

**Effect of Circuit Training on Selected Physical Fitness variables of Middle Distance Runners on Oromia Forest Wild Life Enterprise Athletics club**

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## Abstract

Speed- endurance, muscular strength and speed are components of physical fitness which plays great role in a middle distance running. The primary purpose of this study was to evaluate the effects of selected types of circuit training exercise on enhancing speed-endurance, muscular strength and speed of Middle Distance Runners on Oromia Forest Wild Life Enterprise. The study was conducted to improve speed –endurance, muscular strength and speed performances on 8 male athletes of Middle Distance Runners on Oromia Forest Wild Life Enterprise. These eight male athletes were assigned as one experimental group and their age ranges 18-21 years. All subjects participated in selected circuit training for 8 weeks i.e., three days per week and 60 minutes duration per day. Pre-test and post training test were conducted on physical fitness variables such as flying 30 meter test, standing broad jump and 400meter control tests. The data collected from subjects were analyzed by paired simple t-test to determine the differences between pre-test and post-test mean value results of the participants of the study. According to the findings of the study, 400meter control tests 1.94625 mean differences. In standing broad jump test.02500 meters increments and in flying 30 meter test .04500 mean differences data were observed. Therefore, the results obtained from the study indicate that there were significant improvements within, standing broad jump and 400meter control tests, while not in flying 30 meter test.

**Keywords:-** Circuit Training, Physical fitness, 400M control Test, flaying 30 minutes, standing Broad jump

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# TABLE OF CONTENT

## Contents

Abstract .....	i
Acknowledgments.....	ii
TABLE OF CONTENT .....	iii
LIST OF TABLE .....	vi
LIST OF FIGURE.....	vii
LIST OF ACRONYM.....	viii
<b>CHAPTER ONE .....</b>	<b>1</b>
<b>1. INTRODUCTION.....</b>	<b>1</b>
<b>1.1 Back ground of the study .....</b>	<b>1</b>
<b>1.2 Statement of the problem .....</b>	<b>4</b>
<b>1.3 Objective of the Study .....</b>	<b>5</b>
<b>1.3.1 General Objectives .....</b>	<b>5</b>
<b>1.3.2 Specific objectives .....</b>	<b>5</b>
<b>1.4 Significance of the study .....</b>	<b>6</b>
<b>1.5 Delimitation of the study.....</b>	<b>6</b>
<b>1.6 Limitations of the study .....</b>	<b>6</b>
<b>1.7. Definition of terms.....</b>	<b>6</b>
<b>1.7 Organization of the paper .....</b>	<b>7</b>
<b>CHAPTER TWO .....</b>	<b>8</b>
<b>2. REVIEW OF RELATED LITERATURE .....</b>	<b>8</b>
2.1. Middle-distance events.....	8
2.2. Definition of Circuit Training .....	8

2.2.1.	Benefit of circuit training on physical fitness variable .....	10
2.3.	Objective of Physical fitness development .....	11
2.4.	Additional circuit ideas (Australian College of Sport and Fitness) .....	13
2.4.1.	Stretch or relaxation circuit .....	13
2.4.2.	Duplication i.e. set up station with pairs .....	13
2.4.3.	Split Circuit .....	14
2.4.4.	Overtaking .....	14
2.4.5.	Team Circuit .....	14
2.4.6.	Benefits of circuit training .....	14
2.5.	Adaptations for strength training .....	15
2.6.	Progression in circuit training .....	15
2.6.1.	Muscular endurance circuit training .....	15
2.6.2.	Cardiovascular Endurance Circuit (CVE) .....	16
2.6.3.	Anaerobic Circuit .....	17
2.7.	Speed Endurance .....	17
2.8.	Speed .....	17
2.9.	Physiological Factors Associated with Middle Distance Running Performance ....	18
<b>CHAPTER THREE .....</b>		<b>19</b>
<b>3.</b>	<b>RESEARCH METHODOLOGY AND DESIGN .....</b>	<b>19</b>
3.1.	Research Design .....	19
3.2.	Research site and population .....	19
3.3.	Sampling and methods of sampling .....	20
3.4.	Source of data .....	20
3.5.	Inclusion and exclusion criteria .....	20
3.6.	Circuit training program .....	20

<b>3.7. Methods of Data Analysis</b> .....	23
<b>3.8. Experimental Measurements</b> .....	24
<b>3.9. Ethical Issues</b> .....	27
CHAPTER FOUR.....	28
4. DATA ANALYSIS AND INTERPRETATION .....	28
<b>4.1. Descriptive Statistics</b> .....	28
<b>4.2. Speed-Endurance (400m Control Test)</b> .....	31
<b>4.3. Muscular strength (standing broad jump Test)</b> .....	32
<b>4.4. Speed (flying 30 meter Test)</b> .....	33
<b>4.5. Discussion</b> .....	34
<b>4.6. Summary of discussion</b> .....	36
CHAPTER FIVE .....	37
5. CONCLUSIONS AND RECOMMENDATIONS.....	37
<b>5.1. Summary</b> .....	37
<b>5.2. Conclusions</b> .....	38
<b>5.3. Recommendations</b> .....	39
Bibliography .....	41
Appendix.....	44
<b>Appendix 1</b> .....	44
Appendix 2.....	45



## LIST OF TABLE

Table 1: Muscular Endurance training time on and off .....	16
Table 2.Circuit training schedule .....	21
Table 3: circuit training schedule.....	22
Table 4: circuit training schedule.....	23
Table 5 Normative data for standing broad jump .....	25
Table 6 Normative data for flying 30 meter test.....	26
Table 7: Height of participant in this study (middle distance runners).....	29
Table 8: Weight of the participant of the study .....	29
Table 9: Training age of participants .....	30
Table 10 Mean and Standard deviation of 400m Control Test (Pre-test and Post-Tests).....	31
Table 11 paired sample t-test result of 400m Control Test.....	31
Table 12Mean and Standard deviation of standing broad jump Test (Pre-test and Post-Tests)...	32
Table 13paired sample t-test result of standing broad jump test .....	33
Table 14Mean and Standard deviation of flying 30 meter Test (Pre-test and Post-Tests) .....	33
Table 15paired sample t-test result of flying 30 meter Test .....	34
Table 16post mean, pre mean, mean difference and p value .....	36

## LIST OF FIGURE

Figure 1: Circuit Training .....	10
Figure 2: structure of physical fitness .....	13
Figure 3: Research design .....	19
Figure 4: Age of participant of the study .....	28
Figure 5: Grade level of participant of the study .....	30





## LIST OF ACRONYM

AAU .....	Addis Ababa University
ACSF.....	Australian college of sport and fitness
ACSM .....	American College of Sports Medicine
BPM.....	beats per minute
FITT.....	Fitness Principle: Frequency, Intensity, Time and Type
HRR.....	Heart Rate Reserve
MHR.....	Maximum Heart Rate
MED.....	Master of Education
RHR.....	Resting Heart Rate
<i>PT</i> .....	<i>Pre-Test, ,</i>
<i>PoT</i> .....	<i>Post Test,</i>
<i>MD</i> .....	<i>mean difference</i>
<i>p</i> .....	<i>p-value</i>

## CHAPTER ONE

### 1. INTRODUCTION

#### 1.1 Back ground of the study

Physical fitness is the motor abilities namely strength, speed, endurance, flexibility and coordinative abilities. The motor abilities and their complex form (e.g. strength, endurance, explosive strength etc.) are the basic pre-requisites for human action. Each sport requires a different type and level of physical condition and as a result a different type of training or condition is required for different sports (Singh, 1991).

Workers in the sports field concerned about looking for the best ways and education method as well as training methods to reach with the trainee to the highest possible levels of physical and motor fitness. The methods became the foundations for building and promotion, since they were used for all forms of sports with their various types. Here, the coach should select the most appropriate method in training. (Al- Abhar, 2001).

Different scholars, the training type will have different type of fitness, intensity, and time and type preference. This is called FITT principle. Hence, depending on the intended adaptation, the number of sets and reps will be different. For instance according to (Australian college of sport and fitness, 2013), the muscle size can be increased with lower strength by 6 to 12 reps with 2 to 3 sets, and 1 to 6 reps with 4 to 6 sets for maximum strength in this case muscle hypertrophy will be secondary adaptation. Thompson (2009), “supporting this argues that maximum strength is best developed by exercises which involve a low number of repetitions and a large resistance or loading. Power is developed through fast repetitions using an appropriate loading and strength endurance is developed using a high number of repetitions with a low resistance.”

The objectives of physical training are to increase the athlete’s physiological potential and to develop bio motor abilities to the highest standards (Tudo. Bompa, 1999).

Sport-specific Circuit is to meet the specific requirements of a sport; it is advisable to design a circuit that is sport-specific. In addition to being specific to the sport that the athlete is involved in, a circuit should be related to the age (chronological and training), fitness levels (in particular the fitness weaknesses) and desires / aims of the athletes. Comyns, (2012)

Form Kassahun (2016) review of Sorani, (1966), circuit training was originally developed in 1953 by Morgan and Anderson in England at the University of Leeds. The original purpose of

circuit training was to allow individuals to work out at their own level of intensity while still working

o

t 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 faster during their work out

Certain factors need to be considered, as follows, when designing a sport-specific circuit these are Skills involved in the sport, fitness requirements of the sport; which of these requirements is most important? Will this change depending on the time of year? ,actions or movements involved in the sport, for example, jumping movements in Gaelic football, getting up off the ground quickly in rugby. Major muscle groups used in the patterns of movement involved in the sport, time of year, i.e. pre-season or competitive season. Corbin et al. (2003)

The term sport-specific training' implies that exercises should mimic as much as possible the actions of the body during participation in a given sport. Specificity should not, however, be over emphasized when selecting resistance exercises because it could lead to imbalances. Consequently, finding a balance between general and specific exercises would be appropriate in a circuit (Tom Comyns, 2012).

Middle distance events are the most demanding in track and field because they are actually long sprints. Usually 800m and 1500m events are considered middle distance. Training is designed to develop these attributes. The produce of this study is a professional in the athletics, and wants to study the main effects of muscular strength and endurance, as part of circuit training for speed endurance, to assess their effect on the physical fitness of middle distance runners. "Whatever the concept of the race, the 800m is the distance race that requires the athlete to spend a great deal of time in an anaerobic state; therefore, this should be emphasized during training of 800m and 1600m runners than 3200m runners because those races are 30–50% anaerobic, (Ather coaching manual, 2012).

In the athletics area, Ethiopia has been involved in different competition categories of different level. Especially most of the participant athletes being originally from the rural part of Ethiopia regional clubs play significant role. Of the regions in Ethiopia, Oromia is well known with Arsi athletes long distance runners. Still Oromia regional state is working with different enterprises



of the region to enhance and contribute to the national anthem driven victory in the athletics.  
Among those ente



rprises, Oromia forest wild life enterprise athletic club is one of the Oromia regional clubs founded in 2008 following the study conducted in 2007 by the Oromia sport commission. By the time the commission conducted the research with the aim of: reaching the rural children of the farmer's and create the opportunity to involve them in the athletics, facilitate the continuity of the athletics in the region and in the national, and support clubs as industry. The sport commission then based on these set objectives, criteria of locating the clubs strategically, founded 20 main athletics club in different parts of the region. The researcher heard Abba DulaGemmeda, the president of the region, during the commission's 2008 annual meeting saying; we do not have to work only to make Oromia where athletes "spring from"; rather we have to work for sea change and create "athletic sea flood." Due to this athletic reform made in the region, Oromia forest wild life enterprise athletic club was formed in 'Alemgena' area, and lately shifted to 'Entoto' where it is found by now. The club is under the control of a regional and governmental; organization called Oromia forest enterprise. Temporarily the club covers an estimated area of 5000 m<sup>2</sup> and it will be expected to expand and cover up to 10000 m<sup>2</sup>. When founded the club started its operation with fewer numbers of athletes selected from the champions of different regional competitions depending on the range of distance they run; namely, short, middle and long distance. The middle and long distance runners are managed by the same coach, and the other coach manages the short distance runners. The athletes have governmental services like shelter, diets and sport's wear, and it is entirely dependent on the schedule, consent and initiates of the authorized organ.

## **1.2 Statement of the problem**

Motivation of athlete is very important both at training and during competition. In doing so, achievable goals and derivable actions are important for both training and competition. From the experiences the researcher gained, as a professional, trainings which involve variety of physiological and physical variables which are important, and circuit (is "one completion" of all prescribed exercises in the program) there are the main types of trainings. Types of training selected to this study and deal with the effect of training on the physiological and physical aspects of the athletes. Corbin et al. (2003)

Speed to of the Athlete may be determined by different factors but the researcher believed that most professionals training are the most important. Thus, athletes can dramatically improve his

or her speed with proper training. This is because in principle, the human body's response to training, stress and skill acquisition is dependent on the intentioned outcome, which is a function of level of performance and the capacity for work. And overloading is the essential mechanism, or tool, for creating this adaptation. Any new type of training subjects the body to greater or different stress than that to which has become accustomed. When the load is greater than the normal level of exertion, that load becomes a stressor and stimulates a general adaptation process within the athlete. According to LA84 foundation, the major method of creating adaptation to overloading is "progression". For the intended progress to be achieved, however, an accurate assessment of an athlete's capacity for training must be made. Athletes should be pre-tested and then periodically reassessed in terms of the physical requirements and skills demanded by their respective event(s). Some common physical fitness measurement testing are:-400 Meter Control Tests, Standing broad jump, and Flying 30 minutes test. Such defined measurement of testing physical fitness becomes the foundation upon which the researcher basically aims at answering the effect of circuit training on the selected variables described above. The researcher with above figure to be sorted in mind raises the following three main research questions:

1. Are there differences between pretest and posttest of selected physical fitness variables middle distance runners on Oromia Forest Wild Life Enterprise?
2. Are there significant relationships between pretest and posttest of selected physical fitness variables middle distance runners on Oromia Forest Wild Life Enterprise?
3. Does circuit training have significant effect on selected physical fitness variables middle distance runners on Oromia Forest Wild Life Enterprise?

## **1.3 Objective of the Study**

### **1.3.1 General Objectives**

The general objective of the study is to assess the Effect of Circuit Training on selected Physical Fitness variables of Middle Distance Runners on Oromia Forest Wild Life Enterprise.

### **1.3.2 Specific objectives**

- ✓ To compare the differences between pretest and posttest of selected physical fitness variables middle distance runners on Oromia Forest Wild Life Enterprise
- ✓ To assess the significant relationships between pretest and posttest of selected physical fitness variables middle distance runners on Oromia Forest Wild Life Enterprise.

- ✓ To examine the effect of circuit training on selected physical fitness variables middle distance runners on Oromia Forest Wild Life Enterprise?

#### 1.4 Significance of the study

The study will be used as a stepping stone to other sister clubs and to the target club to assess the effects of the training in depth if this study will have significant effects on the athlete's performance. Since, the performances of the athletes have to be improved using different training mechanisms, conditioning program, progressive improvement using different clearly figured methods of training; such study will be important to develop strategies at the regional and the national level. Depending on the post test results that would be recorded, analysis given in the study and recommending given later, the researcher believes that this study will definitely help other professionals to go through the area in depth.

#### 1.5 Delimitation of the study

This research will be delimited to assess the Effect of Circuit Training on selected Physical Fitness variables of Middle Distance Runners on Oromia Forest Wild Life Enterprise. Delimited to Ethiopia, Oromia, Oromia Forest Wild Life Enterprise. This will be done from June 2018-October, 2019. The study also delimited to variables, including circuit training, speed endurance, muscular strength and speed.

#### 1.6 Limitations of the study

The limitations of the study were; one the health status of the subject's athletes were not controlled; second Atmosphere, Climatic conditions and percentage of humidity were not controlled

#### 1.7. Definition of 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)

**Power** - "Successful athletes are powerful athletes", it is the relationship between speed of contraction and speed of movement. Corbin et al. (2003)

**Muscular strength** is the amount of force produced with a single maximal effort of a muscle group. Corbin et al. (2003)

**Balance**:-the ability to keep an upright posture while standing still or moving ( Tamizhappan, 2010)

**Speed-** the ability to perform a movement or cover a distance in a short period of time (veloaragan, 2010)

**Speed-endurance:-** is the ability to prolong the amount of time where a near maximal speed can be maintained. Brian Mackenzie, (2005),

**Sets** – specified number of repetitions which comprises one set LA84 coaching manual, 2012

## **1.7 Organization of the paper**

This study composed of five chapters. Chapter one focus on introductory part. Chapter two emphasizes on literature review. Chapter three deals with methodology and research design. Chapter four deals with data presentation analysis and discussion and finally in chapter five the main findings summarized, concluded and recommended.

## CHAPTER TWO

### 2. REVIEW OF RELATED LITERATURE

#### 2.1. Middle-distance events

The predecessor of the 800 meters was the half-mile (880 yards or 804.67m), and was first run in Britain around 1830. The 1500 meters was derived from the mile (1609.32) which is still run today, although as a non-standard distance. It was originally run on the 500-metre tracks of continental Europe in the 1800s. The 5000- and 10 000 meters are metric adaptations of the 3-mile (4828m) and 6-mile (9656m) events. (IAAF, 2004)

Middle-distance events are traditionally defined as the track events which fall between the short-distance (or sprinting) events, such as the 100m, 200m, 400m and hurdle events (110m and 400m), and the longer distance events, such as the 10 000m, half-marathon (21.1km) and marathon (42.2km) distances. There is much debate over which events are defined as middle-distance, with some authors including distances up to 10 000m in this category (Brandon, 1995; Snell, 1990). Traditionally, the 800m, 1500m and the mile are described as true middle-distance events, but most authors would include the 3000m and 5000m, as well as the steeple-chase events (2000m and 3000m), in this category. (IAAF, 2004; Snell, 1990)

#### 2.2. Definition of Circuit Training

Circuit training is a combination of high intensity aerobics and resistance training designed to be easy to follow, give you a great workout, and target fat loss, muscle building and heart lung fitness. An exercise "circuit" is one completion of all prescribed exercises in the program; the idea being that when one circuit is complete, you start at the first exercise again for another circuit. Traditionally, the time between exercises in circuit training is short, often with rapid movement to the next exercise. Circuits can be designed using all sorts of equipment to no equipment at all. They can be designed for indoor or outdoor delivery. The concepts of design and delivery are the same for any circuit program you design, regardless of whether you make use of equipment or not. Gettman et.al (1978)

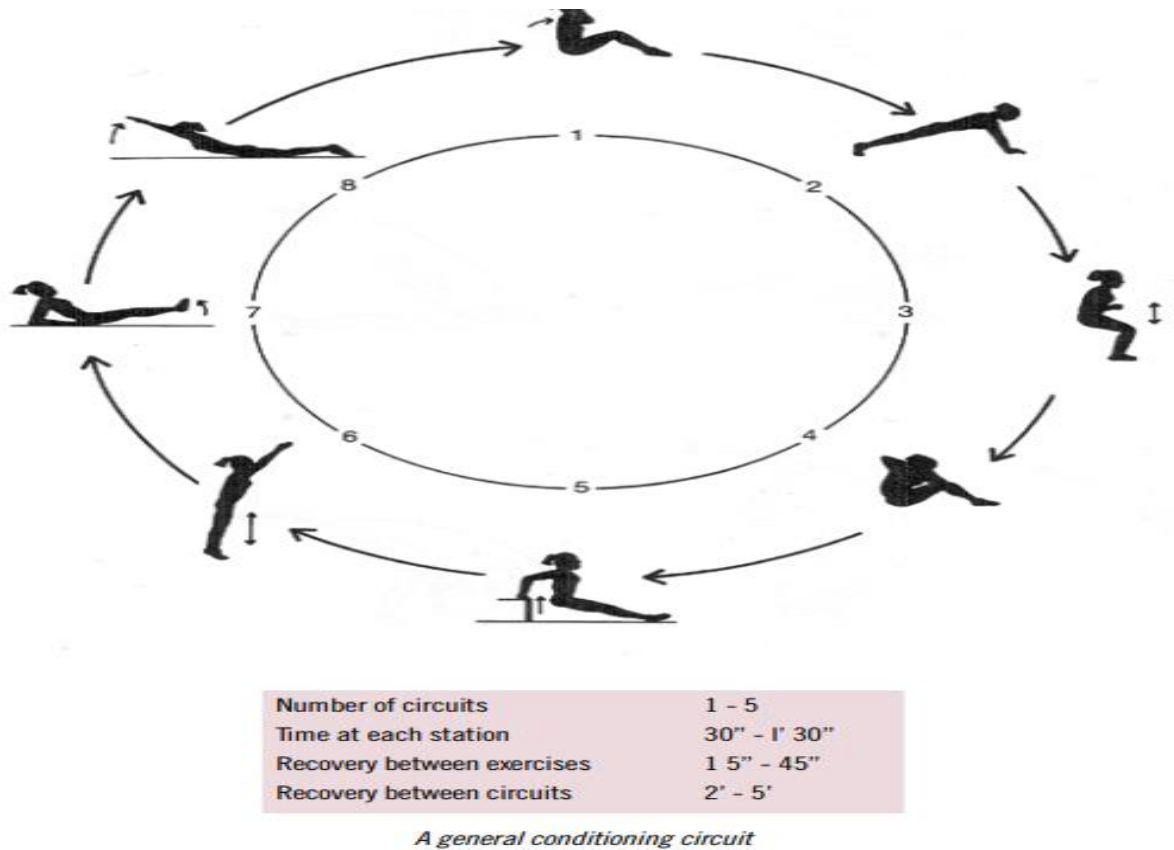
Marcinik, Edward, Hodgdon, Mittleman, Karen, O'brien and James, (1985), from their studies in 10 weeks, they indicate that dynamic strength (both upper and lower) increased for the aerobic/circuit weight training groups but not for the aerobic/calisthenics group. With the

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. However, Marcinik et al., (1985), on their second round, participated in an experimental aerobic/circuit weight training program at 70% of determined one-repetition maximum, and another group second 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. Beckham (2000)



Figure 1: Circuit Training



Source: Thompson (2009)/IAAF

### 2.2.1. Benefit of circuit training on physical fitness variable

According to Kassahun (2016), 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 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.

There were many benefits to using circuit training; one of the major benefits of circuit training was that it was versatile. One can include whatever exercises she or he wants in his or her circuit training. This means that one can work with what he/she have instead of forcing the need for exercise machines and expensive weight sets. One can use his or her own body weight, dumbbells, medicine balls or simple tools like jump ropes. Kassahun Aga (2016) continues and

thinks that circuit training can include from 6 to 15 stations (different from the average 9-12 stations), depending on personal work out goals and 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 can keep oneself to be conditioned and in good physical shape even on the off season. Additionally, if one suffers an injury he or she can simply remove that type of exercise from circuit and replace it with something he or she is physically capable of doing. For example, if sprain an ankle, taking jumping rope out of the circuit and add in some bench presses until the injury is healed. W.B et.al (2001)

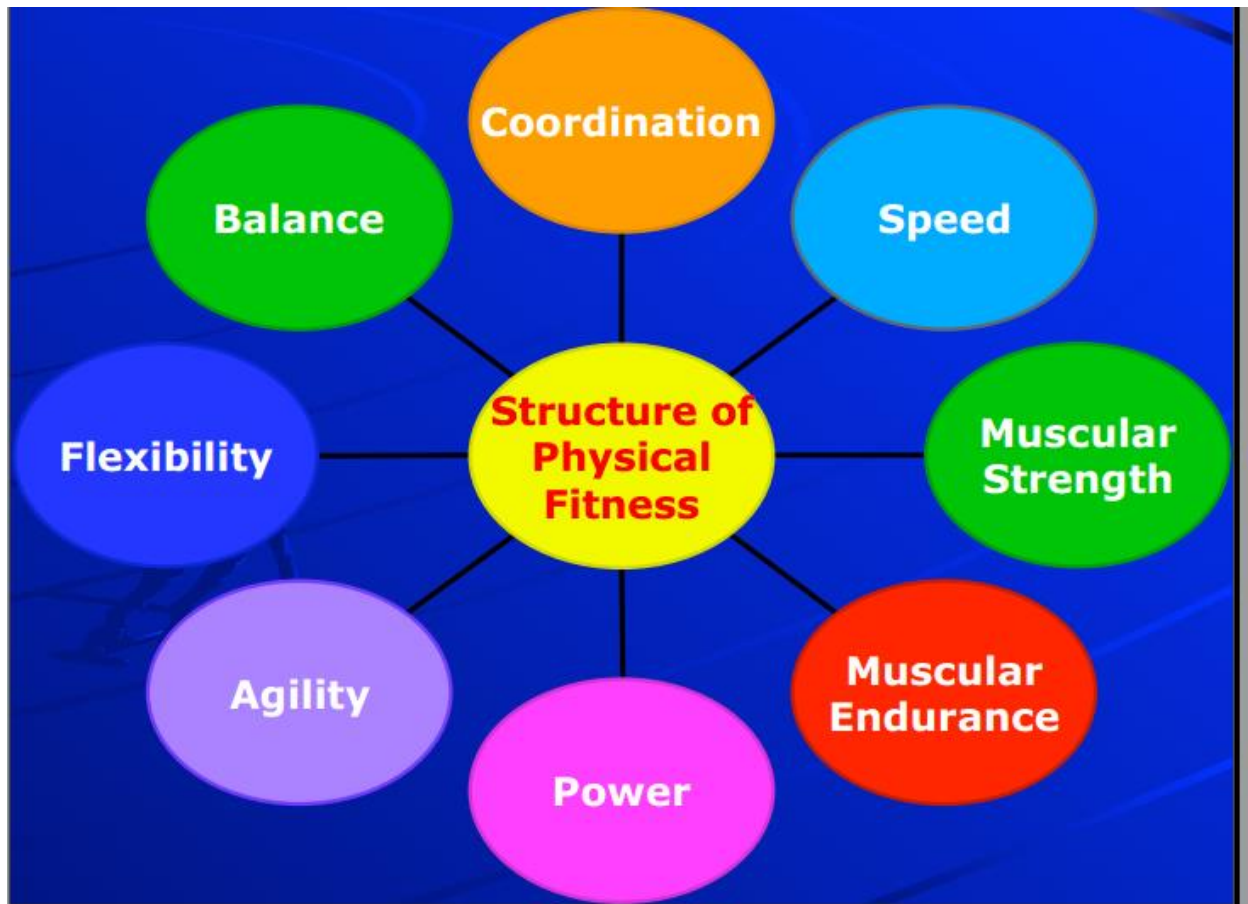
### **2.3. Objective of Physical fitness development**

Training program is used 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). Tan (1999) Young

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. 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. As of Kassahun (2016), 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. 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 heart is capable of a greater stroke volume which means with each beat of the heart, more oxygen carrying blood reaches the body. 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:  $220 - \text{age} = \text{MHR}$ . 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. An individual's work capacity is further determined by his maximal oxygen consumption (VO<sub>2</sub>max). VO<sub>2</sub>max 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 (crossfit.com). 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. In addition to the physiological advantages of exercise, individuals can experience many psychological and emotional benefits from physical training.

Figure 2: structure of physical fitness



Source: Thomas(1993)

## 2.4. Additional circuit ideas (Australian College of Sport and Fitness)

### 2.4.1. Stretch or relaxation circuit

A circuit does not always have to train at high intensity or to the maximum of clients ability; instead a circuit training session could revolve around more relaxed exercises that involved stretching, breathing and relaxation techniques. Gettman et.al (1978)

### 2.4.2. Duplication i.e. set up station with pairs

Think about setting up the circuits and have clients train in pairs rather than on their own. This can give clients an additional person to motivate them or even be competitive against. For example, one client may have to do 10 sit ups, and then swap, and whilst their partner is performing the exercise, they get to rest. It is important that clients are paired off with a partner

of similar capabilities and motivation. Remember motivation can be an individual thing, but clients can be categorized into enjoying certain types of motivation. The apparatus to be worked on is also duplicated. Each person competes simultaneously against the other in the number of repetitions attained in the present time. This is the most common lay out. Young, W.B (2001)

### **2.4.3. Split Circuit**

Person moves along line of apparatus performing predetermined repetitions on each selected apparatus in personal preferential order, no rest allowed. For example 15 reps on each exercise, then move on to the next exercise. Second time around reps may change.) Tan (1999)

### **2.4.4. Overtaking**

Circuit training persons start off at intervals and try to overtake the person in front - techniques must be correct. Always have a minimum of two sets of equipment laid out. An excellent addition to this is to get the group to run completely around the circuit stations, then on to the next exercise. Make sure that if you do this method, your group is fit, and there is sufficient space to run around. Beckham (2000)

### **2.4.5. Team Circuit**

One team performs, the others rest - time or reps tried to be bettered, or set teams in lines and all work together. Move on to next exercises when the whole team has finished. (Teams must be of similar ability). Good for motivating and bonding teams. Gettman (1978)

### **2.4.6. Benefits of circuit training**

There are a number of benefits that can be enjoyed by conducting circuit classes, these include: Ease of conducting the session, Ease of controlling a group of participants, Client can familiarize themselves with exercise that are repeated so less instruction is required, Clients feel part of a team in group circuit training, the session can be completed in a short amount of time, The session can be complete with minimal equipment. Gettman (1978)

## **2.5. Adaptations for strength training**

The major adaptation that occurs from strength training is change in whole muscle size (muscle hypertrophy). This increase in size comes from the increase in the cross section of the myofibril size and increase in amount of myofibrils (individual muscle fibers). Gambetta, V (1996)

A result of this increase in area size causes an increase demand for nutrients and oxygen, therefore the amount of blood capillaries around the muscles, providing nutrients and oxygen to these muscle fibers. Other adaptations that may occur are: improved co-ordination, increase motor unit recruitment, improved strength and function of support tissues, ligaments, tendons and fascia, bone mineral content increases (occurs over a longer period of time 6 months to 12 months) and energy systems become more efficient (increase in store of Phosphocreatine, increase Lactic acid tolerance). For instance; the ability of our body to supply ATP (Adenosine Tri-Phosphate or muscle energy) to our muscle fibers for different contractions in a short period of time depends on muscular strength, which can range from 0 to around 15 seconds.

The purpose of interval training is hence, to enhance the athlete's ability to produce and tolerate lactic acid during a race. Interval training is intense, demanding, and painful. It should not be included more than once a week in a training plan, and some athletes may require two to three days of easy running to recover fully from a hard interval training session (LA84 coaching manual, 1995-2012).

## **2.6. Progression in circuit training**

It is necessary to provide a progressive heightening of the stressor (the exercise stimulus) to oblige the body to seek a higher status of adaptation. Change only one variable at a time Increase the time on before adding resistance Decrease the repetitions of each exercise or the time on when adding another circuit. Gambetta, V (1996)

### **2.6.1. Muscular endurance circuit training**

This includes exercises that cover the upper, middle and lower sections of the body.

Include exercises that work the front and back of the body, i.e. opposing muscle groups, such as quadriceps and hamstrings. Lower-body muscular activities need to include Forwards and

backwards movement, e.g. lunge Up and down movement, e.g. step-up Right and left movement, e.g. side-plunge

The sequencing of the exercises is important. Vary the muscle group area that is worked from one exercise to the next. A common sequence to use is an upper-body exercise followed by a middle-body exercise and then a lower-body one. This selection and order of an ME circuit will avoid excessive fatigue in the muscle group and help to maintain good technique, resulting in a reduced risk of injury and a better training effect. Taşkin H (2009)

**Table 1: Muscular Endurance training time on and off**

Exercises	Time on (s)	Time off (s)	No. of circuits
1. Press-up/modified press-up	30	15	2
2. Sit-up	30	15	2
3. Dumbbell squat & shoulder press	30	15	2
4. Bent-over row	30	15	2
5. Back extension	30	15	2
6. Multi-lunge	30	15	2

Source: The Lucozade Sport Education Program

### 2.6.2. Cardiovascular Endurance Circuit (CVE)

Like the muscular endurance circuit, a CVE circuit would tend to be used during the pre-season. Or it uses many of the movements that are typical of an aerobics session. The movements include dynamic actions using large muscle groups.

It includes on-the-spot and off-the-spot exercises; an example of an on-the-spot exercise is knee-lifts and an off-the-spot exercise would be running shuttles. Include high and low impact exercises The exercises selected should be balanced as follows :Side to side movement Up and down movement Forwards and backwards movement Alternate between the different directions

of movement. Alternate between the high and low impact exercises. Keep the athletes active during the time off (e.g. walking or stepping side to side).

### **2.6.3. Anaerobic Circuit**

The aim of such a circuit is to develop power, speed and anaerobic endurance. It stimulates the body to develop the anaerobic energy systems through bouts of maximum-intensity, short-duration exercises. Exercises tend to be explosive in nature, e.g. squat jumps, and should involve the major muscle groups in the legs; a plyometric exercise is a jumping type exercise designed to develop explosiveness and speed, e.g. hopping, squat jumping. The intensity level is high and the heart rate should be somewhere between 80% and 95% of the maximum heart rate. (The Lucozade Sport Education Programme)

## **2.7. Speed Endurance**

Speed Endurance training sessions are just a bit slower than maximum speed efforts. Training sessions that target Speed Endurance stimulate the body's energy and muscular systems to carry a very fast velocity to near exhaustion. Scott Christensen (2003),

The middle-distance events create a very high aerobic and anaerobic energy system demand for racing success. Athletes need to be aerobically fit, and also to be able to effectively tolerate a high load of lactate produced anaerobically. They also need to improve their maximum speed so they get more efficient at sub-maximal speed. There is just a lot to do to fully develop the elite middle-distance runner. Scott Christensen (2003),

Speed endurance sessions should only be done during a structured microcycle because lactate will accumulate and will need to be buffered, and recovery is more in the 48 hour range. Speed endurance sessions are among the hardest workouts athletes do because one is trying to hold as much maximum speed as possible out to as far as 150 meters. The quality of this type of work for a top-notch miler cannot be overstated. The warm-up unit for a speed endurance session should be long and detailed. Gamble, RP, Boreham, CA, and Stevens (1993)

## **2.8. Speed**

Speed in sport represents complex psychomotor skills (Verchoshansky, 1996). They involve moving the body as rapidly as possible. Speed is classically defined as the shortest time required for an object to move along a fixed distance, which is the same as velocity, but without specifying the direction (Harman & Garhammer, 2008). In practical terms, it refers to the ability to move the body as quickly as possible over a set distance. However, in reality, the issue is



slightly more complex because speed is not constant over the entire distance can therefore be divided into several phases: acceleration, maintenance of maximum speed and deceleration (Plisk, 2008).

## **2.9. Physiological Factors Associated with Middle Distance Running Performance**

Middle distance running involves popular race distances with performance dependent on a number of physiological factors. The physiological characteristics of successful runners are different from those of sprinters and long distance runners. Maximal oxygen uptake ( $\dot{V}O_{2max}$ ), running economy and the anaerobic threshold are variables that have been shown to limit performance during long distance running, and rapid velocity and anaerobic variables have been shown to limit performance during sprinting. Success with middle distance running is dependent on an integrative contribution from aerobic and anaerobic variables which allows a runner to maintain a rapid velocity during a race. The relative contributions of the 2 energy systems are functions of distance, intensity and the physiological abilities of the runner. Middle distance runners can be successful with physiological profiles that include a variety of aerobic and anaerobic capabilities, and this characteristic separates them from long distance runners.

## CHAPTER THREE

### 3. RESEARCH METHODOLOGY AND DESIGN

#### 3.1. Research Design

This study focuses on effect of circuit training on selected physical fitness variables of middle distance runners on Oromia Forest Wild Life Enterprise. In order to achieve this study quasi-experimental design was used. Thus, this study has only experimental design but no control group. The participants was assessed pretest and posttest of selected physical fitness variables speed endurance, muscular strength and speed. At the middle the participants was given 8-weeks circuit training was given. The assumption in designing the research is that the athletes are professionals and can: Pace selves demonstrate speed, strength and speed endurance

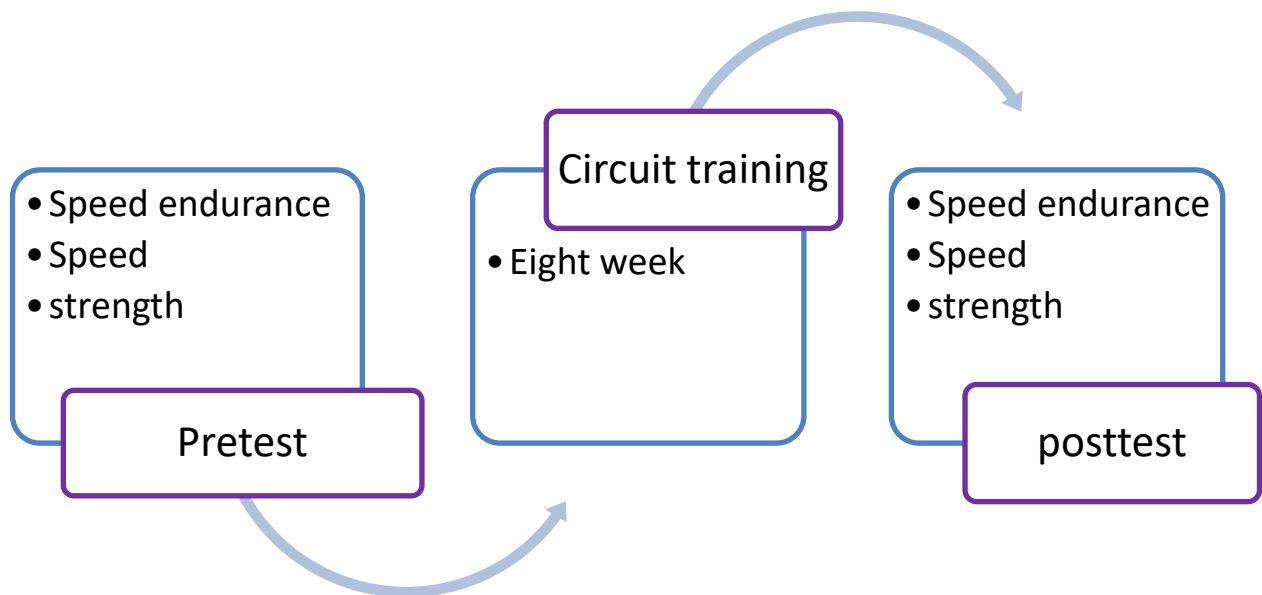


Figure 3: Research design

#### 3.2. Research site and population

The Oromia Wild Life Forest Enterprise Athletics Club is located in Oromia region Sululta Woserbi Town commonly known as Entoto located near Addis Ababa. It has an altitude ranging from 2800m to 3000m. Oromia Wild Life Forest Enterprise Athletics Club has 43 athletes engaged in short, middle and long distance athletics category.

### **3.3. Sampling and methods of sampling**

For the purpose of this study, totally 8 athletes age ranged from 18 to 21 years was selected as subjects from the Oromia forest enterprise athletic club. Purposive sampling technique was used in order to select all middle distance runners.

### **3.4. Source of data**

The research employs both primary and secondary data source. Primary data was 8-weeks circuit training protocol which was collected from middle distance runners. The secondary source was as a support experimental work reviews of literatures which are one or the other way related to the topic

### **3.5. Inclusion and exclusion criteria**

The inclusion criteria includes age range 18-21, weight 53-68kg, free from injury and diseases or sickness and elite athletes. Exclusion criteria was injury reported athletes, athletes engaged in competition and new entry athletes.

### **3.6. Circuit training program**

The duration of the training was eight weeks with 6 days per a week 60 minutes per one day. The training program was again consisted of warm up exercise for 10 minutes to raise pulse: i.e. to gradually raise the heart rate and warm up the largest muscle groups to the working rate. More oxygen is also made available to the working muscles, which will improve performance. Activities often include jogging, side stepping and skipping; to stretch: i.e. to lengthen the specific muscles used in the main activity, helping to prevent injury. Most of this should be active stretching, which involves stretching the joints while moving; and to mobilize joints: i.e. to move the joints into positions appropriate to the main activity, again helping to prevent injury. Activities often include rotation exercises, such as shoulder rotation, when the joint is moved carefully through its full range of movement. Circuit training exercise of core Push up, Jumping jack, Squat jump, running on the spot, Step up, bent over row, Zigzag running

<b>Warming up</b>	<b>exercise</b>	<b>Intensity/ time per station</b>	<b>No of circuit per session</b>	<b>Rest interval between sets</b>	<b>Rest interval between circuit</b>	<b>Speed of execution</b>	<b>frequency</b>	<b>Cooling down</b>
Week 1-3								
<b>15 min</b>	<b>Sit up</b>	<b>30 sec</b>	<b>2</b>	<b>30 sec</b>	<b>2 min</b>	<b>Medium</b>	<b>6 days</b>	<b>10 minute</b>
<b>15 min</b>	<b>Push up</b>	<b>30 sec</b>	<b>2</b>	<b>30 sec</b>	<b>2 min</b>	<b>Medium</b>	<b>6 days</b>	<b>10 minute</b>
<b>15 min</b>	<b>Jumping jack</b>	<b>30 sec</b>	<b>2</b>	<b>30 sec</b>	<b>2 min</b>	<b>Medium</b>	<b>6 days</b>	<b>10 minute</b>
<b>15 min</b>	<b>Squat jump</b>	<b>30 sec</b>	<b>2</b>	<b>30 sec</b>	<b>2 min</b>	<b>Medium</b>	<b>6 days</b>	<b>10 minute</b>
<b>15 min</b>	<b>Sprint</b>	<b>30 sec</b>	<b>2</b>	<b>30 sec</b>	<b>2 min</b>	<b>Medium</b>	<b>6 days</b>	<b>10 minute</b>
<b>15 min</b>	<b>Step up</b>	<b>30 sec</b>	<b>2</b>	<b>30 sec</b>	<b>2 min</b>	<b>Medium</b>	<b>6 days</b>	<b>10 minute</b>
<b>15 min</b>	<b>Skinning rope</b>	<b>30 sec</b>	<b>2</b>	<b>30 sec</b>	<b>2 min</b>	<b>Medium</b>	<b>6 days</b>	<b>10 minute</b>
<b>15 min</b>	<b>Zigzag running</b>	<b>30 sec</b>	<b>2</b>	<b>30 sec</b>	<b>2 min</b>	<b>Medium</b>	<b>6 days</b>	<b>10 minute</b>

**Table 2.Circuit training schedule**

Week 4-6
----------

15 min	<b>Sit up</b>	45 sec	2	1min	3 min	Medium	6 days	10 minute
15 min	<b>Push up</b>	45 sec	2	1min	3 min	Medium	6 days	10 minute
15 min	<b>Jumping jack</b>	45 sec	2	1min	3 min	Medium	6 days	10 minute
15 min	<b>Squat jump</b>	45 sec	2	1min	3 min	Medium	6 days	10 minute
15 min	<b>Sprint</b>	45 sec	2	1min	3 min	Medium	6 days	10 minute
15 min	<b>Step up</b>	45 sec	2	1min	3 min	Medium	6 days	10 minute
15 min	<b>Skinning rope</b>	45 sec	2	1min	3 min	Medium	6 days	10 minute
15 min	<b>Zigzag running</b>	45 sec	2	1min	3 min	Medium	6 days	10 minute

**Table 3: circuit training schedule**

Week7-8
---------

15 min	<b>Sit up</b>	<b>1min</b>	<b>2</b>	<b>90 sec</b>	<b>3 min</b>	<b>fast</b>	<b>6 days</b>	<b>10 minute</b>
15 min	<b>Push up</b>	<b>1min</b>	<b>2</b>	<b>90 sec</b>	<b>3 min</b>	<b>fast</b>	<b>6 days</b>	<b>10 minute</b>
15 min	<b>Jumping jack</b>	<b>1min</b>	<b>2</b>	<b>90 sec</b>	<b>3 min</b>	<b>fast</b>	<b>6 days</b>	<b>10 minute</b>
15 min	<b>Squat jump</b>	<b>1min</b>	<b>2</b>	<b>90 sec</b>	<b>3 min</b>	<b>fast</b>	<b>6 days</b>	<b>10 minute</b>
15 min	<b>Sprint</b>	<b>1min</b>	<b>2</b>	<b>90 sec</b>	<b>3 min</b>	<b>fast</b>	<b>6 days</b>	<b>10 minute</b>
15 min	<b>Step up</b>	<b>1min</b>	<b>2</b>	<b>90 sec</b>	<b>3 min</b>	<b>fast</b>	<b>6 days</b>	<b>10 minute</b>
15 min	<b>Skinning rope</b>	<b>1min</b>	<b>2</b>	<b>90 sec</b>	<b>3 min</b>	<b>fast</b>	<b>6 days</b>	<b>10 minute</b>
15 min	<b>Zigzag running</b>	<b>1min</b>	<b>2</b>	<b>90 sec</b>	<b>3 min</b>	<b>fast</b>	<b>6 days</b>	<b>10 minute</b>

**Table 4: circuit training schedule**

### **3.7. Methods of Data Analysis**

Data was analyzed using statistical package software (SPSS) version 23.0. To compare the differences between pretest and posttest of selected physical fitness variables middle distance runners on Oromia Forest Wild Life Enterprise. Mean and standard deviation was used, to assess the significant relationships between pretest and posttest of selected physical fitness variables middle distance runners on Oromia Forest Wild Life Enterprise. Spearman correlation coefficient will be used and to examine the effect of circuit training on selected physical fitness variables middle distance runners on Oromia Forest Wild Life Enterprise multiple regression coefficients will be used. Significant level is  $p < .05$

### 3.8. Experimental Measurements

#### A) 400 Meter Control Tests:-to monitor speed endurance, of a 400 meter athlete

##### Objective

The objective of this test is to monitor the speed, speed endurance of a 400-metre athlete.

##### Required Resources

To undertake this test, you will require:

- 400-metre track
- Cones
- Stopwatch
- Assistant

##### How to conduct the test

This test requires the athlete to undertake a series of sprints, with recovery, over 150-metres, 300-metres and 600-metres.

- The athlete warms up for 10-minutes
- The assistant marks the 150-metres, 300 meter, and 600 meter sections on the track with cones
- The assistant gives the command "GO" and starts the stopwatch
- The athlete sprints the 150-metres section as fast as possible
- The assistant stops the stopwatch when the athlete's torso crosses the finishing line and records the time
- The athlete has a 15-minute recovery
- The assistant gives the command "GO" and starts the stopwatch
- The athlete sprints the 300-metre section as fast as possible
- The assistant stops the stopwatch when the athlete's torso crosses the finishing line and records the time
- The athlete has a 15-minute recovery
- The assistant gives the command "GO" and starts the stopwatch
- The athlete sprints the 600-metre section as fast as possible
- The assistant stops the stopwatch when the athlete's torso crosses the finishing line and records the time

##### Analysis

Analysis of the test result is by comparing it with the athlete's previous results for this test. It is expected that, with appropriate training between each test, the analysis would indicate an improvement in the athlete's 400-metre speed and speed endurance.

### **B) Standing long jump in meter:**

#### **Objective**

- To monitor the development of the athlete's elastic leg strength.

#### **Required Resources**

To undertake this test, you will require:

- Long Jump Pit
- 30-metre tape measure
- Assistant

#### **How to conduct the test**

- The athlete warms up for 10 minutes
- The athlete places their feet over the edge of the sandpit, crouches down and using the arms and legs jumps horizontally as far as possible landing with both feet into the sandpit
- The assistant measures and records the distance from the edge of the sandpit to the nearest impression made by the athlete in the sandpit
- The athlete repeats the test 3 times
- The assistant uses the longest recorded distance to assess the athlete's leg strength

The following table is for male athletes (adapted from Hede et al. 2011)

**Table 5 Normative data for standing broad jump**

Age	Excellent	Above average	Average	Below average	Poor
>16	>2.44m	2.44 - 2.29m	2.28 - 2.16m	2.15 - 1.98m	<1.98m

#### **Analysis**

Analysis of the test result is by comparing it with the athlete's previous results for this test. It is expected that, with appropriate training between each test, the analysis would indicate an improvement in the athlete's leg strength

### **C) Flying 30 meter test**



## Objective

To monitor the development of the athlete's maximum sprint speed.

## Required Resources

To undertake this test, you will require:

- Flat non-slip surface
- Cones
- Stopwatch
- Assistant

## How to conduct the test

This test requires the athlete to sprint 60 metres.

- The athlete conducts a warm-up for 10 minutes
- The assistant marks out a 60-metre straight section (AC) with cones and places a cone at the 30-metre point (B)
- From a sprint start with appropriate start commands (on your marks, set, "GO") from the assistant the athlete sprints the 60m
- The assistant starts the stopwatch on the command "GO"
- The assistant records the time the athlete's torso crosses the 30-metre point (B) and the 60-metre point (C)

## Analysis

Analysis of the test result is by comparing it with the athlete's previous results for this test. It is expected that, with appropriate training between each test, the analysis would indicate an improvement in the athlete's sprint speed.

The following normative data, adapted from Chu (1996), has been obtained from the results of tests conducted with world class athletes.

CHU, D.A. (1996) *Explosive Power and Strength*. Champaign: Human Kinetics

**Table 6 Normative data for flying 30 meter test**

	Excellent	Above Average	Average	Below Average	Poor
Male	<2.6 secs	2.6 - 2.9 secs	2.9 - 3.1 secs	3.1 - 3.3 secs	>3.3 secs

### **3.9. Ethical Issues**

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 have clear information about the purpose of the study and will agree (professionals) to participate in this study and there were free from different health related problems.

## CHAPTER FOUR

### 4. DATA ANALYSIS AND INTERPRETATION

This chapter dealt with the analysis of data collected from the samples under this study. The purpose of the study was to examine the effects of circuit training in improving speed-endurance, strength and speed performance of selected Athletes in Middle Distance Runners on Oromia Forest Wild Life Enterprise Athletics club. To achieve the purpose of the study 8 male Athletes from Oromia Forest Wild Life Enterprise Athletics club were selected as subjects and their age was 20-25 years. They were assigned in one group and the selected exercises were given for 8 weeks. The variables which were selected for this study were 400 Meter Control Tests, Flying 30 meter test and Standing broad jump. Pre and post tests were conducted for all 8 study subjects and the test results were recorded. The collected data were analyzed by paired sample t-test using SPSS version twenty (V.23). The results for each variable were discussed below.

#### 4.1. Descriptive Statistics

Figure 4: Age of participant of the study

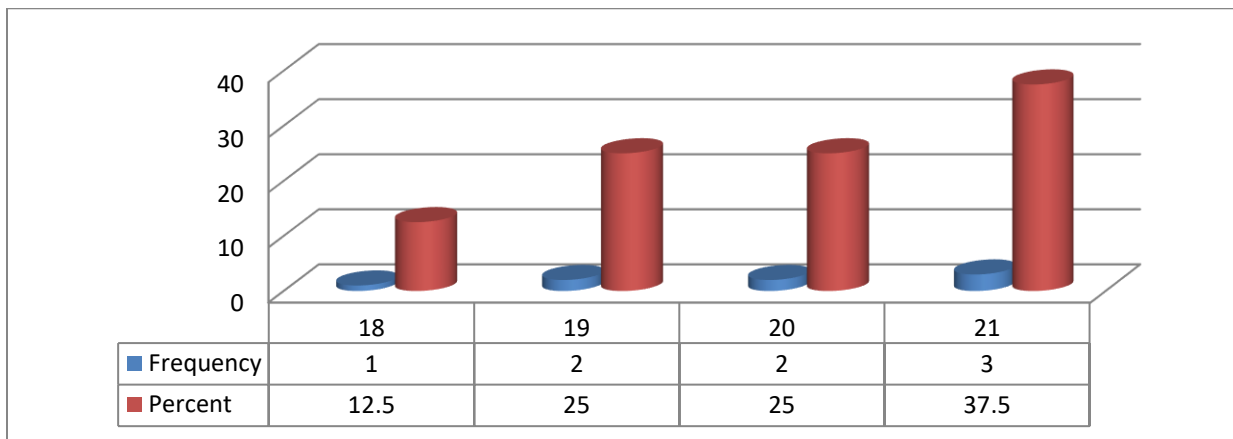


Figure 4.1 illustrated that age of participant of the study. In this regards 37.5 of the participant were in the age category, followed by 25% of the participant were in the age category of 20 and 19 where as 12.5 % of the participants were in the age category of 18. Thus, from the above information the majority participant in this study were in the age category of 21.

**Table 7: Height of participant in this study (middle distance runners)**

		Frequency	Percent
Height	1.74	1	12.5
	1.75	1	12.5
	1.76	2	25.0
	1.78	2	25.0
	1.79	2	25.0
	Total	8	100.0

Table 4.1 showed that Height of participant in this study (middle distance runners). Concerning to this, 25 % of the participant of the study were with the height 1.76,1.78 and 1.79 where as 12.5% of the participant of the study were with 1.74 and 1.75.

**Table 8: Weight of the participant of the study**

Item	Weight	Frequency	Percent
Weight	54	1	12.5
	55	1	12.5
	56	1	12.5
	57	1	12.5
	58	1	12.5
	59	1	12.5
	60	1	12.5
	61	1	12.5
	Total	8	100.0

Table 4.2 depicted that weight of the participant of the study. In this regards, weight of the participant were 54 kg, 55 kg, 56kg, 57 kg, 58 kg, 59 kg,60 kg and 61 kg each accounts 12.5% of the participant of the study.

**Figure 5: Grade level of participant of the study**

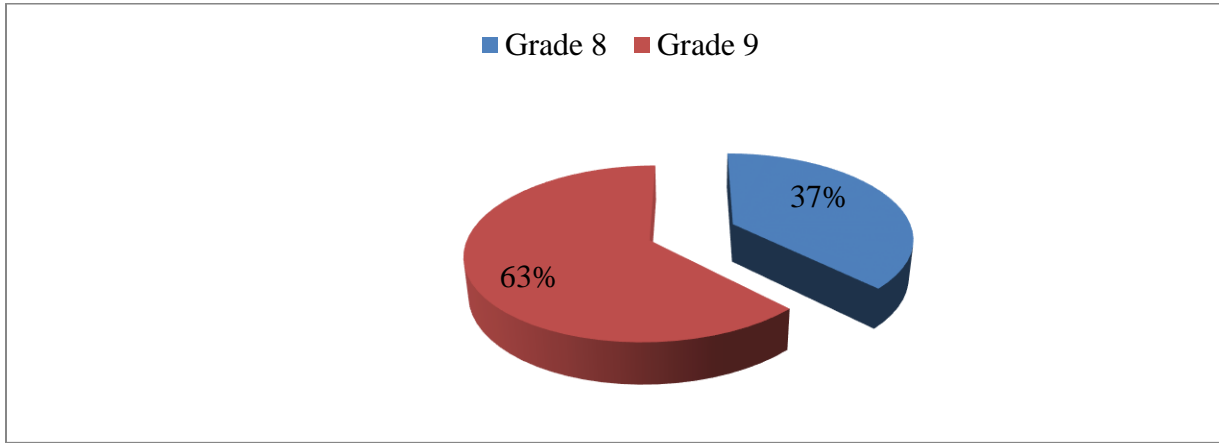


Figure 4.2 shows grade level of participant of the study. Concerning to this, 63 % of them were grade level of 9 where as 37% of them were grade 8. From the above information it is possible to say the majority of participants have grade level of 9.

**Table 9: Training age of participants**

Item	Responses	Frequency	Percent
Training age	3	2	25.0
	4	1	12.5
	5	2	25.0
	6	3	37.5
	Total	8	100.0

Table 4.3 depicted that training age of participants. Concerning to this, 37.5 % of the participant have training age of 6 years where as 25 % of the participant have 5 years and 3 years training age each. Thus, the majority of the participants have 6 years training age.

## 4.2. Speed-Endurance (400m Control Test)

**Table 10 Mean and Standard deviation of 400m Control Test (Pre-test and Post-Tests)**

Variable	N	mean	Std. Deviation
Pretest of 400m Control Test	8	4.6363	1.19390
posttest of 400m Control Test	8	6.5825	.76956

As depicted on the above table 10 that there was a change observed speed-endurance pre-post training tests mean values score of 8 weeks exercise. The mean value of pre training tests results of 400m Control Test was  $4.6363 \pm 1.19390$  and post training test mean value result 400m Control Test was  $6.5825 \pm .76956$  From these results the researcher was observed the change in their performance of the subjects due to circuit training, when we compare 400m Control Test of pre and post test result of the participants after 8 weeks of exercises program, It showed increments on the performance of the subjects within 1.94625mean differences. In order to conclude that the mean change of 1.94625 pre-post test results is significant or not, and to generalize the mean speed-enduranceabilities whether the improvement is significant or not, after threaten eight weeks circuit training, a test has been run and its result has been discussed under the following section.

**Table 11paired sample t-test result of 400m Control Test**

Variable	Paired Differences					t	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre-post 400m C.T	-1.94625	1.18581	.41925	-2.93761	-.95489	-4.642	7	.002

It was temporarily stated that there is an improvement in speed-endurance abilities due to the eight weeks circuit training. To compare mean speed-endurance abilities of the subjects of pre-posttest results at a significance level of  $\alpha = 0.05$  Pairedsample t-test was conduct. The test statistics shows a *p-value* of 0.002 which is way much reduced than the significance level. Therefore, when the p-value is less than the significance level, we conclude that there is significant improvement in the speed-endurance abilities after threaten eight weeks circuit training.

#### 4.3. Muscular strength (standing broad jump Test)

**Table 12** Mean and Standard deviation of standing broad jump Test (Pre-test and Post-Tests)

Variable	N	mean	Std. Deviation
Pretest of standing broad jump	8	1.3325	.01282
Posttes of standing broad jump	8	1.3575	.00707

The above table 12 showed that there was change in pre-post test results. The muscular strength of the subjects was measured using a standing broad jump test. The improvement was seen on standing broad jump test mean differences values due to the eight weeks circuit training, in which the subjects were engaged in. The mean value for standing broad jump test before training was 1.3325 with standard deviation of .01282 and post training results mean value of standing

broad jump test was 1.3575 with standard deviation of .00707 after eight weeks training program. The mean differences value was increased by .02500. If we compare the mean values for the pre-posttest results, there is a difference of 0.02500. With this much difference, can we conclude the muscular strength of the groups are different? The answer is given with the analysis in the next paragraph.

**Table 13**paired sample t-test result of standing broad jump test

Variable	Paired Differences					T	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre-post standing broad jump	-.02500	.01069	.00378	-.03394	-.01606	-6.614	7	.000

It was temporarily recognized that there is change in muscular strength due to the eight weeks circuit training. **Paired** sample t-test was conduct to compare mean muscular strength of the subjects of pre-posttest results at a significance level of  $\alpha = 0.05$ . The test statistics shows a *p-value* of 0.000 which is way much reduced than the significance level. Therefore, when the *p-value* is less than the significance level, we conclude that there is significant improvement in the muscular strength after threaten eight weeks circuit training.

#### 4.4. Speed(flying 30 meter Test)

**Table 14**Mean and Standard deviation of flying 30 meter Test (Pre-test and Post-Tests)

Variable	N	Mean	Std. Deviation
Pretest of flying 30m test	8	3.0088	.00991
posttest of flying 30m test	8	3.0538	.08733

As depicted on the above table 14 that there was achange observed flying 30m meter pre-post training tests mean values score of 8 weeks exercise. The mean value of pre training tests results



of flying 30 meter was 3.0088 with standard deviation of .00991 and post training test mean value result flying 30 meter were 3.0538with standard deviation of.08733 From these results the researcher were observed the improvement in their performance of the subjects due to circuit training, when we compare flying 30 meter of pre and post test result of the participants after 8 weeks of exercises program. It showed increments on the performance of the subjects within **.04500** mean differences. In order to conclude that the mean difference of **.04500** pre-post test results is significant or not, and to generalize the mean speedabilities whether the improvement is significant or not, after threaten eight weeks circuit training, a test has been run and its result has been discussed under the following section.

**Table 15**paired sample t-test result of flying 30 meter Test

Variable	Paired Differences					T	Df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pre-post flying 30 meter Test	-.04500	.08367	.02958	-.11495	.02495	-1.521	7	.172

It was temporarily known that there is an improvement in speed abilities due to the eight weeks circuit training. To compare mean speed abilities of the subjects of pre-posttest results at a significance level of  $\alpha = 0.05$  Pairedsample t-test was conduct. The test statistics shows a *p-value* of .172 which is way much increased than the significance level. Therefore, when the *p-value* is greater than the significance level, we conclude that there is no significant improvement in the speed abilities after threatens eight weeks circuit training.

#### 4.5. Discussion

The purpose of this study was to evaluate the effects of selected types of circuit training on enhancing speed-endurance, muscular strengthand speed of Middle Distance Runners on Oromia Forest Wild Life Enterprise. There were significant improvement were observed in speed-endurance and muscular strength whilenot inspeed physical fitness variable.

The pre-test result of mean value for 400 meter control test was 4.6363 and the post-test mean values 6.5825 of 8 athletes Middle Distance Runners on Oromia Forest Wild Life Enterprise. The findings on 400 meter control test p-value was .002, revealed that there was significant mean difference between the tests. This indicated that they were enhanced in their performance level. This shows they go to in the right direction. The rationale behind the improvement in performance was due to circuit training program which was conducted for 8 weeks

The finding of this study was in agreement with the findings of Taşkin, H. (2009) who conducted the study on circuit training, which is designed to be performed 3 times a week for a 10-week period of training, improves sprinting ability, intensive acceleration, speed endurance, and anaerobic endurance.

The pre-test result of mean value for muscular strength was 1.3325 and the post-test mean values 1.3575 of 8 athletes Middle Distance Runners on Oromia Forest Wild Life Enterprise. This indicated that they were enhanced in their performance level. This shows they go to in the right direction. The standing broad jump result was compared with an international standing broad jump norm among similar age groups that above 16 year (Hede et al. 2011). The international standing broad jump test norms is <1.98m for this age groups while the standing broad jump test mean value result of this study was 1.3575. Hence, the study result has fallen in **poor standard** (norms found on the table 5 below) Due to this; they should do more exercises to improve this performance capacity. But there was progressive improvement in muscular strength performance which indicated by the mean difference tested by paired sample t-test which showed among pre and posttest of 8 athletes Middle Distance Runners on Oromia Forest Wild Life Enterprise. The findings on muscular strength p-value was .000, 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 8 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  $VO_2\max$ . However, circuit strength-training produced significant improvements in  $VO_2\max$  and resting heart rate. Gettman also found significant reductions in body fat percent, fat

weight, 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.

The pretest mean value 3.0088 and posttest mean value 3.0538 on speed abilities of 8 Middle Distance Runners on Oromia Forest Wild Life Enterprise. In these results there is a difference pre to posttest mean value. But the significance of the result, it shows there was no improvement on speed ability of athletes.

#### 4.6. Summary of discussion

**Table 16** post mean, pre mean, mean difference and p value

Variables	Po Mean	Pr mean	MD	P
400m Control Test	6.5825	4.6363	1.94625	.002
standing broad jump	<b>1.3575</b>	<b>1.3325</b>	.02500	.000
flying 30m test	3.0538	3.0088	.04500	.172

*PT= Pre-Test, ,PoT = Post Test, MD- mean difference p= p-value*

Table 16 showed the overall result of each test. It includes the mean, mean difference from one test to another and the significance of posttests relative to the pretest. In all the parameters there were progressive significantly improvements in performance changes which were observed in speed-endurance, muscular strength, While not speed physical fitness variables in Middle Distance Runners on Oromia Forest Wild Life Enterprise. When we compare the result of circuit training of the two results that means pre-posttest in three days per a week for 8 weeks improvement was shown. But their degree is varying from one variable to the other. When we compare post result of speed-endurance was 1.94625, muscular strength was .02500, and speed was .04500. Generally, the result of this study revealed that circuit training program is useful to improve the speed-endurance and muscular strength fitness.

## **CHAPTER FIVE**

### **5. CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1. Summary**

The most appropriate time to use an anaerobic circuit is just before and during the competitive season. An anaerobic circuit should only be used with athletes who have a good overall level of fitness and who participate in a sport with a high anaerobic demand. The aim of such a circuit is to develop power, speed and anaerobic endurance. It stimulates the body to develop the anaerobic energy systems through bouts of maximum-intensity, short-duration exercises

Therefore, to achieve the purpose of current study, it was examined circuit training exercises in order to improve speed- Endurance, muscular strength and speed performance of Athletes" abilities in the case of Middle Distance Runners on Oromia Forest Wild Life Enterprise.

To achieve the purpose of this study, 8 male Athletes were selected between the age group of 18 and 21 years. All of them were grouped in one experimental group. In order to attain the objective of the research, the study subjects of sport proficiencies were measured through fitness parameters based on their circuit training exercises. The parameters used to measure speed-Endurance, muscular strength and speed were: 400m Control Test, standing broad jump and flying 30m test were applied on the study subjects. The exercise schedule was designed for 2 months. At which three days exercise session per week with 60 minutes durations and moderate to high intensity was applied. Each 60 minute sessions were divided in to three phases: warming up, main parts (exercises for fitness) and cooling down phases. The data was collected from the study subjects; and analyses was done through using SPSS version (V23)software based on the test results, which collected from the study subjects.

The paired sample t-test was used in this study. Based on the result analysis made, at the end of the study it was observed that 400m Control Test and standing broad jump tests the participants were increased significantly due to the exercise program and significant change were observed in improvement of speed- Endurance, muscular strength performance of Athletes measurements, but the flying 30 meter test of the participants were not increased significantly due to the circuit training program and significant change were not observed in improvement of speed performance of Middle Distance Runners on Oromia Forest Wild Life Enterprise

## **5.2. Conclusions**

Based on the major findings of the study to examine circuit training exercises in improving speed-endurance, muscular strength and speed performance of athletes the following points were stated as conclusions as follows.

- It was observed that an intimate difference between pre and post physical fitness performances of the subjects of the study. Thus, the finding of this study showed that, there were improvements on speed-endurance and muscular strength performance of the participants after 8 weeks exercises of 400 meter control and standing broad jump. While there was not improvement on speed performance of the athletes after 8 weeks exercise

program on flying 30 meter, when we compared the flying 30 meter test of pre and posttest of the subjects.

- This study found that there was progressive improvement in the selected physical fitness variables (speed-endurance and muscular strength during training periods in Middle Distance Runners on Oromia Forest Wild Life Enterprise
- This study found that there was progressive improvement in speed variables but not significantly during training periods of the athletes.
- And the degree was shown in speed-endurance and muscular strength rather than speed abilities.

### 5.3. Recommendations

Based on the finding of the study the researcher attempted to recommend the following action to be implemented for the better result scientific evidence demonstrates that circuit training yields a host of physiological and psychological benefits, while simultaneously addressing almost every component of fitness – making it an extremely valuable training modality.

- As effects of circuit training program on speed-endurance, muscular strength performance of Athletes was crucial; athletics and other sport coaches or concerned bodies may consider exercise as a part of main work for middle distance runner Athletes

- To empower the speed-endurance, strength and speed performance of Athletes, it was good if the responsible bodies provide financial, material, motivational and physical fitness support to those athletes
- Circuit training needs specialized research studies relating to its contribution to speed.
- Future research in this area needs to consider the duration, intensity and types of exercise program

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## Appendix

### Appendix 1

<b>Serial codes of subject</b>	<b>Age</b>	<b>Height</b>	<b>Weight</b>	<b>Grade</b>	<b>Training age</b>	<b>400m</b>	<b>30minuts</b>	<b>Standing broad jump</b>
subject -1	20	1.76	56	8	6	4,44	4.02	1.34
Subject-2	19	1.75m	55	8	3	5. 98	3.59	1.33
Subject -3	19	1.80m	68	9	3	4.91	4	1.33
Subject-4	20	1.66m	53	9	5	4.72	3.58	1.32
Subject-5	18	1.75m	54	9	4	5.3	3.55	1.31
Subject-6	21	1. 74	62	9	6	2.14	4	1.34
Subject-7	21	1.80m	60	9	5	5.71	4	1.34
Subject -8	21	1.77	61	8	6	4.39	4.07	1.35

## Appendix 2

<b>Serial code of subject</b>	<b>Age</b>	<b>Height</b>	<b>Weight</b>	<b>Grade</b>	<b>Training age</b>	<b>400m</b>	<b>30minuts</b>	<b>Standing broad jump</b>
Subject-1	20	1.76m	56	8	6	5.57	3.15	1.37
Subject-2	19	1.75m	55	8	3	6.41	3.05	1.36
Subject-3	19	1.80m	68	9	3	6.3	3.2	1.36
Subject -4	20	1.66m	53	9	5	6.89	3.1	1.35
Subject-5	18	1.75m	54	9	4	6.18	3.25	1.35
Subject-6	21	1. 74	62	9	6	6.12	2.55	1.35
Subject-7	21	1.80m	60	9	5	6.09	3.25	1.36
Subject-8	21	1.77	61	8	6	7.1	3	1.36