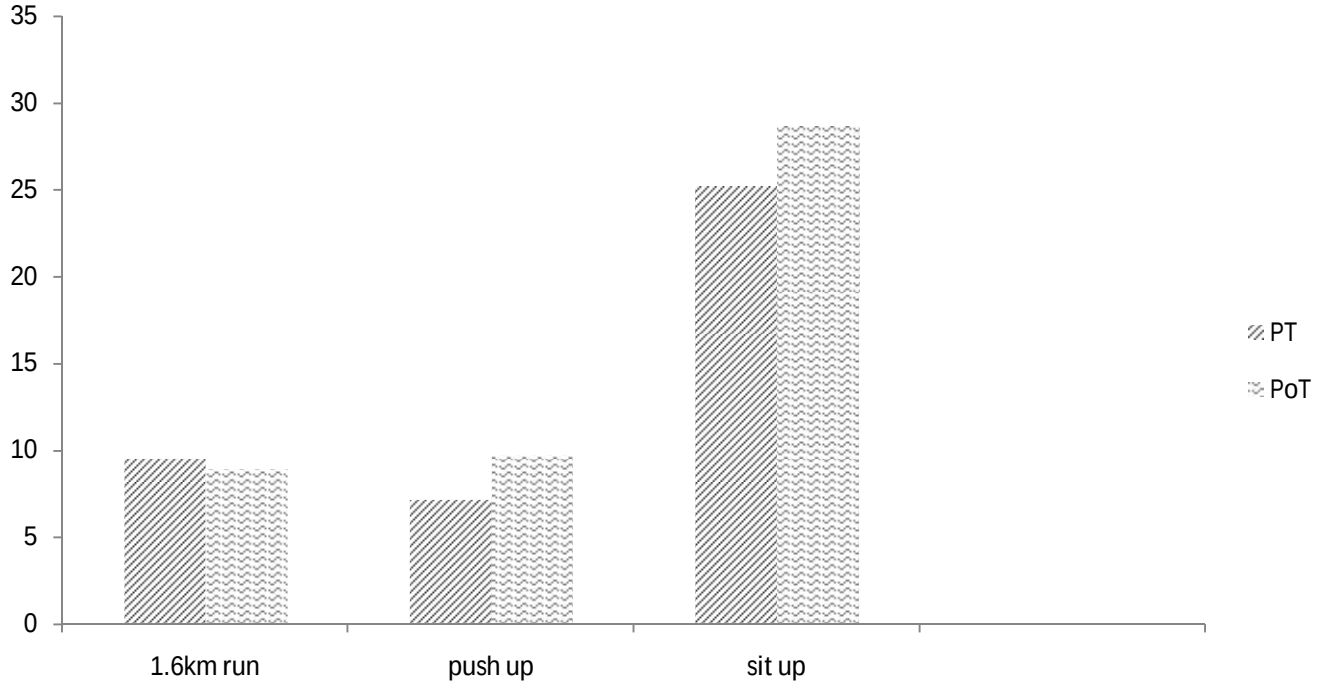
The pre of intervention group and pre and post test of comparison group mean value for muscular strength was 7.17, 7.00 and 7.08 showed that those female students were at caution health level (Appendix Table 3). Therefore, they must work hard to improve this performance capacity immediately; if not, they go to hazardous health level and they may suffer an injury and long-term damage might already be under way: Whereas, post test mean values of intervention group for muscular strength are (9.71) indicated that they were at enhanced health level. This shows they go to in the right direction. Due to this, they should do some exercises to improve this performance capacity. But there was progressive improvement in muscular strength performance which indicated by the mean difference among pre and post test of Intervention and comparison groups. The findings

on muscular strength revealed that there was significant mean difference between the tests. The mean difference in muscular strength was due to the circuit training exercises in which they were engaged in for 12 weeks.

The finding of this study was in agreement with the findings of Gettman (1979) who conducted the study on comparing the effects of circuit strength-training and jogging program. The study revealed that both programs were effective in producing significant improvement in treadmill times and $V0_2$max. However, circuit strength-training produced significant improvements in VO_2max and resting heart rate. Gettman also found significant reductions in body fat percent, fat weight, sum of six skin folds and waist girth as a result of circuit strength-training, as well as significant increases in lean body weight, biceps girth, isotonic and isometric strength measures.

Hoeger (2002) has condemned the idea that strength is a basic component of fitness and wellness which necessary for the normal physical activities and enjoyment for happier life. Strength refers to the maximum tension or force muscles develop in a single contraction against a given resistance. It is crucial for optimal performance in daily activities such as sitting, walking, running, lifting, carrying objects and doing household work or even enjoying recreational activities.

Alike, other variables muscular endurance also showed improvement in performance from intervention group to comparison groups test. The pretest of intervention and pre and post of comparison test mean value of muscular endurance was 25.16, 25.52 and 23.15.Showed that those female students were at caution health level.(appendix table4). Therefore, they must work hard to improve this performance capacity. However, in intervention post test mean values there was significantly improvement in the performance of the participants. The mean values for post tests of intervention groups were (28.64), respectively. This showed that their performance capacity of muscular endurance enhanced due to the circuit training program. This mean difference among tests showed that there was progressive improvement in performance of muscular endurance during 12 weeks training periods.



Note that cv = cardio respiratory endurance, pu = push - ups, su = sit – ups

Figure 4.1: Intervention pre and post Mean values of health related physical fitness

As shown above: This figure1 shows the mean difference of pre test to post test on health Related physical fitness of intervention group difference shows the improvement The figure 1 showed that the participants' cardio respiratory endurance, muscular strength and muscular endurance significantly improved due to circuit training that carried out 2 days per week for 3 months and enabled the subjects to perform better in 1.6 km run, push-ups and sit ups than earlier performance. Therefore, circuit training was recommended for those who want to develop their cardio respiratory endurance, muscular strength and muscular endurance.

The finding of this study was in agreement with Kaikkonen*et al.* (2000) who conducted the study on the effects of 12 weeks low resistance training on cardio respiratory endurance and muscular fitness on ninety health sedentary adults and found the training

group significantly improved cardio respiratory endurance .Lin *et al.* (2006) who dealt with the effectiveness of aerobic exercise intervention on work site health related physical fitness and observed that exercise group had significantly more improvements in abdominal muscle strength and endurance.

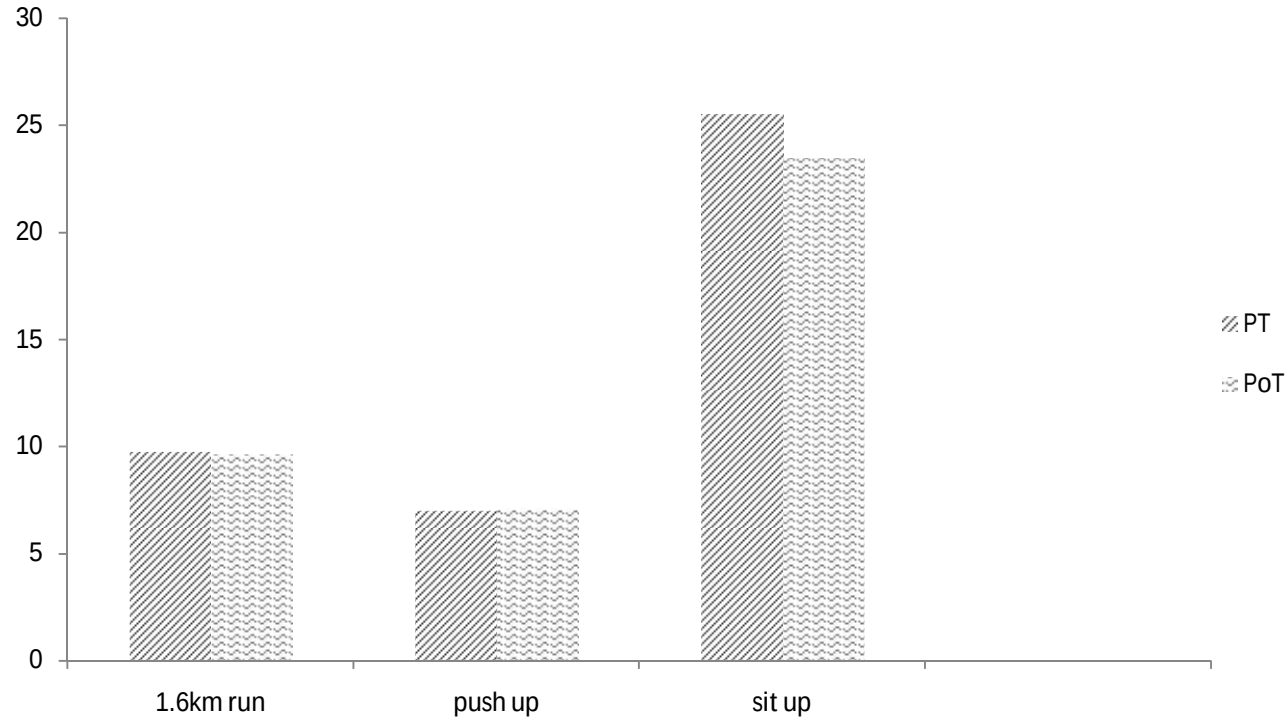


Figure 4.2: Comparison group pre and post test Mean values for health related physical fitness

As shown above figure2 shows there is no mean difference of pre test to post test on health related physical fitness in comparison group.

Figure 2 showed that comparison group's cardio respiratory endurance, muscular strength, muscular endurance showed that the comparison group female students at caution health level those was due to lack of circuit training program. Therefore they must work hard to improve this performance capacity: Unless they go to hazardous health level.

Table 4.6: Skill related physical fitness pre-test and post-test in one place of the two groups

	Dependent Variables	Pre-test		Post-test			
		Mean	SD	Mean	SD	t-value	Sig.
Intervention	Agility	12.86	0.406	12.14	0.53	1.80	0.000
	Power	1.54	0.12	1.65	0.09	3.39	0.001
Comparison	Agility	12.89	0.37	12.90	0.39	0.48	0.926
	Power	1.57	0.13	1.53	0.09	1.34	0.185

Note, p < .05, * = Significant *and the data in the form of Mean ± SD*

As indicated in table 3, there was significantly improvement in performance on agility and power of female students from pre to post tests in intervention group. In agility, the pre to post training test mean value for Conversion were 12.86, 12.89 and12.90.Showed that those female students were at caution health level (Appendix Table 5) at the beginning of the training program. Therefore, they must work to improve/enhance their performance capacity immediately; if not, they may go to hazardous health level. And this shows risk for their health level. Whereas, the post test mean values of intervention groups were (12.14) which indicated that they were at enhanced health level. These mean values indicated that they were heading in the right direction of health level.

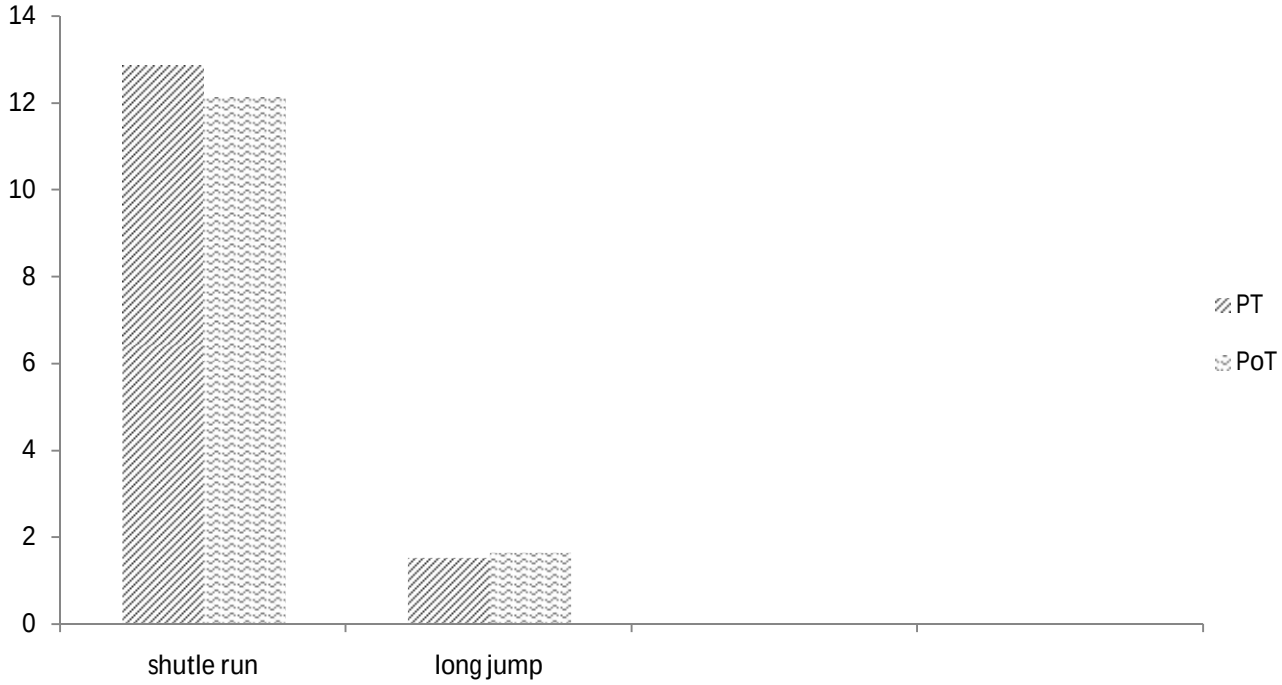
The findings on agility revealed that there was significantly improvement in performance. The improvement in agility performance level was due to the circuit training program in which they were engaged in for twelve weeks. The lower time spent in covering distance, the greater effects of training on speed, direction change and acceleration were indicating improvement of agility. The above table illustrates the improvement of agility, because there was decline in time throughout 12 weeks training.

The finding of this study was in agreement with Sharmila(2013) who mentioned that seven weeks progressive training of physical fitness program has significant improvement on all the physical fitness components in case of boys. The practice of progressive training program improved the speed, explosive power, endurance strength and forearm muscles of girls. There was no significant difference on agility and strength of abdominal muscle, component of physical fitness in girls.

Alike agility there was significantly improvement in the power of participants. The pre of intervention group and pre and post training test mean values of comparison groups were (1.54, 1.57 and 1.53) this illustrated that novice female students were at caution health level (Appendix Table 6). Therefore, they must do training in order to improve their performance capacity and health level. Whereas, post test mean value of intervention were 1.65.showed that they were at enhanced health level. As a result, they should do some exercises to improve their performance capacity. But, the mean difference between pre, and post tests indicated that the progressive improvement in performance on power during 12 weeks periods of training. The rationale behind their improvement in performance of power was the circuit training program held for 12 weeks. The standing long jump was used to measure power of the subjects.

The findings on power, as discovered by the paired samples t-test, showed statistically significances. The significant mean difference in power was due to the 12 weeks circuit training exercises of the regular training. The longer distance covering during standing long jump reveals the greater effects of training on power. The above table also illustrates that improvement of power mean increment in the distance they jumped.

The results of this study was in agreement with the result of Adeniji(2007) who conducted study to examine the comparative effects of circuit training program on Speed and Power of Pre- and Post-Menarcheal girls. Pre- to posttest control group experimental design was used to carry out the study. A total of eighty secondary school girls from St. Peter's College, Olomore, Abeokuta, in Ogun State of Nigeria, ages 10-17 years took part in the study. The findings of Adeniji indicated that the circuit training on speed and power were significantly better for experimental group.



Note, p < .05, * = Significant *and the data in the form of Mean ± SD*

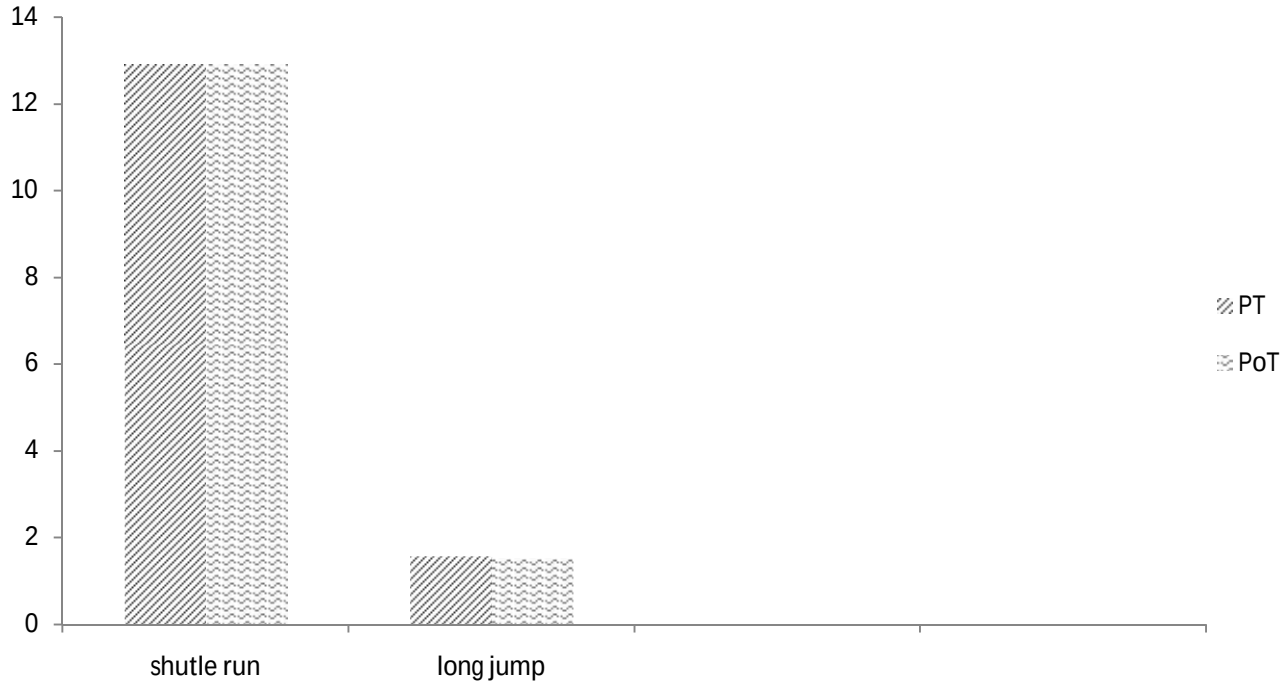
Figure 4.3: Intervention group pre-test and post -test Mean values for skill related physical fitness

As shown above this figure3 shows the mean difference of pre test to post test on skill related physical fitness in Intervention group were deference from pre to post. This difference shows the improvement of the fitness.

The figure 3 showed that the participants shuttle runs and standing long jump performance. The performance for these two variables had been observed in the improvement of agility and power due to circuit training that carried out 2 days per week for 3 months that enabled the participants to perform better from pre to post test. Therefore, circuit training was recommended for those who want to develop their agility and power.

The result of this study is supported with the study of Shaikh and Mallick (2012) that conducted the study on the effects of ply metrics training among University male students and found that ply metric training was effective in improving explosive power, agility and muscular endurance.

The finding of this study is supported with the study of Manohar and Sarvesh, (2011) who carried out their study on selected circuit training exercises that contribute positively towards the improvement in performance of cardiovascular endurance, vertical jumping ability, agility, muscular endurance and skill ability of football players as tested by shuttle run test, bent knee sit ups test, 30m running with the ball test and kicking accuracy test. Associated physical fitness variables of football players were also improved significantly as a result of selected circuit training exercises



Note, p < .05, * = Significant *and the data in the form of Mean ± SD*

Figure 4.4: Comparison group pre-test and post -test Mean values for skill related physical fitness. As shown above this figure4 shows the mean value of pre test to post test on skill related physical fitness in comparison group. In this group there is no difference pre to post test value. It shows there was no improvement of the fitness in comparison group.

The figure4 showed that the non participant of circuit training or the comparison group shuttle run to test agility and standing log jump to test power, the performance of those female students were at caution health level. In this condition they go to hazardous health level. This deference was made between those two groups. That means between experiment and non experiment due to circuit training two days per week for three months. To improve those performances they must follow this circuit training like the novice female students of intervention groups

4.6 The comparison between health related and skill related physical fitness

In the bellow table 5 the results of the paired t-test analyses related to the interpretation of the total health and skill related fitness scores for the students' toward their circuit training is listed within mean and standard deviation for each of the variable by using pre test mines post test. So the high mean score indicates that the highest degrees of fitness improvement. The results are presented as follow

Table 4.7: The mean difference value and significance level of each test results

Dependent Variables	**Test(J)Mean**	**Test (I)**	**Mean Value for (I)**	**MD (J-I) Respectively**	**P**
Cardio Respiratory Endurance (CRE)	In. PoT (J)9.52	PT (I)	8.93	-0.59	0.014
	Com. PoT(J) 9.69	pt (I)	9.74	-0.05	0.805
Muscular Strength (MS)	In. PoT (J) 9.71	PT	7.17	2.54	0.001
	Com. ex. PoT 7.08	PT	7.00	0.08	0.899
Muscular Endurance (ME)	In.PoT (J) 28.64	PT	25.16	3.48	0.009
	Com. ex. PoT 23.45	PT	25.52	-2.07	0.123
Agility	In.PoT (J)12.14	PT	12.86	-0.72	0.000
	Com ex. PoT 12.90	PT	12.89	0.01	0.926
Power	InPoT (J) 1.65	PT	1.54	0.11	0.001
	Com. ex PoT 1.53	DT	1.57	-0.04	0.185

Note: PT= Pre-Test, Test, PoT = Post Test, MD- mean difference

Table 4 showed the overall result of each test. It includes the mean, mean difference from one test to another and the significance of post tests relative to the pre test. In all the parameters there were progressive significantly improvements in performance changes which were observed in Cardio respiratory endurance, muscular strength, muscular endurance and agility and power physical fitness variables in intervention group; While not in comparison groups. When we copier the result of circuit training of the two group that means health related and skill related physical fitness in two days per a week for 12 weeks improvement was shown. But their degree is varying from one variable to the other. When we compare post result of cardio respiratory endurance was 0.59, muscular strength was2.54, muscular endurance was3.48, agility was0.72 and power was0.11. From this result we conclude that health related shows more improvement than skill related physical fitness. Generally, the result of this study revealed that circuit training program is useful to improve the physical fitness variables among female participants

CHAPTER FIVE: SUMMARY, DISCUSSION CONCLUSIONS AND RECOMMENDATIONS

This chapter is devoted to the presentation of summary, conclusions and recommendations forwarded on the basis of the finding presented in the previous chapter one, chapter two, chapter three and chapter four

5.1. Summary

The main purpose of this study was to examine effects of circuit training program on physical fitness among female students: jardaga jarte high school wallaga zone male students (Oromia region) and to forward alternative solutions that might help in alleviating the problem under study. In effects of circuit training order to achieve this purpose, a quasi experiment method was designed and employed. This study was attempted to get answers for the following basic questions:

1. What is the effect of circuit training program on muscular endurance and strength development?
2. What changes the circuit training program will bring in cardio respiratory fitness and power on female students?
3. What is significance of circuit training program on participants in enhancing agility fitness variables?

This research was conducted on 24 intervention group and 24 comparison groups of grade 9 female students of Alibo Secondary School of Horo Guduru Wollega Zone aged 15-16years old in Oromia Region. All subjects under study took part on two groups; before and after training that means pre-test and post test results from October to December in 2016, 40 mints in period two days per a week for three months.

5.2. Discussion of the study

This study assessed and tried to investigate effects of circuit training program on selected physical fitness variables like cardio respiratory endurance, muscular strength, muscular endurance, agility and power of Alibo Secondary School female students. While when we

assess this training on all variables of health related and skill related fitness variables so many materials was limited. Such as: balanced diet and modern materials in that rural aria shortage of human power like only one sport teacher in one school, lack of financial payment for assistant teacher and the like.

The major findings that depend on the research questions for this investigation were the increment or the improvement of selected physical fitness variables such as: cardio respiratory endurance, muscular strength, muscular endurance, agility and power. There are a lot of exercises that develop physical fitness of participants (Appendix Table 9). For this study1.6 km run was used to measure cardio respiratory endurance; a number of modified push-ups per 30 seconds was used to measures muscular strength; a number of sit ups per 60 seconds was used to measure muscular endurance; 4x10 m shuttle run was used to measure agility while standing long jump was used to measure the power of two groups, which means both intervention and comparison groups. The analysis of data were done through independent t-test to see the difference if any. The level of significance was set at 0.05.

As the tests result indicated that there was progressive improvement in performance from pre-test to post test on intervention groups due to the circuit training program in 12 weeks. But there was no change in the second group or in comparison groups.

The tests results showed that statistically significance enhancement observed in the participants' fitness level. Circuit training provides strenuous work entirely suited to an individual's specific needs, existing capacity and rate of adjustment to progressive vigorous exercises. The finding of this study was in agreement with Kaikkonen*et al.* (2000) who conducted the study on the effects of 12 weeks low resistance training on cardio respiratory endurance and muscular fitness on ninety health sedentary adults and found the training group significantly improved cardio respiratory endurance .Lin *et al.* (2006) who dealt with the effectiveness of aerobic exercise intervention on work site health related physical fitness and observed that exercise group had significantly more improvements in abdominal muscle strength and endurance.

While in comparison group the performance of those female students were going to hazardous health level or not improved. That deference was due to lack of circuit training which taken in12 weeks from October to December. The finding of this study was in agreement with Sharmila(2013) who mentioned that seven weeks progressive training of physical fitness program has significant improvement on all the physical fitness components in case of boys. The practice of progressive training program improved the speed, explosive power, endurance strength and forearm muscles of girls. There was no significant difference on agility and strength of abdominal muscle, component of physical fitness in girls.

5.2. Conclusions

Based on the major findings of the study, these points were stated as conclusion:

- Selected circuit training exercises contribute to the improvement of physical fitness variables on selected physical fitness
- This study found that there was progressive improvement in the selected physical fitness variables during training periods in intervention groups, while not in comparison groups.
- Regular participation in circuit training improve physical fitness of female students.
- Circuit training was found better in improving the cardio respiratory fitness, muscular endurance and muscular strength performance of the participants and significant to improve the performance of the participants on agility and power physical fitness.
- And the degree was shown in health related rather than skill related. This implies to get more improvement it requires more time. Rather than two days per a week it needs three to four days per a week.

5.3. Recommendations

Based on the results of study, these recommendations are made:

- Curriculum designer should include the needed information and guidelines for health and physical education for students. Emphasis should be given to have adequate diet and regular physical activity three days to four days per a week to score maximum level.
- Physical education should inform the improvement of the cardio respiratory endurance, muscular strength and muscular endurance of female students one has to subject them to physical activities or exercises.
- The students should be participate in regular physical activities that can be encourages female students.
- In order to have widespread opportunities to encourage females to participate in physical activities, there is great need for government agencies, private individuals and organizations to find and support productive physical activity programs in which females can participate.
- Circuit training should be included as an integral part of training in physical education program in primary school, secondary school and also in precollege and collage.

  Based on the results of study, these recommendations are made:

- School should include the needed information and guidelines for health and physical education for students. Emphasis should be given to have regular physical activity. To improve the cardio respiratory endurance, muscular strength and muscular endurance of female students, one has to subject them to physical activities or exercises. Regular participation in physical activities should be encouraged among female students.
- The students should be participate in regular physical activities that can be encourages female students by including the topic in high school.

- In order to have widespread opportunities to encourage females to participate in physical activities, there is great need for government agencies, private individuals and organizations to find and support productive physical activity programs in which females can participate.

- Circuit training should be included as an integral part of training in physical education program in high school. The subjects in this study belonged to the secondary school students. A similar study could be undertaken on high school female students.

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APPENDICE

Appendix I

Physical Activity Readiness Questionnaire (PAR-Q)

Being more active is very safe for most people and for most should not cause any problem or hazard. However, some people should check with their doctor before they start becoming much more physically active. The following list of questions should be completed by anyone who is looking to start an exercise program, to increase their current activity level or participate in a fitness testing assessment. The questionnaire helps to determine how safe it is for you .The questionnaire is suitable for those aged 15 and above. Common sense is your best guide in answering these questions. Read the questions carefully and answer each one honestly. Put x in the box of your answer.

Participant's information

Name----------

Age ----------

Address----------

2. Personal healthy history.

Yes	No	
☐	☐	Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?
☐	☐	Do you feel pain in your chest when you do physical activity?
☐	☐	In the past month, have you had chest pain when you were not doing physical activity?
☐	☐	Do you lose your balance because of dizziness or do you ever lose

consciousness?

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

☐ ☐ Are you currently taking any medical treatment such as using tablets or others?

Do you have any of the following disease?

Write Yes or No in th box.

☐ Diabetes

☐ Stroke

☐ musculoskeletal injury

☐ Hypertension

☐ Cardiovascular disease

Do you know of any other reason why you should not do physical activity? Write on the space provided:

_____

_____

_____

If you answered YES

If you answered "yes" to one or more questions, talk with your trainer before you start becoming much more active or before you have a fitness test. Tell your trainer about the PAR-Q and which questions you answered "yes".

If you answered NO

If you answered "no" honestly to all of the questions, you can be reasonably sure that you can start becoming much more physically active or take part in a physical fitness appraisal – begin slowly and build up gradually. This is the safest and easiest way to go.

Things Change

Even if you answered "no" to all questions, you should delay becoming more active if you are temporarily ill with a cold or a fever or if you are or may be pregnant. If your health changes so that you then answer "yes" to any of the above questions, tell your fitness or health professional and ask whether you should change your physical activity plan.

Assumption of risk

I hereby state that I have read, understood and answered honestly the questions as wellas I wish to participate in training program.

Client's name _____ Trainer's name _____

Signature _____Signature _____

Date _____ Date _____

Thank you for your cooperation!!

Appendix II

Table 2. Pre-post test data record sheet

Name _____

Age _____

Date Selected Fitness Components	Test Items	Unit	Pre-test	Post test
Cardio respiratory endurance	1.6 km	Minute		
Muscular Strength	30 second Push up	Rep/30 seconds		
Muscular Endurance	60 second sit up	Rep/60 seconds		
Agility	4x10 m shuttle run	Second		
Power	Standing long jump	Meter		

Source: Own

Appendix III

Different Standards and Norms for Test

Table 3. Standards and Norms for Cardio respiratory endurance of 1.6 km run test

15 years	16 years	Rating
≤ 8.20	≤ 8.20	T
8.21-9.24	8.21-9.24	E
9.25-9.27	9.25-10.27	C
≥ 10.28	≥ 10.28	H

Source: www.brianmac.co.uk./ 'Performance Evaluation Tests'.

Table 4. Standards and Norms for Muscular Strength of 30 seconds push-up test

15 years	16 years	Rating
□ 12	□ 12	T
10-12	10-12	E
5-9	5-9	C
□ 5	□ 5	H

Source: www.brianmac.co.uk./ 'Performance Evaluation Tests'.

Table 5. Standards and Norms for Muscular Endurance of 60 seconds sit-up test

15 years	16 years	Rating
≥ 32	≥ 32	T
27-31	27-31	E
21-26	21-26	C
≤ 20	≤ 20	H

Source: www.brianmac.co.uk./ 'Performance Evaluation Tests'.

Table 6. Standards and Norms for A uttle run test

15 years	16 years	Rating
≤ 11.7	≤ 11.7	T
11.8-12.2	11.8-12.5	E
12.6-13.1	12.6-13.1	C
≥ 13.2	≥ 13.2	H

Source: www.brianmac.co.uk./ 'Performance Evaluation Tests'.

Table 7. Standards and Norms for Power of standing long jump test

15 years	16 years	Rating
≥ 1.75	≥ 1.75	T
1.60-1.74	1.60-1.74	E
1.45-1.59	1.45-1.59	C
≤ 1.44	≤ 1.44	H

Source: www.brianmac.co.uk./ 'Performance Evaluation Tests'

Table 8. Definition of Ratings Symbols

Symbol	Definition
T	Tremendous – Whatever you are doing, keep doing it, it is working; congratulations, but do not slacken off now – keep up the good work.
E	Enhanced – Well done, you are heading in the right direction; you might consider varying the type or amount of exercise in your life slightly in order to reach the next level.
C	Caution – You should do some exercise to improve this performance capacity; your body might not be able to perform in this area should it be required to.
H	Hazardous – You must work to improve this performance capacity immediately; if not, you may suffer an injury and long-term damage might already be underway.

Source: www.brianmac.co.uk./ 'Performance Evaluation Tests'.

Appendix IV

Training Schedule

The main purpose of the circuit training program is to examine the effect of selected physical fitness variables on novice female students of Alibo Secondary School for 12-weeks experimental periods (April, May and June). The frequencies of the exercise is 3 days/ week and its duration is 40 minutes per session with 8 minutes of appropriate warm-up,18 minutes circuit training,5minutes of cool down and totally 9 minutes for active rest among station. Exercises for warm up: walking, jogging, arm-cycling, rope jumping, stride jumping and dynamic whole body stretching. Exercises for cool down: Jogging, Walking and static stretch of whole body.

Table 9. Three months circuit training workout schedule

No	Items	Duration
1	Frequency	2 days/week
2	Set	Two
3	Repetition	'n' numbers/60 seconds.
4	Intensity	55%-70%MHR
5	Duration of whole training	12 weeks
6	Duration of training/session	40 minutes/session
7	Duration for each exercise	60 seconds/station
8	Active rest among stations	30 seconds/station
9	Days of training	Tuesday (morning9:20-10:00 A.m and Thursday morning 10:15-10:55 A.m.)
10	Number of stations	Six

Table 10. Exercises for whole body workout

Station		1	2	3	4	5	6
D A Y S	Tues.	Push up	Lateral speed drill	Sit up	Ricochets	Abdominal crunch	Squat Thrust
	Thurs.	Knee push up	High knee sprint	Twist sit up	Jumping Jacks	Treadmills	Wide Push up

Table 11. Upper, lower, core and total body circuit training exercises

No	Upper body circuit Training exercises	Lower body circuit Training exercises	Core region circuit Training exercises	Total body Circuit Training exercises
1	Push up	Lateral speed drill	Sit up	Ricochets
2	Knee push up	High knee sprint	Twist sit up	Jumping jacks

Source: http://www.brianmac.co.uk/exercise.htm (Accessed 4/2/2013).

Declaration

I, the undersigned, declare that this is my work and that all sources of materials used have been duly acknowledged.

Name	Kassahun Aga
Signature	_____
Place	Addis Ababa University
Date of submission	_____

This thesis has been submitted for examination with my approval as university advisors;

Name	Signature	Date
ADVISOR: Mekbib Alemu (PhD)	_____	_____