JIMMA UNIVERSTY

SPORT ACADEMY

DEPARTMENT OF SPORT SCIENCE

EFFECTS OF TWELVE WEEKS CIRCUIT AND INTERVAL TRAINING ON
SELECTED PHYSICAL FITNESS VARIABELS OF MALE FOOTBALL
PROJECT PLAYERS IN THE CASE OF MARYE SECONDARY AND
PREPARATORY SCHOOL

BY

HUSSEN AHMED

SUBMITTEDTO JIMMAUNIVERSITY SPORT ACADEMY DEPARTMENT SPORT
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FOR MASTERS DEGREE OF EDUCATION IN TEACHING PHYSICAL
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Major Advisor: - MEKOYA MENGESH (MSC)

CO-Advisor:-   AMANU EBA (MSC)

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APPROVAL SHEET

JIMMA UNIVERSITY SPORT ACADEMY

DEPARTMENT OF SPORT SCINCE

As research advisor, I hereby certify that I have read and evaluated this thesis entitled **"THE EFFECTS OF TWELVE WEEK CIRCUIT AND INTERVAL TRAINING ON SELECTED PHYSICAL FITNESS VARIABLES OF MALE FOOTBALL PROJECT PLAYERS IN THE CASE OF MARYE GENERAL SECONDARY AND PREPARATORY SCHOOL"**

Name of Major Advisor	Signature	Date
Mekoya Mengesh (Msc)	…………….	……………..
Name of Co-Advisor	Signature	Date
Amanu Eba(Msc)	………………..	……………..

As a member of the board of examiners of the MED teaching physical education thesis proposal open defense examination, we certify that. We have read and evaluated the thesis proposal prepared by HUSSEN AHMED and examined the candidate .We recommended that the thesis to be accepted as fulfilling the thesis requirement for the degree of MED in teaching physical education.

1 Name of external examiner	Signature	Date
……………………………..	…………………	…........................
2 Name of internal examiner	Signature	Date
Assistance professor Samson Wondrad	………………..	…........................
3 Name of chairperson	Signature	Date

DECLARATION OF THE AUTHOR

I, the under signed declare that this thesis is the result of my own work and all sources or materials used for this thesis have been appropriately acknowledged. This thesis is submitted in partial fulfillment of the requirements for Master of Degree in physical educations. I confidently declare that this thesis has not been submitted by any scholar to any other institutions or University for the award of any academic degree, diploma, or certificate.

Name of the Author: Hussen Ahmed Nurye

Department: Sport Science

 Place: Jimma University

Date of Submission:_____

 Signature:_____

DEDICATION

This thesis is dedicated to my families and parent for their constant physical, emotional, and financial support throughout my educational career and life. Without their tolerance, understanding, support and most of all love, the completion of the work would have been impossible.

BIOGRAPHICAL SKETCH

The Author was born on June 10, in 1981 in Amhara region South Wollo Zone around Dessie town particularly, in Kutaber Woreda. He attended elementary school at Kundi and secondary school education at kutaber high school and he attained preparatory school in Dessie Memhir Akalewold. After he completed my high school education, he joined Dessie teachers training college and he graduated with diploma in 2002 E.C. he also joined Wollo University in 2003 E.C and he graduated BSc degree in sport science in 2007 E.C. he have been teaching physical education in different schools in Amhara Region. After two years, he joined Jimma University to continue postgraduate program in the field of sport science.

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Finally, I offer my regards and blessing to all those who support me in any respect during the completion of the thesis.

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LIST OF ACRONYM

AAHER: American Alliance for Health, Physical Education and Recreation

PARQ: Physical Activity Readiness Questionnaire

ACSM: American College of Sports Medicine

CEG1: Circuit training Experimental group one

IEG2: Interval training Experimental group two

CG: Control group

ANOVA: Analysis of variance

EG : Expermental Group

Abstract

The main purpose of this study was to assess the effects of twelve week circuit and interval training on male football player's physical fitness on Marye general secondary and preparatory school. The training which was given to trainees was not sufficient to develop physical fitness level. The study employed True-experimental research design .The researcher selected 54 male high school students purposively. Simple random sampling lottery system were used to assign subjects for circuit training experimental group (CEG1) interval training experimental group (IEG2) and control group. Divided randomly into 3 equal groups at which group one got treatment with circuit training (N = 18) and group two with interval training (N= 18) and group three was a control group (N =18)and also Randomly Selected physical fitness variables were muscular endurance, flexibility, speed and agility. The experimental group engaged in exercise program (3 days per week for 40-60 minutes for twelve week).However, the control group did not perform circuit and interval training with experimental group. But both groups are members' school football players. Pre and posttest measurement taken from the three groups before and after the experimental period of twelve weeks of interval and circuit training , which were performed three times per week. physical fitness variables namely muscular endurances and flexibility are used fitness Gram and for speed, agility are used American Alliance for Health, Physical Education and Recreation (AAHER)test .The researcher was used this test battery, the test are valid, reliable and manageable and secure field test that can be used to monitor. The data collected from the participants were analyzed by using SPSS version 20 software. via descriptive, paired t-test ANOVA and Fishers list significance difference LSD post hoc with level of significance difference (p< 0.05) Result indicated that the circuit training and interval training have significantly improved in selected physical fitness variables, muscular endurance, flexibility, speed and agility. The result concluded as both circuit and interval training methods shows a better improvement on selected physical fitness due to twelve weeks training program of marye high school male football players. The major findings in this study also suggest that the football specific 90 degree push up test30 meter run, Illinois agility, sit and rich test can be utilized in the testing and identification of football performance. Generally physical fitness level had significant effects on player's performance through the required test .Hence circuit and interval training has been preferable for the enhancement of physical fitness variables of football player's performance.

Key word; *interval training, circuit training, physical fitness flexibility, agility, speed, muscular endurance*

CHAPTER ONE

INTRODUCTION

1.1 Back ground of the study

Football is a sport that requires a multitude of athletic abilities and aim to make improvements in aspects the explosive acceleration and fast sprinting speed, muscular endurance and strength in the lower body, muscular balance and high levels of neuromuscular co-ordination, Body awareness and agility, the ability to know where player's body is, and able to move it, discipline to take orders and decisions, as well as putting the team firs ,good flexibility to avoid injury, Football players are prone to poor hamstring flexibility and correct balance between your quadriceps and hamstrings, as well as strength imbalances between player's left and right leg (Sokmen, Beam, Witchey& Adams, 2002).

The concept of training is reflected in words or terms, which are given to separate components of training (technique training, strength training) or separate methods of procedures of doing physical exercise (interval training and circuit training).Training means various physical exercises and their objective, methods and procedures, which are used for the improvement, maintenance and recovery of performance capacity and performance readiness. Training adaptation is the sum of transformations brought about by systematically repeated exercises. These structural and physiological changes results from a specific demand that athletes place on their bodies by the activity they pursue depending on the volume, intensity and frequency of training. Physical training is beneficial as long as it forces the body to adapt to the stress of the effort (Bompa, 1999).

The primary purpose of any training program is to optimize performance during competition. To accomplish this goal, the coach/trainer needs to design and implement a comprehensive training program that allows players to cope with the physical demands of the game while taking account of the large inter-individual variation in physiological response to training. Cellular, organ and systemic alterations occur in a relatively predictable and uniform manner when training programs are appropriately designed and implemented. Present study is undertaken to find out the effect of circuit training and interval training on physical and physiological variables of secondary school football

players. Soccer requires peak physical conditioning of its players to be played at the highest level. The only way to achieve this level of conditioning is training specifically for soccer and the amount of running done in a match. The benefits of this training vary from better performance on the pitch (soccer field) for longer amounts of time to a decreased chance of injury or cramping before, during and after a match. Also, the better conditioned a player is, the more likely he is to perform with the same amount of skill necessary when passing, dribbling and shooting at the end of the game as the beginning. At any level above a school level, soccer limits the amount of substitutions a team can make. Therefore, any player who tires easily becomes a liability. Two types of running should be done to improve and maintain a player's fitness. The first is "offseason" training. It should be done two weeks after the previous season ends and should finish 10 days before the next season begins. The focus should be on maxing out potential and increasing gains in speed, recovery and endurance. The second type is "in-season" training, which should be done before and after games. It needs to focus on maintaining endurance and muscle recovery. Training should not be done more than 12 to 15 hours after a game, unless its stretching and loosening the muscles through light jogging. Scott, (March, 2012).

Functional Training is how much certain movement will transfer into the actual activity of sport. Functional training is a matter of neural complexity and central nervous system demand. The higher the central nervous system demand more functional movement is there. The brain which control muscular movement thinks in terms of whole motion, not individual muscle. The primary goal of functional training is to transfer improvement achieve in one movement to enhancing the performance of another movement by affecting the entire neuromuscular system. Functional training is a method of training that is based on preparing the body for real-world challenges such as balance, stability, turning, bending, and lifting. Doing this ensures that the nervous system is working properly and that all parts of the body are used in the appropriate manner with the correct muscles firing at the right time, functional exercises are usually trained in upright positions and involve movements in multiple planes of motion simultaneously just like in sport (i.e. football, volleyball, athletics, etc.). The effect of functional training on elderly people and disease and injured person were elaborately studies. Very recently the functional training has been coined in the advanced sports world and now it becomes buzzword. (Rosch-et al., 2000) examined that the effectiveness of functional training on football performance.

Circuit training is a method of physical conditioning in which one moves from one exercise to another, usually in a series of different stations or pieces of equipment. Circuit training is a style of training that develops overall fitness. Performed regularly, circuit training will simultaneously improve muscular strength, endurance, cardiovascular fitness, and flexibility. "Circuit training is a method of fitness training that is designed to develop general, all-round physical and cardiovascular fitness.It is an excellent training program for improving different type of physical fitness abilities based on the program in different stations. The program was developed by (Morgan). Helgened and Haff (2004) suggested that an interval training session in the game of football should involve standard features of training such as warm-up, stretching, the training session proper and a cool-down. The key to successful interval training lies in utilizing the proper intensity of exercise followed by a rest interval (Reilly &Gilbourne,s.a, 2003)

Interval training is based on the concept that a greater amount of work can be performed at higher exercise intensities with the same or less fatigue compared to continuous training. Interval training can be manipulated by altering the i) distance of the run, ii) recovery duration, iii) number of repetitions, iv) time of the run and v) actions undertaken during recovery. High-energy phosphagens, anaerobic glycol sis and oxidative metabolism all contribute to ATP turnover to supply energy during short-term bouts of brief maximal intensity exercise. Athletes can perform a considerably greater volume of exercise by breaking the total exercise period into shorter more intense bouts with rest or active recovery intervals inserted between the intense bouts (Cathal, 2013).

1.2 Statement Of The Problem

Football is a sport that requires a multitude of athletic abilities and aim to make improvements in aspects the explosive acceleration and fast sprinting speed, muscular endurance and strength in the lower body, muscular balance and high levels of neuromuscular co-ordination, Body awareness and agility, the ability to know where player's body is, and able to move it, discipline to take orders and decisions, as well as putting the team firs ,good flexibility to avoid injury, Football players are prone to poor hamstring flexibility and correct balance between your quadriceps and hamstrings, as well as strength imbalances between player's left and right leg (Sokmen, Beam, Witchey& Adams, 2002).

According to Carroll and Mendoza, (2012) soccer is a major sport for young athletes in the United States, and is also rapidly becoming a major sport for males and females for all ages. Because young athletes go through puberty at different times, they vary a great deal among each other in size and maturity. These differences pose a challenge to the athletes and their coaches. The primary characteristics of a young athlete are: motivation; physical fitness (i.e. muscle strength, power, endurance, flexibility, proper body composition, and cardiac respiratory endurance); discipline, coach ability; skills; ability to be a part of a team; ability to think under stress; and good spatial orientation.

Football practitioners require many attributes to become successful players. These include cardiovascular endurances, muscle strength and endurance, flexibility, agility, coordination. Few players possess natural ability in all areas, indeed the vast majority of players undergo training programs in some or all attributes, to improve their ability on the field. (Reilly & Gilbourne,s.a, 2003).

Subash (2016) was studied the influence of circuit ,interval training and skill on selected physical physiological and performance variables of football players, it was concluded that no significant differences interval and circuit training on selected physical fitness and physiological variables in football players. As the study which was conducted on the effect of circuit and interval training physical fitness by Nagamani and bubu (2013) ,vesconi (2006) concluded that there were similar physical and physiological characteristics were found within sample of football players with the age of 18 up to 25.

To become successful football player physical fitness requires many attributes like, muscular endurance, muscular strength, flexibility, speed, agility, skills and tactical knowledge. Unless problems are not carefully identified and possible solutions formulated in school football game, the performance of player are not executing efficiently throughout the game and may continue without improvement and also becoming the problem of successful and efficient performance implementation by male student football players. So, one of the great means to achieve student's performance is through giving a great attention of fitness of trainees with incorporating in a training program properly. In marye secondary and preparatory school male football player students usually two days of training per week is being delivered, however this training has basic problems; from the researcher's observation point of view, the training which was given to the trainees was insufficient to develop endurance, agility, strength ,flexibility and speed. As a result in Ethiopia today; it is become difficult to get youth players who are physically fit to permanently replace players to woreda, zonal, national clubs and national football teams. In the researcher's point of view; lack of physical fitness is one of the commonly mentioned reason for losing once achievement in many games in Ethiopia and the same that of in our Woreda. Due to these reasons in case of Ambasel an attempt was made to evaluate the effects of circuit training on football skill performance and related physical fitness component of male student football players on marye secondary and preparatory school.

The researcher has carried out this research in South wollo zone Ambasel Woreda specifically in marye secondary and preparatory school and got a chance to observe the level of male football player students' performance in this area. Even though there are school teams, and when the researcher observed the team training situation trainers have given less attention for trainee's fitness and trainees yet not enough to fit to implement football efficiently. Due to these reason players show limitations on their performance when the researcher observes for more than three years in inter school competition. This really shows there were physical fitness problem of football project player of male students. So, the researcher thinks that if the coach gives great attention to physical fitness on their training session it would have influence on player's selected physical fitness performance otherwise the situation made male student's football players continue to have poor performance.

The central issue that drives this study is to know the effect of circuit and interval training on some selected physical fitness of male football players for the age of 16 to 18. The above section of this study revealed that there are a number of different conclusions drawn from various studies regarding the influences of circuit and interval training on physical fitness variables of football players. This study takes a different methodological approach and differed with respect to the subjects studied. In addition to this since there were no studies that were conducted at Ambasel Woreda on the effect of circuit and interval training on male football player's physical fitness qualities. These create a knowledge gap in Ambasel woreda football players. Because of this reason there is lack of justification on the effect of circuit and interval training on physical fitness quality of football project players in ambasel woreda particularly in Marye secondary school.

In general the knowledge of the researchers, no research has been done on the effect of circuit and interval training on male football project player's physical fitness variables in case of Marye secondary and preparatory school and it is identified by the investigator as a main gap and researchable. so that the researcher deeply saw the importance of those study participants and their contribution to development of football in Ethiopia at large the researcher motivated to address physical fitness variables in using circuit and interval training intervention in Marye secondary and preparatory school, in Ahmara region, Ethiopia. What initiates me to conduct this research is the problem of physical fitness level of high school student's male

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football players, while they play football during competitions their performance in first half did not repeat in the second half of the game .Hence, it is considered appropriate by the researcher to conduct the study entitled Effects of Circuit and Interval Training on Selected Physical fitness of High School male Football project Players.

1.3 Objectives of the Study
This study was directed the following general and specific objective

1.3.1. General Objective
The general objective of this study was to assess the effects of twelve weeks circuit and interval training on selected physical fitness of high school football players. To achieve this general objective, the following specific objectives were set.

1.3.2. Specific Objectives
The specific objectives of the study are:

1. To evaluate the effect of twelve week circuit and interval training program on flexibility of Football players.

2. To measure the effect of twelve week circuit and interval training program on muscular endurance of male football player's.

3. To assess the effect of circuit and interval training program on speed of male football players.

4. To examine the effect of circuit and interval training program on agility of male football players.

5. To assess significant difference among circuit and interval training and control group agility performance of male football players.

1.4 Hypothesis
On the basis of evidence available in the literature so far and with personal experience as well as discussion with experts it is hypnotized that:

1 H_0: There is no significant effect of circuit and interval training on flexibility among football players.

2 H_0: There is no significant effect of circuit and interval training on muscular endurance among football players.

3 H_0: There no significant effect of circuit and interval training on speed among football players.

4 H_0: There is no significant effect of circuit and interval training on agility among football training.

5 H_0 There is no significant difference among circuit and interval training and control group agility performance of male football players.

1.5 Significance of the Study

The main aim of this study was to assess the effect of twelve week circuit and interval training on selected physical fitness of male football players at marye secondary and preparatory school. In addition to this study might have the following significance for concerned body:

➢ It might help to evaluate the effect of circuit and interval training on flexibility.

➢ It might help to measure the effect of circuit and interval training on muscular endurance of football players.

➢ It might help to assess the effect of circuit and interval training on speed of football players.

➢ It might help to examine the effects of circuit and interval training on agility of football players.

➢ It provides meaning full information for players who involves on circuit and interval training programs for the improvement of physical fitness.

➢ It helps to motivate, encourage, and aware male football players to engage circuit and interval training programs.

➢ This study was beneficial to different football clubs, coaches and football players.

➤ Finally it used as initiation for other researcher's further studies that are in some extent related with this research topic.

1.6 Delimitations

This research was delimited to:

Amhara region Southwollo zone, Ambasel district marye secondary and preparatory school,Football players, age between16 to 18,Twelve week circuit and interval training, three days per a week and for 40-60 minutes per session,Physical fitness components flexibility, muscular endurance, speed and agility and the total number of subject was delimited to fifty four (54) high school football players.

1.7 Limitation of the study

The researcher believed that the following conditions might to be limiting factors that influence the process of investigation and findings of the study.

The subjects that were undertaken may not have previous knowledge about well organize training in a regular basis and also COVID 19 pandemics was the main problems the reason why the activities need personal contacts.

1.8 Definitions of terms

Agility: The ability to rapidly change the position of the entire body in time and space with speed and accuracy (Verschurenet,al2009) .

Circuit training is a combination of six or more exercises performed with short rest periods between them for either a set number of repetitions or a prescribed amount of time. One circuit is when all of the chosen exercises have been completed. Multiple circuits can be performed in one training session. http://schema.org/SearchResultsPage.

Flexibility: The ability of a joint to move through its full range of motion (ROM), from a flexed to an extended position (Fitness, 2005).

Interval training is simply alternating short bursts (about 30 seconds) of intense activity with longer intervals (about 1 to 2 minutes) of less intense activity. For instance, if your exercise is walking and you're in good shape, you might add short bursts of jogging into your regular brisk walks. http://schema.org/SearchResultsPage"

Muscular endurance: is the ability of muscle or muscle group to resist fatigue and to make repeated contraction against defined sub maximal resistance (DavidK.Miller ,1998).

1.9. Organization of the study

This thesis consists of five chapters. The first chapter deals with the back ground of the study, statement of the problem, hypothesis of the study, objectives of the study, significance of the study, delimitation of the study, definitions of terms used in the study. The second chapter deals with the review of related literature, and the third chapter deals with the research design, methodology of the study. The fourth chapter deals with presentation, analysis, and discussion of the data and the last chapter deals with the summary of findings, conclusion, and recommendation of the study.

CHAPTER TWO

2. Review of Related Literature

2.1 The Science of Foot Ball Training

Physical training is a key part of preparing to play soccer at any level, but organizing a genuinely effective training requires both an understanding of the physiological principles involved and a practical knowledge of the demands of the game (Hardayal Singh, 1991). Anaerobic training whereby players are required to change direction abruptly. Exercises for agility had best incorporated early in the training session when players are still relatively fresh .Speed endurance Improvement of anaerobic capacity would have reflected in an increased average power output in a single exhaustive effort. In order to enhance the 'production' of anaerobic power, the exercise intensity should be near maximal. Even so, blood lactate may not reach very elevated levels although the muscle lactate concentrations can be very high (Reilly and Bangsbo, 1998). The exercise duration can be up to 40 s but the rest period between bouts should be about 4–5 times the exercise duration to allow recovery to take place. Six to eight repetitions recommended. 'Retention' training designed to aid the maintenance of speed during a sequence of efforts. The player becomes abler to retain performance when a short sprint had repeated. In this instance, the exercise duration can be longer (30–90 s) but the rest interval should only be about the same as the exercise duration. The session divided into two sets, for example 5 ẋ 40 s with 4 min between the two sets. The blood lactate concentrations should increase progressively with successive repetitions. These speed–endurance sessions should enhance activities of glycolytic enzymes. They are also effective in increasing the buffering capacity of muscle. The training effects are localized to the muscles engaged in the exercise. Speed–endurance training for 'retention' purposes is likely to have some effect on the aerobic system since the regimen has some similarities to intensive aerobic interval training. Dawson et al. (1998) demonstrated multiple benefits of repeated sprints.

Anaerobic training 91 Soccer-specific soccer drills various drills are available within soccer (football) coaching manuals, which can have modified to provide the desired training stimulus (Reilly, 2005a). The exercise to rest ratio can manipulated to form a high-intensity speed endurance session. Bangsbo (1994) provided an example of such a high-intensity.

2.2 Basic Concepts of football

Football is presently the most popular sport throughout the world in terms of spectators and participants because of this large number of people use their leisure time, and participate in football activity. It is one of those rare games which demands not only speed but agility, strength, power, and endurance along with skill (Reilly, 1996). Soccer is a game that requires combined fitness qualities of strength, speed, agility, and endurance. The objective of playing the game is to score more goals than the opposing team. Goals are scored by getting a ball across the goal line under the crossbar and between the goal posts. The game consists of two halves with a brief intermission (Chrisman, 2009). A soccer team consists of 11 individuals all of which must undertake specific roles and associated functions in each specific position in order to make a successful team (Hughes, 2012).

2.3 Effect of Training on Physical Fitness Components

Functional Training is how much certain movement will transfer into the actual activity of sport. Functional training is a matter of neural complexity and central nervous system demand. The higher the central nervous system demand more functional movement is there (Board works Ltd 2006) The brain which control muscular movement thinks in terms of whole motion, not individual muscle. The primary goal of functional training is to transfer improvement achieve in one movement to enhancing the performance of another movement by affecting the entire neuromuscular system. Functional training is a method of training that is based on preparing the body for real-world challenges such as balance, stability, turning, bending, and lifting. Doing this ensures that the nervous system is working properly and that all parts of the body are used in the appropriate manner with the correct muscles firing at the right time, functional exercises are usually trained in upright positions and involve movements in multiple planes of motion simultaneously just like in sport (i.e. football, volleyball, athletics, etc.). The effect of functional training on elderly people and disease and injured person were elaborately studies. Very recently the functional training has been coined in the advanced sports world and now it becomes buzzword. (Rosch D et al., 2000) examined that the effectiveness of functional training on football performance.They found that flexibility, power, speed, endurance and football skills improved after functional training. (Oliver and Brezz, 2009) examined the effect of functional balance training on women volleyball players. They found improvement in the fitness level. They recommended that

functional balance activity is cost effective and should be added to any form of strength and conditioning program in an attempt to enhancing the programs effectiveness' and to develop functional postural activation will not only assist with functional performance, but also in the prevention of injury. Furthermore, experimental research conducted to ascertain the muscular fitness benefits of functional training is limited and focused specifically on improving function in older adults (Milton et al., 2008; de Vreede, et al., 2005; Whitehurst et al., 2005).

2.4 Training Methods

There are different methods of specific training programs available for the development of physical and physiological fitness components to their maximum. Training methods include weight training, interval training, sprint training, fartlek training, circuit training, isotonic training, isometric training and isokinetic training. But, before giving training, coaches or physical education teachers should have a clear understanding of the method of training to be given to the sports men concerned (Kamlesh, 2009).

2.5 Circuit Training

Circuit training is a number of routine with specified objectives which takes into consideration its design, rationing, and resistance difference in principle of individual difference among the clients. This can be succeed either by time-specific exercises with continuous rest periods, or by time routines involved during the shortest possible time within the whole circuit of routines (cycle), where the first goal of the performance is succeeding it within the shortest possible period (Reddy & Jyoti, 2012). When planning the circuit training units, converting the resistance through the stations should be taken into consideration in a manner well-matched to the basic muscle groups.

Circuit training is the best ground for the enhancement of the educational aspects. In this concern, self-dependence, work, and self-assessment are broadly available in the circuit training. Circuit training has various educational benefits such as availing mutual respect opportunity among the individuals and respecting those with lower abilities and capabilities equally at the same level of respect to those of higher abilities (Reddy& Jyoti,2012).

The literature review Hamoudat, (2008), Oudat & Ghassab (2007), Al-Rashidi (2006) reveals that there is a decline of the physical fitness components among the college students. The researcher, through his work within the education and training domains, finds a decline in

the components of the physical fitness among students who are enrolled in the Faculty of Physical Fitness and Sports Science. The current study fills the gap in the professional literature. Therefore, the researcher applied a training program using the circuit training method to identify the improvement degree in the components of the physical fitness of the students. This was achieved by taking pre/post measurements of the tests that measured the physical fitness components.

According to Taskin H, (2009) conduct a study to determine the effect of circuit training directed toward motion and action velocity over the sprint-agility and anaerobic endurance. A total of 32 healthy male physical education students with a mean age of23.92 (plus or minus) 1.51 years were randomly allocated into a circuit training group (CTG; n = 16) and control group (CG; n = 16). A circuit training consisting of 8 stations was applied to the subjects 3 days a week for 10 weeks. Circuit training program was executed with 75% of maximal motion numbers in each station.

The FIFA Medical Assessment and Research Centre (F-MARC) test battery, which was designed by FIFA, was used for measuring sprint-agility and anaerobic endurance. Pre- and post-training testing of participants included assessments of sprint-agility and anaerobic endurance. Following training, there was a significant ($p < 0.05$) difference in sprint-agility between pre and post testing for the CTG (pre-test = 14.76 (plus or minus)0.48 seconds, post-test = 14.47 (plus or minus) 0.43 seconds). Also, there was a significant ($p < 0.05$) difference in anaerobic endurance between pre and post testing for the CG (pretest =31.53 (plus or minus) 0.48 seconds, post-test = 30.73 (plus or minus)0.50 seconds). In conclusion, circuit training, which is designed to be performed 3 days a week during 10 weeks of training, improves sprint-agility and anaerobic endurance.

2.5.1 Benefit of circuit training on physical fitness variable

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 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 significance at 0.05 level. From the result it was found that the specific circuit training program is more effective in developing physical fitness and long jump performance of college women athletes.

Kumaraiyanathan and Surendar (2013) found out the effect of circuit training and yogic practice on power production. The study was conducted on sixty men college students from various arts and science colleges in Thanjavur District were randomly selected as subject. They were randomly assigned equally into three groups, group -1 underwent circuit training group (n=20) group 2 underwent yogic practice group (n=20) and group 3 acted as control group (n=20). Among the power parameter leg explosive strength was measure through sergeant board. The data was collected from the experimental and control groups were statistically examined with Analysis of covariance (ANCOVA). Leg explosive power showed significant difference among the groups.

Jorge Ramírez-Lechuga, et le (2010) conducted a study on Fifty secondary-school children (32 boys, 18 girls; mean age of 17 years). Subjects participated in an 8-week endurance training program (2-3 h/week at a prox. 85% VO2 max), using different methods of training (continuous constant running -CCR-, Fartlek -FTK-, Circuit Training -CT-and Interval Training -IT-). The study was conducted during the PE lessons. During the sessions, individual heart rate was continuously monitored (5s interval) using a heart rate monitor (Polar S810). Subjects were asked which method of training was their favorite one or was considered by them more motivational; also, they were asked about the intensity perceived according to the training method used (Borg's CR10 scale, from0 -no intense- to 10 -extremely intense-). To develop aerobic endurance, first it was preferred CT method (35.4%),

followed by IT (25.0%), CCR (16.7%), FTK (12.5%), and "all the methods equally" (10.4%). The training method that students perceived as more intense was FTK (7.27±1.39), followed by "all the methods equally (7.21±1.10), CCR (6.92±1.64), IT (6.77±2.09), and CT (6.75±1.97). While for the boys the less intense method was CCR, for the girls it was CT, although there were no significant differences with regard to the other methods. In general, the PE lessons focused on the improvement of the aerobic endurance are perceived as very intense (7 onCR10 scale).

Ramakrishnan and Gopinath (2014) analyzed the impact of weight training and circuit weight training on selected strength and physiological variables among players of various games and sports. Forty five male players studying in various colleges around Thiruvallur, Tamilnadu, were selected as respondents and their aged between 18 to 23 years. They were apportioned into three equal groups, each group consisted of fifteen subjects, in which experimental group I underwent weight training, experimental group - II underwent circuit weight training and group - III acted as control group. The training period is for three days (alternative days) in a week for twelve weeks. Prior to and after the experimental period, the subjects were tested on leg strength, strength endurance and vital capacity. Leg strength was assessed by administering dynamometer in kilograms while strength endurance was assessed by administering sit-ups test in numbers per minute and vital capacity was analyzed by using wet speedometer in liters. This study brings to light that the weight training and circuit weight training groups improved the leg strength, strength endurance and vital capacity significantly. The weight training and circuit weight training has brought positive changes in leg strength, strength endurance and vital capacity than the control groups. Moreover, there was less significant difference between the weight training group and circuit weight training group.

2.5.2 Interval   training
Interval training is the most versatile method of endurance training which involves repeated efforts art at a relatively faster pace, separated by measured intervals of incomplete recovery (Singh, 1991). Interval training in the sports field is a popular means of training that affects the physiological functioning of the body and brings the change in the synchronicity of the internal organic function which ultimately influences the performance and efficiency.

Interval training consists of repetition runs over a specific distance, done in a set time, separated by recovery periods that are specified in terms of duration, distance, or both (i.e. it consists of alternating intervals of fast running and recovery). Training sessions will focus on specific race demands. It is a component of a balanced training program that will include recovery days and a range of other running activities, depending on the goals of the individual. A mix of interval training, a range of distances and types of runs (for example, hills, cross country) contribute to overall fitness and the capacity to engage in successful competitive running (Kamlesh, 2009).

Researchers, coaches and athletes defined as interval training in varies ways. The most acceptable definition given by Kenney, Wilmore &Costill (2012) states interval training as a type of training method which is repeated, brief exercise bouts interspersed with short rest intervals between bouts. In this type of training as with other forms of physiological conditioning, exercise intensity must over load the specific energy system which is desired for improvement through sport- specific muscle activation (Katch, &McArdle, 2011).

Interval training consists of repeated bouts of moderate to high-intensity exercise interspersed with periods of rest or reduced intensity exercise. The German coach WoldemanGerschler has been credited with formalizing interval training in the 1930's. Interval training is based on the concept that a greater amount of work can be performed at higher exercise intensities with the same or less fatigue compared to continuous training. Interval training can be manipulated by altering the i) distance of the run, ii) recovery duration, iii) number of repetitions, iv) time of the run and v) actions undertaken during recovery. Athletes can perform a considerably greater volume of exercise by breaking the total exercise period into shorter more intense bouts with rest or active recovery intervals inserted between the intense bouts (Cathal, 2013).

2.5.3 Aerobic Interval Training

Aerobic interval training is an interval training which elicits aerobic metabolism at higher ratio than anaerobic metabolism which can perform either in short aerobic interval training (10-30 second each exercise interval) form or in long aerobic interval training (30-60 second each exercise interval) form (Billat, 2001a).Sometimes aerobic interval training is also known as repeated maximal sprints or maximal dynamic exercise sprint training.

2.5.4. Anaerobic Interval Training

Anaerobic interval training as energy expenditure that uses anaerobic metabolism (without the use of oxygen) that last less than 90 seconds, utilizing and exhaustive effort. This type of interval training can be done in to two ways. In the first method of training the variables which are going to be measured in the time limit or the number of repetition that an individual was able to sustain for different pause durations. The second method which is recently used and athlete repeat maximal bouts with different pause durations (30seconds to 4 to 5 minutes).In this method the changes in maximal dynamic power during successive exercise period and characterized the associated metabolic changes in muscle. (Billat (2001b)).

2.6 Fitness for Football Players

Physical fitness is one of the most important aspects of soccer performance. A skillful player will go a long way in the sport, but without the fitness part of their game, they will not be the complete player. Aerobic endurance fitness is one of the most important physical fitness attributes for soccer players. Players need to be able to maintain a high level of intensity throughout the 90-minute game. Another very important fitness component is anaerobic fitness, which means running speed and particularly repeat sprint ability. Players also need good agility, strength, power and flexibility. See more discussion on the fitness components for soccer (Robert Wood, First Published: 2008).

2.7 Training Fitness

Regular training has needed for all areas of fitness. Here are some important factors to remember for an effective training program. Have a good plan. The training had directed to achieve specific goals and individualized to maximize the physical capabilities of particular players. In order to improve, the physical load needs have increased over time, as the players get fitter. By using cross training and by incorporating fitness into the training drills it will keep it interesting and maintain the motivation of the players. There is more information about training for sports, and an article about training for speed in football (Robert Wood, First Published: 2008).

2.8 Fitness Tests

There is increasing use of fitness testing in professional sports clubs, especially in football, rugby, athletics and hockey. County-level clubs now use fitness testing, as many tests are inexpensive and require only a limited level of experience to carry out effectively. Professional sports clubs use the tests to measure an athlete's fitness levels after injury or during pre-season training. These clubs, sometimes in conjunction with universities, have access to the specialist equipment required for more complex fitness tests. Your local sports or fitness center will use some fitness tests on a daily basis with their clients. These tests will probably be more basic in nature, although they still require some level of expert is and equipment. (https://www.google.com.et/search Fitness Tests for Football).

2.9 Field Testes

Soccer is a practical activity and so its coaches are continually on the look-out for appropriate tests which allow them to assess fitness of players in field conditions. A convenient practical test for estimating the maximal oxygen uptake of soccer players is the multi-stage shuttle run (Leger et al., 1988). The speed is dictated by a rhythm on a tape recorder, the individual response of running intensity being monitored. This test had now accepted as a valid method of indirectly estimating the maximal oxygen uptake. It is suitable for testing of football squads as it has a reasonable fidelity to movements in the game. The ability to recover quickly from strenuous exercise may be important in soccer, which involves intermittent efforts interspersed with short rests. The Harvard Step Test designed initially for college men and later used in testing of military conscripts provides a fitness index which is based on the recovery of pulse rates over 3.5 min after a standard work-rate. The test has a long history of use in the fitness assessment of soccer players (Reilly, 1990).

Bangsbo (1994) described various running tests specifically designed for soccer players. They included a sprint test performed seven times over a slalom course of about 35m with 25 s rest between sprints. The duration of each sprint is recorded and a fatigue index is obtained by comparing the fastest and slowest sprints.

2.9.1 Flexibility

Flexibility is a health-related component of physical fitness that relates to the range of motion available at a joint. According to Franks (1997) & Intel (2001) specify that flexibility requires range of motion without discomfort or pain. Another form of flexibility training is known as Self-Myofascial Release, which involves putting pressure on tight muscles in order to work out knots. Yoga and Pilate's classes'also great ways to gain flexibility (Tyler Read 2017). Explosive strength, dance, gymnastics improve flexibility (viski, et al 2007)

It is a health-related component of physical fitness that relates to the range of motion available at a joint (USDHHS, 1996), and it is the ability to move the joints through their full range of motion and stretching exercises can improve to normal (Insel & Roth,2002). Flexibility is specific to each joint of the body, thus there is no general measurement of flexibility as there is for cardiovascular fitness. Flexibility is typically measured in the lab using measurement devices such as a goniometer, flexometer and in the field with test exercises such as the sit and reach, and the zipper.

Poor flexibility can directly affect cardiovascular endurance, muscle strength and muscular endurance. Physiologically flexibility can include extra-muscular (range of motion at a joint) and intramuscular factors such as hyper tonicity (knots) within the muscles themselves. Aerobic exercise and strengthening allows muscle to contract and flex. Those muscles also need to be starch to protect them from injury and to improve range of motion in the joints. So, aerobic activities have its own contribution for flexibility and balance. People benefit from increased flexibility on a daily basis, both in routine tasks and those associated with more rigorous physical activity (American College of Sports Medicine, 1995).

A research of Nagaraj et al, (2011) studied effect of stretching exercises and aerobic exercises on flexibility of school boys. The results of pre-test and post-test using sit and reach box were compared with using Analysis of Covariance. The result shows that combined exercises (stretching and aerobics exercises) were significantly better than stretching exercises, aerobics exercises in flexibility. Thus flexibility can be more developed by aerobic and stretching exercising.

Sit and reach test is the most common test for measuring flexibility is the sit-and-reach test, which designed to assess the flexibility of the hamstrings and lower back. The equipment required for this test is minimal – a yardstick and a bench. It has recommended that the client's legs should be 12 inches (30.5 cm) apart with the heels touching the bench. The client should reach forward slowly and as far as possible without causing injury, keeping the hands parallel. The knee joint should not flex. The score has obtained by recording the furthest point obtained by the fingertips against the yardstick. If the client fails to reach the 0 mark then he or she is given a minus score, for example –14 cm. The test has done three times with the best score recorded. Found performance on the sit-and-reach was significantly better with the ankle in a passive plantar flexion as opposed to the fixed dorsi flexion posture required when the test has administered using a sit-and-reach box. (Liemohn et al, 1997)

2.9.2 Speed

Kreighbaum and Barthes (1996) define speed as how fast a body is moving or the distance that covered divided by the time it takes to cover that distance. Speed is the ability to cover a set distance quickly, and is explosive in nature. Speed is vital for a number of activities in sport and exercise, especially sprinting and jumping activities Baechle (1994) defines speed as the ability to move the body or body parts through a required range of motion in the fastest possible time. Speed comprises of reaction time, acceleration, maximum speed and speed endurance. It is also important for certain positions in team-based sports, such as soccer .Speed defined several different ways. Several types of speed have demonstrated in the game of Soccer. There are three different types of Soccer speed: sprint speed, quickness and technical speed.

Sprint Tests is a client tested for speed over various distances, depending on the demands of his or her sport. For example, a long jumper may wish to test his or her speed over 15 meters, which is a relevant distance for long jump technique (Davis B. et al; Physical Education and the Study of Sport; 2000). On response to a stimulus such as a whistle, the client should sprint as quickly as possible over the prescribed distance. The time has measured in seconds. It is common practice to give the client a one-meter flying start regardless of the test distance. This is because you want to measure the athlete's true speed and not their ability to react to a stimulus (e.g. a whistle). This test requires only a suitable surface, a timing device, cones and

a measuring instrument. In the past, the timing device was always a traditional stopwatch, but with that method, the tester's reaction speed influences the result, so it is now common to use electronic timing gates as suggested *(*Malhotra et al 1979, Subramanian 1981, Nagerkoti 1989, Bala 2000 and Tarlok 2001).

2.9.3 Agility

Agility is a function of the nervous system, incorporating proprioception and co-ordination of muscle activity in both lower limbs and in upper body for control of balance. There has not been a comprehensive research investigation of agility training due to the difficulty of identifying the mechanisms of adaptation. Nevertheless, it is clear that top soccer players perform well on tests of agility and that this function is amenable to training (Arnot R and Gaines C, Sports Talent, 1984). Agility is the ability to rapidly change the position of the entire body in time and space with speed and accuracy (Verschuren,et al 2009).

(Verschuren, et al 2009 define agility refers to the ability to change direction quickly without losing balance. It is an important attribute of good soccer players, both when dribbling a ball past an opponent and countering the movements of an opponent in possession of the ball. On comparing elite 15–16-year old players with age-matched sub-elite soccer players, Reilly et al. (2000) found that performance in an agility run test was the best distinguishing feature of the elite individuals.

Testing agility is the vast majority of tests purported to assess agility are tests for change of direction speed, as acknowledged by Ellis et al in Gore (2000, p. 132). The basic movement patterns of many team sports require the player to perform sudden changes in body direction in combination with rapid movement of limbs. The ability of the player to use these maneuvers successfully in the actual game will depend on other factors such as visual Processing, timing, reaction time, perception, and anticipation. Although all these factors combined are reflected in the players on field ''agility'', the purpose of most agility tests is simply to measure the ability to rapidly change body direction and position in the horizontal plane. In their review of the literature, Draper and Lancaster (1985) found no valid attempts at evaluating agility. The Illinois agility test (Cureton, 1951; Hastad & Lacy, 1994), 20-m sprint, up and- back test and the 505 test has compared. At the time, the Illinois test had considered a standard test of agility.

2.9.4 Muscular Endurance

Muscular endurance, which represents multiple muscle contractions or a sustained muscle contraction over a period of time, for example during running, climbing, swimming, jogging, running on tread mill at the gym there will be muscle contraction those muscle contraction can assists the improvements of muscular endurance. During aerobic exercise, minute ventilation increases and an increased load is placed on the respiratory muscles. Both the frequency and the speed of contraction in the muscle are increased (Harms et al., 2000).

Chia-Lin Li, et al, (2005) evaluated on the effects of aerobic exercise intervention with goals of improving health-related physical fitness conducted as a quasi-experimental design. The study concluded that 12-week aerobic exercise program was effective in improving the abdominal muscle strength and endurance.

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CHAPTER THREE

3 THE RESEARCH ME THODOLOGY

3.1 Study area

This research were conducted at south wollo zone ,Amhara regional state for consecutive tewlve week ,starting from april to june 2013 and marye is placed which is located at a latitude and longitude of 11^030^0N 39^036^0 AND an elevation of 1711m .Ambasel district is one of the 24 district in south wollo zone Amhara regional state located at about 440km east of the capital of the region, Bahir Dar,60 km south of Dessie which is the capital of south wollo Zone and 461km from Addis Ababa. It is bounded in the west Tenta woreda , in the east Tehuledere Woreda ,in south kutaber and in the north Habru

Woreda(https://en.m.wikipedia.org/amhara region).

Figure 1 Map of the Study Site
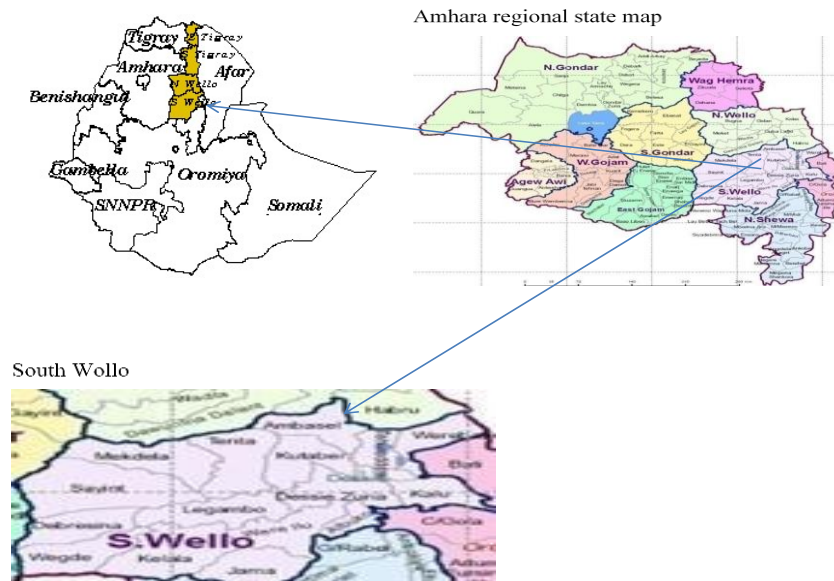
Source; htt: //www. Goggle map/south wollo/wuchale.com.et/search? q=goggle +map+picture

3.2 Research   design

The study focuses on to assess the effect of twelve week interval and circuit training program on football player physical fitness in the case of Marye general secondary `and preparatory school students. Depending on the nature and appropriateness of the pre and post test data, the researcher employ with true experimental design, since it helps to measure, assess, evaluate and analyze the effect of interval and circuit training exercise on some selected physical fitness variables. The experimental group's one and two were receive special designed circuit and interval training while group three were not treat by special training since they were a control group.

As the purpose of the study was to get the Effects of Circuit Training and Interval Training on selected physical fitness variables of High School Male Football project Players, all the subjects of experimental groups were exposed to relate standard tests to record the pretest data.

Pre – Test (phase – I)

As the purpose of this part of the study was to understand the effects of circuit training and Interval training on selected physical fitness variables of high School male football players, all the subjects of experimental and control groups are exposed to relate standard tests to record the pretest data.

Treatment stimuli or training (phase – II)

After the pretest was over, all the subjects of the experimental group undergo twelve weeks training of interval and circuit training practices for 1 hour per a day and three days in a week. The training was given at morning. Simultaneously, the subjects of the control group were engaged in football game and some recreational activities, but not participated on regular training program.

Posttest (phase III)

Finally, when the treatment or training period of twelve weeks was over, all the subjects of the experimental and control groups were assessed with the standard tests which were already performed in pretest.

Study design lay out

Treatment	Physical fitness variables
Frequency	3 days/week
Total duration	12 weeks
Duration/Session	40-60 minutes
Intensity	Low, Moderate, high
Exercise days	Monday, Wednesday, Friday
Time of training	Morning
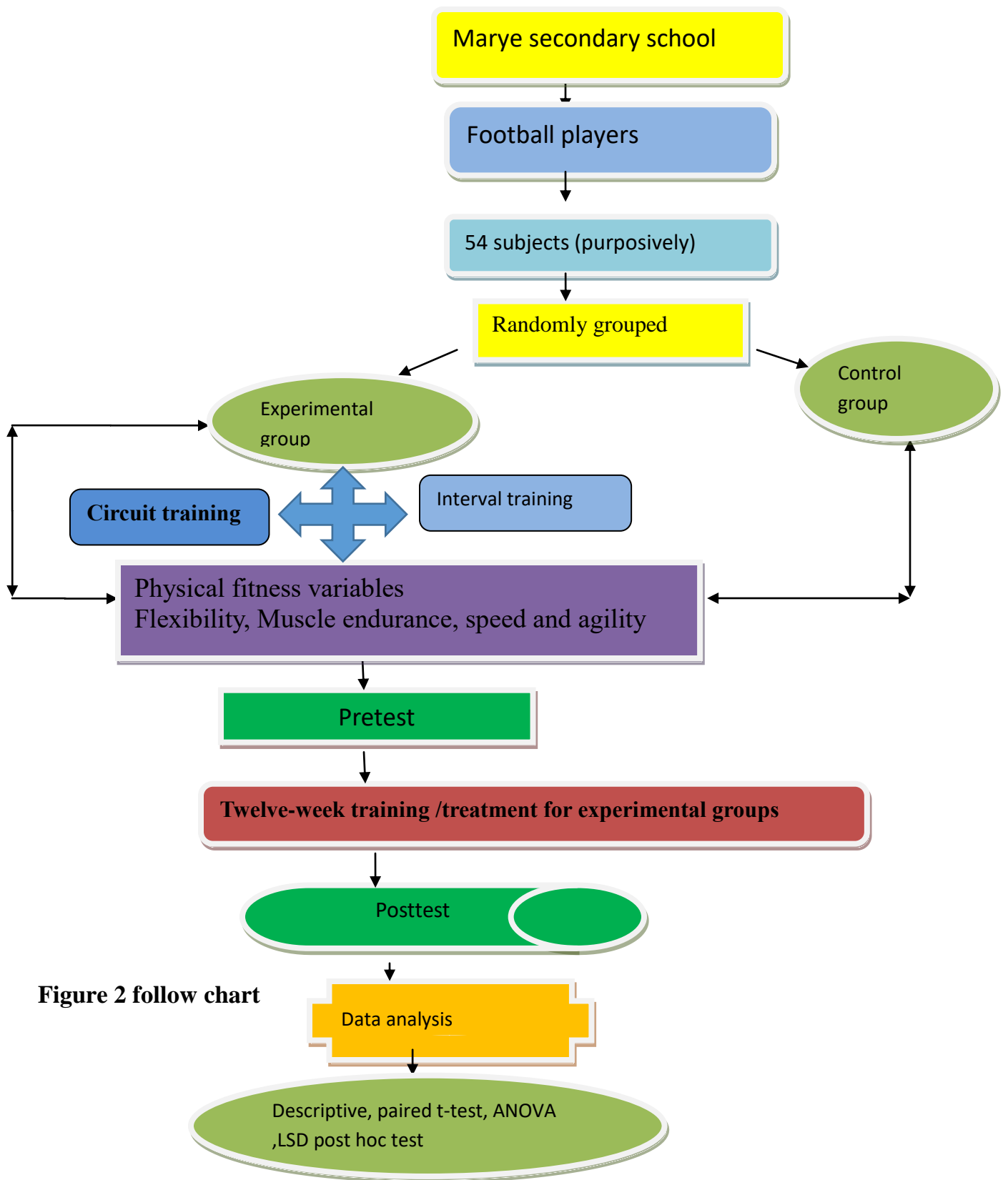
Figure 2 follow chart

3.3 Population of the study

The total population at Marye secondary and preparatory school was 1546 male students. Among the total population the school had 60 male football player students.

3.4 Target Population of the study

The study was conducted at Marye general secondary and preparatory school male football player students. Since the research is experimental design to monitor in training as well as manage in test administrations and data analysis only 54 male students had been taken from the school football player student's purposively age ranged from 16 to 18 years who were participated in football project.

3.5 Sample size and sampling techniques

Purposive sampling techniques were used to select the subject. Based on this criteria the sample size of this study were fifty four male football players (N=54), who learned in Marye secondary and preparatory school. Simple random sampling lottery system was used to assign control and experimental group. Finally, Experimental group one and two underwent 12-week interval and circuit training exercise and other group assigned as a control. All the subjects' were taking part in their regular activities as per school time table.

3.6 Inclusion and exclusion criteria

The criteria for inclusion and exclusion of the subjects are as follows:The subjects below and above 16 to 18 were excluded from this study. The subjects who were expected to remain present till the experimental trials were finished to be incorporated in this study. The Subjects who fulfill the health history questionnaires were included in this study. The subjects suffering from known serious health problems were excluded. Moreover, the subjects having incapacitating physical illness as ruled out by clinical investigation were excluded prior to the study. Players those participated in different teams were excluded.

3.7 Selection of variables

After going through the related literature the following dependent and independent variables were chosen to collect the data at pretest and posttest and to render training.

3.7.1 Dependent Variables

The variables that depend on the effects of circuit and interval training of this study were physical fitness variables such as flexibility, muscular endurances, speed and agility respectively.

Before and after experiment following tests for the subjects of both the experimental and control groups were assessed with the help of some standard test measurement.

Physical fitness components and standard test measurements

No	Fitness variables	Test	Measurement
1	Flexibility	Sit and reach	Centimeter
2	Muscular endurance	Ninety degree push up test	Repetition/minuet
3	Speed	30 meter dash / speed test	Second
4	Agility	Illinois Agility test	Second

3.7.2 Independent Variables

The variables that antecedent to the dependent variables of this study were interval and circuit training.

3.8 Training Protocol

Nrmal Circuit, timed station circuit and fitness interval training increasingly and includes 12 week, 3 days per week 40 to 60 minutes per period. Percentage of one repetition maximum as exercise intensity and volume of training were considered. Total training exercise type were kept constant through 12 week training program but the intensity ,repetition and duration of exercise were increased.

3.8.1 Training Protocol of circuit training

Normal Circuit and timed station circuit training can be completed 2-4 time per week as with resistances training ,for general fitness a resistance should be chosen that allow the station to completed for the prescribed period of time (1-2 minutes for example) , circuit training classes consist of about 8-12 station usually completed for 30-90 rest with 30-90 second rest between each station progression can come through either increasing the station time or decreasing the rest intervals .chosen only one at a time however a total of 1-3 circuit is typical with 2-3 minutes rest between each circuit.The protocol circuit training for general fitness are 8-12 number of exercise with 30-90 second and the number of circuit per session 1-3 for 30-90 rest interval between set ,further more rest interval between circuit 2-3 minutes to medium speed of execution and 2-4 frequency per week.

3.8.2 Training protocol of interval training

The fitness interval training is where the individual performs a work period followed by a rest or recovery period. Interval training involves following a fixed pattern of periods of strenuous exercise alternated with periods of rest or light activity. Interval training protocol differ in terms of length for both high and low intensity interval ,the ration of high to low intensity ,the level of intensity during workouts. The original protocol interval training work out requires 5 minutes of warming up 8 interval of 20 seconds all out intensity exercise followed by 10 seconds rest ,and 2 minutes cool down.

3.9 Source of data

The data used for this study were collected through field test, experimental and secondary data document analysis variables according to the designed procedures.

3.9.1 Primary source of data

In order to collect information about male's football player was used through field test.

3.9.2 Secondary source of data

Secondary source of information was used for this study collect from both published and unpublished materials like books, journals and web service.

3.10   Procedures of data collection

To achieve the objective of the study researcher was used quantitative data collection method to collect data from the subjects. All measurements and data were collected by quantitative method through appropriate selected physical fitness variables. Pretest and posttest physical fitness test measuring test was applied as data collection instrument. These physical fitness tests have four test batteries (push-up, 30m dash run, Illinois agility test and Sit and Reach). The researcher was collected all the information from the male football players through test batteries and the Research Scholars put maximum effort and meticulous care to have precision and accuracy in the measurements.

3.10.1 Sit and reach Test

Purpose: to measure flexibility

Facilities and Equipment: 20 inches' scale, one bench.

Procedure: This test involved students sitting on the floor with legs stretched out straight ahead with bare footed. The sole of the feet was placed flat against the box. Both knees were locked and pressed flat to the floor. With the palms facing down wards, and the hands will side by side, the subject reaches for ward along the measuring line as far as possible. Ensure that the hands remain at the same level, not one reaching further forward than the other. The students were asked to pull forward their body as you can and hold the position for one to two seconds while the distance was recorded.

Instructions: Specifically how far he could bend forward without bending his knees is important.**Scoring:** The subject's score was the distance on the scale he could touch and hold for two seconds. Better score of two trials was recorded. Source www.topendsports.com
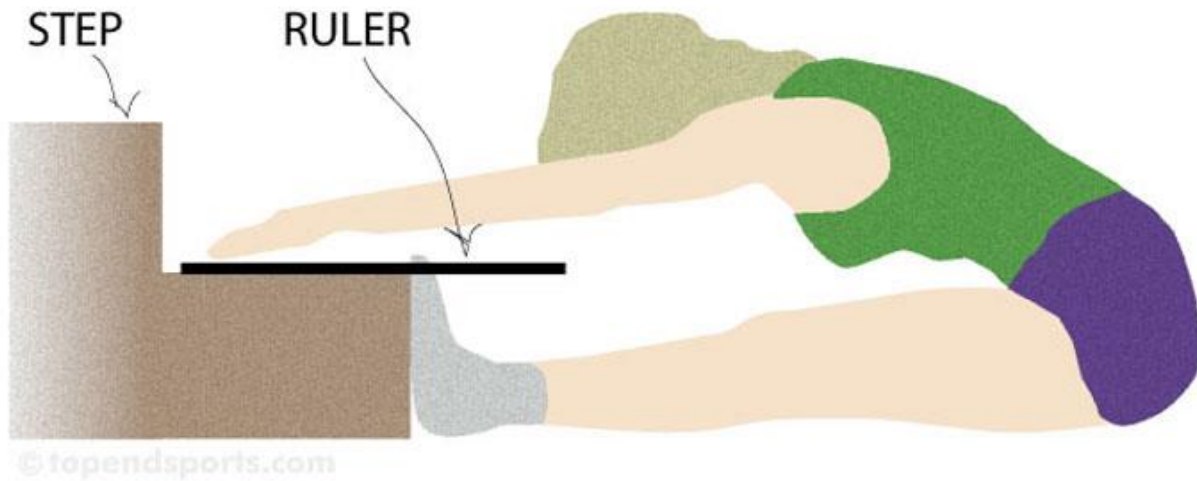
Figure 3 sit and rich test

3.10.2 Ninety degree pushup test

Purpose: - to measure the endurances of the arm and chest

Facilities and equipment: flat and clear floor, stopwatch

Procedure: Hands shoulder width apart and directly below the shoulder joint and make sure your eyes are looking at the floor, so the chin is not tucked in or the head up.

Instructions: The timing starts when your body is set in the correct position and the upper arm are parallel to the floor and do push-ups repeatedly by lowering the body until the arms bend 90 degree and the upper arms are parallel to the floor. Finally, the number of pushups able to perform in one minute was recorded.

Scoring: The score is the number of the 90 degree push- ups performed. First miss counts; second miss ends assessment.

Figure 4 ninety degree push up
 Source www.topendsports.com

3.10.3. 30 Meter dash/ speed test /

Purpose: - To measure speed of the players

Facility/ Equipment required: Stop watch or timing gates, cone markers, flat and clear surface of at least 50 meters.

Procedures: - The subject starts from a stationary position, with one foot in front of the other. The front foot must be on or behind the starting line. This starting position held for 2 seconds prior to starting, and run as much as possible with speed sprint until 50 meter cover.

Instruction: Subject must run with maximizing speed (such as keeping low, driving hard with the arms and legs) and encourage to continue running hard through the finish line. No rocking movement allowed.

Scoring:-   three trials are allow, and the best time is record .The timing should start from the first movement and will finish when the chest crosses the finishing line movement allowed.

Start 0   30 m end
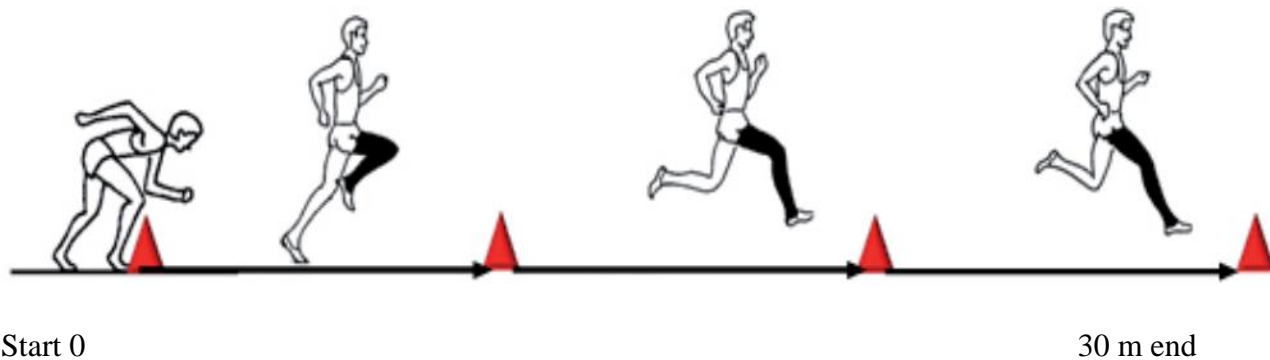
Source: Peter J L Thompson the Official IAAF Guide To Coaching Athletics, 2000

Figure 5 30 meter dash test.

3.10.4 Illinois /Agility Test /

 Purpose: To measure the agility of the subject.

 Facility/Equipment required: Flat surface, marking cones, stopwatch and measuring tape

Procedures: Subjects lied on their front (head to the start line) and hands by their shoulders. On the 'Go' command the stopwatch will start, and the athlete gets up as quickly as possible and runs around the course in the direction indicated, without knocking the cones over, to the finish line, at which the timing is stop.

Instruction: The subjects run as fast as possible without rest until the distance over

Scoring: The stop watch will start at the starting point when the player and stop at the finishing of the agility test and the total second will record.
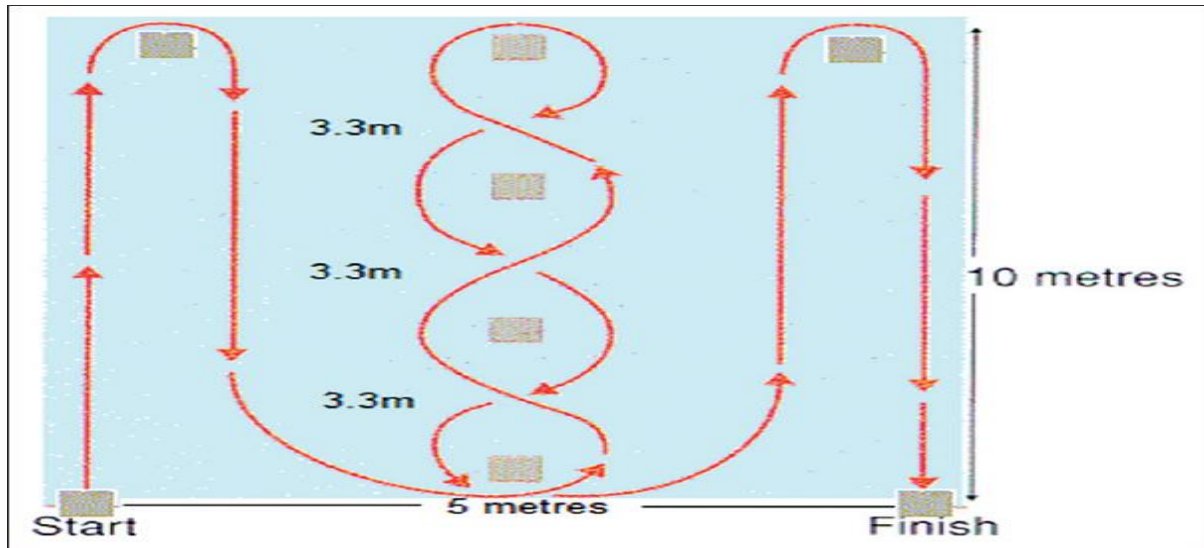
Figure 6 Illinois agility test   Adopted from: Dragijsky, 2017 agility classification of training

3. 11 Method of Data Analysis

All the quantitative data that were gathered before and after treatment through physical fitness test measures were tabulated, interpreted and analyzed. Measures of central tendency like mean and measures of dispersion like standard deviation were used to summarize and describe the findings. To determine the effects of circuit and interval training on selected physical fitness components the researcher use computerized Statistical package software (SPSS V 20). To analyze the data Descriptive statistics, paired sample t-test and ANOVA was applied to find out the significant difference if any, among the experimental groups and control group on selected fitness variables separately. Further Fishers least significance diffrence (LSD post-hoc test) was applied if significant difference exists. Level of significance was set at 0.05

3.12 Ethical consideration

This study was going in line with ethical issues. The privacy of the participant was protected. Generally, this research was conducted as per rules, policies and research ethics of Jimma University. The protocol was approved by the university guideline and written consent was given to the Marye secondary and preparatory school football project players as well as participants was inform earlier.

CHAPTER FOUR

4. Results and Discussion

4.1 Background information student respondants

Table1 Background information student respondents

Group	NO	Age		Height		Weight	
		M	S.D	M	S.D	M	S.D
Circuit training (CEG1)	18	16.61	.778	1.567	.045	50.5	1.513
Interval training (IEG2)	18	17.00	.840	1.569	.036	50.81	2.10
Control Group (CG)	18	16.94	.873	1.588	.026	50.8	1.278

Key : SD==Standard deviation   M== mean   EG1 = Circuit training EG2 = Interval training CG= control group

As shown the above table1 the general characteristics of the study participants regarding to age, height and weight. The mean of age (CEG1= 16.6, IEG2 = 17.00and CG = 16.94) height (CEG1=1.567, IEG2=1.569 and CG = 1.588) and weight (CEG1=50.5, IEG2 = 50.81 and CG = 50.8), this shows that they were homogeneous and their standard deviation of age (CEG1= 0.778, IEG2 =0.84 and CG =0.87) height (CGE1 =0.45 IEG2 =0.36 ,and CG=0.26) and weight (CEG1 =1.513 , IEG2 =2.10 and CG3= 1.278) ,Subjects were relatively had the same age, height and weight at the beginning of the exercise.

4.2 Pre and post results of physical fitness variables of circuit training

Table 2 Descriptive analysis and mean differences values comparison of flexibility EG and CG circuit training.

Variables	Intervention	M±SD	Paired differences Posttest- pre test M±SD	T	DF	P- value
Flexibility test EG	Pre test	9.22±4.88	4.36±2.14	8.643	17	0.001
	Post test	13.58±4.09				
Flexibility test CG	Pre test	9.06±4.137	0.056±1.305	0.1769		0.453
	Post test	9.00±4.41			17	

Key : SD= standard deviation M= mean   DF = degree of free dome

As shown from the above table 2 The average pretest score of mean value of flexibility /sit and reach test on EG recorded 9.22 with SD 4.88 and CG was founded to be 9.17 with an SD of 4.27. and paired difference pretest, posttest mean value of speed test on circuit training EG 4.36 with SD 2.14 from this data we can see that the scores in the pretest for both groups were close. In contrast, the average posttest score after twelve week circuit training of EG was founded 13.58 with SD of 4.09 and for CG mean 8.97 with SD4.04. And the paired difference pretest posttest mean value of speed test of interval training CG 0.19 with SD of 1.07. from this data one can see that the score in the post test for both groups were very different .one can pick up that this numbers in pretest and posttest mean score (achievement levels) are different. Hence this data indicates that there is significant difference and ` improvement between pretest ,posttest results of EG and there is no improvement between pretest and posttest results of CG, there was no significance difference between the pretest and posttest values of control group with level of significance p= 0.453 (p>0.05).

Table 3 Descriptive analysis and mean differences values comparison of muscular endurance test result of EG and CG circuit training.

Variables	Intervention	M±SD	Paired differences Posttest pre test M±SD	T	DF	P- value
Muscular endurance test EG	Pre test	10±3.82	-4.89±1.81	-11.451	17	0.001
	Post test	14.89±2.72				
Muscular endurance test CG	Pre test	10.17±3.86	-0.11±1.13	.416	17	0.682
	Post test	10.06±3.47				

Key : SD= standard deviation M= mean   DF = degree of free dome

As shown from the above table 3 the average pretest score of mean value of muscular endurance/ninety degree pushup test on EG recorded 10.00 with SD 3.82 and CG was founded to be 10.17 with an SD of 3.89. And paired difference pretest, posttest mean value of speed test on circuit training EG 4.89 with SD 1.81 from this data we can see that the scores in the pretest for both groups were found at the same level of physical fitness between EG and CG before twelve week circuit training. In contrast, the average posttest score after twelve week circuit training of EG was founded 14.89 with SD of 2.72 and for CG mean 10.06 with SD3.47. And the paired difference pretest posttest mean value of speed test of interval training CG -0.11 with SD of 1.13. from this data one can see that the score in the post test for both groups were very different .one can pick up that this numbers in pretest and posttest mean score (achievement levels) are different. Hence this data indicates that there is significant difference and improvement between pretest ,posttest results of EG with significance level of p=0.001(p>0.05. and there is no improvement between pretest and posttest results of CG, there was no significance difference between the pretest and posttest values of control group with level of significance p= 0.682(p>0.05).

Table 4 Descriptive analysis and mean differences values comparison of speed test of EG and CG circuit training.

Variables		M±SD	Paired differences	T	DF	P- value
			Posttest- pre test M±SD			
Speed test EG	Pre test	6.25±.404				0.001
	Post test	4.8 3±.37	-1.41±0.32	-18.852	17	
Speed test C G	Pre test	6.25±0.89	0.033±.059	-2.380	17	0.260
	Post test	6.28±0.86				

Key : SD= standard deviation M= mean   DF = degree of free dome

As shown from the above table 4 the average pretest score of mean value of speed on EG recorded 6.25 with SD 0.404 and CG was founded to be 6.26 with an SD of 0.89.and paired difference pretest, posttest mean value of speed test on circuit training EG-1.41 with SD 0.32. From this data we can see that the scores in the pretest for both groups were closing between experimental and control group before twelve week circuit training on football players. In contrast, the average posttest score after twelve week circuit training of EG was founded 4.83 with SD of 0.37 and for CG mean 6.26 with SD 0.89. and paired difference pretest posttest mean 0.02 with SD 0.08.from this data one can see that the score in the post test for both groups were very different .one can pick up that this numbers in pretest and posttest mean score (achievement levels) are different. Hence this data indicates that there is significant difference and improvement between pretest ,posttest results of EG and there is no improvement between pretest and posttest results of CG, there was no significance difference between the pretest and posttest values of control group with level of significance p= 0.453 (p>0.05).

Table 5 Descriptive analysis and mean differences values comparison of agility test of EG and CG circuit training

Variables		M±SD	Paireddifferences	T	DF	P- value
			Posttest- pre test M±SD			
	Pre test	18.47±1.41	4.17±1.19			
Agility test EG	Post test	14.30±1.29		14.87	17	0.001
Agility test CG	Pre test	18.43±1.32	0.56±1.09	-.440	17	0.915
	Post test	18.53±1.43				

Key : M = mean, SD = standard deviation, Df= degree of free dome

As shown from the above table 5 the average pretest score of mean value of agility on EG recorded 18.43 with SD 1.41and CG was founded to be 18.43 with an SD of 1.32. and paired difference pretest, posttest mean value of speed test on circuit training EG-4.16 with SD 1.18 from this data we can see that the scores in the pretest for both groups were close. from this data someone can easily understand there is a little difference between experimental and control group before twelve week circuit training on football players with the level of 0.001 (p<0.05) In contrast, the average posttest score after twelve week circuit training of EG was founded 4.83with SD of 0.37 and for CG mean 18.46 with SD 1.43. and paired difference pretest posttest mean 0.028 with SD 1.09.from this data one can see that the score in the post test for both groups were very different .one can pick up that this numbers in pretest and posttest mean score (achievement levels) are different. Hence this data indicates that there is significant difference and improvement between pretest ,posttest results of EG and there is no improvement between pretest and posttest results of CG, there was no significance difference between the pretest and posttest values of control group with level of significance p= 0.915(p>0.05).

Table 6 Descriptive analysis and mean differences values comparison of flexibility EG and CG interval training

Variables		M±SD	Paired differences	T	DF	P- value
			Posttest- pretest M±SD			
Flexibility test	Pre test	9.11±4.701	4.56±1.38	-13.990	17	0.001
	Post test	13.67±4.80				
Flexibility test	Pre test	9.17±4.27	-0.19±1.07	-0.769	17	0.453
	Post test	8.97±4.40				

Key : M = mean, SD = standard deviation, Df = degree of free dome F== f-ratio

As shown in the above table 6, the average pretest score of mean value of flexibility test on EG was founded 9.11 with the SD of 4.70; and CG was founded to be 9.17 with SD of 4.27. And the paired difference pretest posttest mean value of flexibility test of EG was recorded 4.56 with a SD of 1.38; from this data we can see that the scores in the pretest for both groups were close. After twelve week interval training EG mean score was 13.67with SD 4.80and CG mean score 8.97 with SD of 4.40. from this data we can see that the scores in the posttest scores in the posttest for both groups were very different.one pick up that these numbers in the pretest and posttest mean scores (achievement levels) are different .Hence, these data indicated that there is a significant difference and improvement between pretest and posttest results of EG and there is no improvement between pretest and post test results of CG with level of significance p= 0.453 (p>0.05).

Table 7 Descriptive analysis and mean differences values comparison of muscular endurance EG and CG of interval training

Variables		M±SD	Paireddifferences	T	DF	P- value
			Posttest-pretest M±SD			
Muscular endurance test EG	Pre test	10.28±2.967	8.11±7.32	-4.704	17	0.001
	Post test	18.39±8.368				
Muscular endurance test CG	Pre test	10.17±3.89	-0.11±1.13	-0/416	17	0.682
	Post test	10.06±3.47				

Key: M = mean, SD = standard deviation, Df = degree of free dome F== f-rati

As shown in the above table 6, the average pretest score of mean value of muscular endurance test on EG was founded 10.28 with the SD of 2.967; and CG was founded to be 10.17 with SD of 3.89. And the paired difference pretest posttest mean value of muscular endurance test of EG was recorded 8.11 with a SD of 7.32; from this data we can see that the scores in the pretest for both groups were close. After twelve week interval training EG mean score was 18.39with SD 8.368 and CG mean score 10.06 with SD of 3.47. and the paired difference pretest posttest mean value of muscular endurance test of CG was recorded -0.11 with SD of 1.13. from this data we can see that the scores in the posttest scores in the posttest for both groups were very different.one pick up that these numbers in the pretest and posttest mean scores (achievement levels) are different .Hence, these data indicated that there is a significant difference and improvement between pretest and posttest results of EG and there is no improvement between pretest and post test results of CG with level of significance p= 0.682 (p>0.05).

Table 8 Descriptive analysis and mean differences values comparison of speed test of EG and CG interval training

Variables		M±SD	Paired differences	T	DF	P- value
			Posttest-pretest M±SD			
Speed test EG	Pre test	6.23±0.49	-1.156±0.52	-9.339	17	0.001
	Post test	5.07±.15				
Speed test CG	Pre test	6.25±0.89	0.02±0.08	1.166	17	0.260
	Post test	6.28±0.86				

Key: M = mean, SD = standard deviation, Df = degree of free dome F== f-ratio

As shown in the above table 8, the average pretest score of mean value of agility test on EG was founded 6.23 with the SD of 0.49; and CG was founded to be 6.26 with SD of 0.89. And the paired difference pretest posttest mean value of speed test of EG was recorded -1.156 with a SD of 0.52; from this data we can see that the scores in the pretest for both groups were close. After twelve week interval training EG mean score was 5.07 with SD 0.15 and CG mean score 6.28 with SD of 0.86. And the paired difference pretest posttest mean value of speed test of CG was recorded -0.02 with SD of 0.08. from this data we can see that the scores in the posttest scores in the posttest for both groups were very different.one pick up that these numbers in the pretest and posttest mean scores (achievement levels) are different .Hence, these data indicated that there is a significant difference and improvement between pretest and posttest results of EG and there is no improvement between pretest and post test results of CG with level of significance p= 0.260 (p>0.05).

Table 9 Descriptive analysis and mean differences values comparison agility test on EG and CG interval training

Variables	group	M±SD	Paired differences	T	DF	P- value
			Posttest-pretest M±SD			
Agility test	Pretest EG	18.43±1.07	-1.77±0.79	-9.255	17	0.001
	Posttest EG	16.66±1.20				

Agility test	Pretest CG	18.43±1.367	0.028±1.09	0.496	17	0.633
	Posttest CG	18.46±1.43				

Key : M = mean, SD = standard deviation, Df= degree of free dome

As shown in the above table 8, the average pretest score of mean value of speed test on EG was founded 18.43 with the SD of 1.04; and CG was founded to be 18.43 with SD of 1.32. And the paired difference pretest posttest mean value of agility test of EG was recorded -1.77 with a SD of 0.79; from this data we can see that the scores in the pretest for both groups were close. After twelve week interval training EG mean score was 16.66 with SD 1.20 and CG mean score 18.46 with SD of 1.43. And the paired difference pretest posttest mean value of speed test of CG was recorded -0.028 with SD of 1.09. from this data we can see that the scores in the posttest scores in the posttest for both groups were very different.one pick up that these numbers in the pretest and posttest mean scores (achievement levels) are different .Hence, these data indicated that there is a significant difference and improvement between pretest and posttest results of EG and there is no improvement between pretest and post test results of CG with level of significance p= 0.915 (p>0.05).

Table 10 analysis variances (ANOVA) of Comparison of pre and posttest variables of physical fitness

Variables	Group	N	Pre test M±SD	Df	F	P	Post test M±SD	Df	F	P
Flexibility	Circuit group	18	9.22±4.88	(2,51)	.003	.997	13.58±4.09	(2,51)	6.584	0.003
	Interval group	18	9.11±4.70				13.67±4.80			
	Control group	18	9.17±4.27				8.97±4.401			
Muscular endurances	Circuit group	18	10.0±3.82	(2,51)			14.89±2.72	(2,51)	10.568	0.000
	Interval group	18	10.28±2.97		.028	.973	18.39±8.37			
	Control group	18	10.17±3.87				10.06±3.47			
Speed	Circuit group	18	6.25±.404	(2,51)			4.83±.37	(2,51)	36.018	0.000
	Interval group	18	6.23±.499		.013	.987	5.07±.15			
	Control group	18	6.26±.88				6.28±.86			
Agility	Circuit group	18	18.43±1.41	(2,51)			14.28±1.29	(2,51)	45.863	0.000
	Interval group	18	18.43±1.04		.000	1.000	16.66±1.203			
	Control group	18	18.43±1.33				18.46±1.43			

Key M = mean, SD = standard deviation, Df= degree of free dome

In the above table 10 the analysis variance of posttest mean between the experimental and control group of physical fitness qualities a significant difference among the three groups at p< 0.05, flexibility (P= .000), muscular endurances (P= .000), speed(P= .000) ,agility (P=.000) respectively. And the analysis variance of posttest mean between the experimental and control group of physical fitness qualities a significance difference among three groups at p< 0.05, flexibility (P= .997), muscular endurances (, P= .973), speed(, P= .987) ,agility (P=1.000) respectively.

Table 11 LSD post hoc test mean of posttest among three groups of physical fitness

Variables	Methods I	Methods J	Mean Difference (I-J)	p- value
Flexibility	Circuit training	interval training	-0.08	.955
		control group	4.61*	.003
	Interval training	circuit training	0.08	.955
		control group	4.69*	.003
	Control group	circuit training	-4.61*	.003
		interval training	-4.69*	.003
Muscular endurance	Circuit training	interval training	-3.50	.060
		control group	4.83*	.011
	Interval training	circuit training	3.50	.060
		control group	8.33*	.000
	Control group	circuit training	-4.83*	.011
		interval training	-8.33*	.000
Speed	Circuit training	interval training	-0.24	.197
		control group	-1.45*	.000
	Interval training	circuit training	0.24	.197
		control group	-1.21*	.000
	Control group	circuit training	1.45*	.000
		interval training	1.21*	.000
Agility	Circuit training	interval training	-2.38*	.000
		control group	-4.18*	.000
	Interval training	circuit training	2.38*	.000
		control group	-1.79*	.000

	Control group	circuit training	4.18[*]	.000
		interval training	1.79[*]	.000

."*" difference between arithmetic means is significant at the significance level ($\alpha \leq 0.05$)

The post hoc method the flexibility post mean between circuit training with interval training (p=.955) circuit training with control group (p=0.003), interval training with control group (p=0.003) were shown significant differences.

The muscular endurance post mean between circuit training with interval training (p=0.060) circuit training with control group (p=0.11), interval training with control group (P=0.003) and the post mean of speed between circuit training with interval training (p=.197) circuit training with control group (p=0.00), interval training with control group (p=0.00) a significant difference among the three groups at p>0.05 and p< 0.05.

The post hoc method the agility post mean between circuit training with interval training (p=0.000) circuit training with control group (p=0.000), interval training with control group (p=0.000) were shown significant differences among three groups p>0.05 and p< 0.05.

4.3 DISCUSION ON HYPOTHESIS

The present study assess on the effect of circuit and interval training on selected physical fitness component of male student football players on marye secondary and preparatory school. Subjects participated throughout the treatment period and cooperated for the success of collection of necessary data. The experimental or treatment group participated in 12-week circuit and interval training program performing selected physical fitness exercises designed to the football players, while the control group did not participate in the 12 week training program of exercises. The subjects of experimental & control groups were to instruct not to start any programs during the 12-week period and only perform their normal regular football training. The analysis done with the appropriate statistical tools on the research problem have brought out significance findings as a circuit and interval training out comes through selected variables of the study such as flexibility, muscular endurance speed and agility. The finding of this study in each variable are discussed as follows.

In case flexibility test, the result indicated that effective change was observed on players who engaged in twelve weeks circuit and interval training flexibility fitness level. So, the formulated

null hypothesis was rejected, but the alternative hypothesis was accepted at 0.05 level of confidence when assessed in sit and reach test. This indicates that twelve weeks circuit and interval training program proved to be a useful exercise modality for improving flexibility fitness variable significantly among experimental group. The finding of this study is in agreement with Circuit training is a method of physical conditioning in which one moves from one exercise to another, usually in a series of different stations or pieces of equipment. Circuit training is a style of training that develops overall fitness. Performed regularly, circuit training will simultaneously improve muscular strength, endurance, cardiovascular fitness, and flexibility. "Circuit training is a method of fitness training that is designed to develop general, all-round physical and cardiovascular fitness" (Scholich, 1990).

In case muscular endurance fitness, there was significant difference in-between the pre to post test score in CEG1 and IEG2 when assessed in ninety degree push up test. The result suggests that both CEG1 and IEG2 significantly improved muscular endurance fitness significant at 0.05 level of confidence. But in CG no significant difference were found .The improvement of EG in performance was due to the circuit and interval training exercise in which they were engaged in twelve week training program. When we compare the mean score of EG before circuit and interval training with the mean score of after 12 weeks circuit exercise, the mean difference value increased . This result indicated that effective change was observed on players who engaged in twelve weeks circuit and interval training endurance fitness level. So, the formulated null hypothesis was rejected, however the alternative hypothesis was accepted at 0.05 level of confidence when assessed in ninety degree push up test. This indicates that twelve weeks circuit and interval training program proved to be a useful exercise modality for improving endurance fitness variable significantly among experimental group. Depend on the result agree with the idea of circuit and interval training appears to have multiple benefits on health and fitness, as various studies have shown that it may elicit significant increases in aerobic capacity muscular strength and muscular endurance (Klika and Jordan (2013). In addition to this result has been supported by Lee et al (1997) who recorded the effect of set circuit training program on strength and endurance of college age men that analyzed the impact of circuit training on the development of muscular endurance and found significant development.

In case speed fitness, there was significant difference in-between the pre to post test score in EG when assessed in 30meter dash run test. The result suggests that EG significantly improved speed fitness significant at 0.05 level of confidence. But in CG no significant difference were found. The improvement of EG in performance was due to the circuit exercise in which they were engaged in twelve week circuit training. This result indicated that effective change was observed on players who engaged in twelve weeks circuit and interval training speed fitness level. So, the formulated null hypothesis was rejected, but the alternative hypothesis was accepted at 0.05 level of confidence when assessed in 30meter dash run test. This indicates that twelve weeks circuit training program proved to be a useful exercise modality for improving speed variable significantly among experimental group. According to Taskin (2009) conduct a study to determine the effect of circuit training directed toward motion and action velocity over the sprint-agility and anaerobic endurance. From this result it is possible to conclude that training program has positive effects on speed performance. The findings are also is agreement with the results of Arun, Kumar (2016) investigated the effect of circuit training on selected motor abilities among male football players. The study showed that there was a significant improvement on physical variable speed.

Generally, the result of the present study in accordance with the result of other findings proved that circuit and interval training would have significant effect on speed of marye secondery school football players.

In case of Agility fitness test, there was significant difference in-between the pre to post test score in EG when assessed in Illinois agility run test. The result suggests that EG significantly improved agility fitness significant at 0.05 level of confidence. But in CG no significant difference were found. The improvement of EG in performance was due to the circuit exercise in which they were engaged in twelve week circuit training.

The average pretest score of mean value of agility and paired difference pretest, posttest mean value of speed test on circuit training EG-. Hence this result indicates that there is significant difference and improvement between pretest ,posttest results of EG and there is no improvement between pretest and posttest results of CG, there was no significance difference between the pretest and posttest values of control group with level of significance p= 0.915(p>0.05).

This result indicated that effective change was observed on players who engaged in twelve weeks circuit training agility fitness level. So, the formulated null hypothesis was rejected, but the alternative hypothesis was accepted at 0.05 level of confidence when assessed in Illinois test. This indicates that twelve weeks circuit training program proved to be a useful exercise modality for improving agility fitness variable significantly among experimental group. According to Taskin (2009)

conduct a study to determine the effect of circuit training directed toward motion and action velocity over the sprint-agility and anaerobic endurance. From this result it is possible to conclude that training program has positive effects on agility performance and also the present study is agreement with the finding of Verschuren, et al (2009) conducted the study on the effects of 12 week conditioning program involving speed, agility and its effect on agility performance in young soccer players.

CHAPTER FIVE
5 Summary, Conclusions And Recommendations
5.1 Summary

The purpose of this study was to assess the effects of circuit and interval training on male football player's physical fitness variables in Marye general secondary and preparatory school by allowing them to participate in three groups for twelve weeks. For this purpose, 54 male football players (age16 to 18 years.) were participated in this study.

The subjects were assigned purposively into three groups of eighteen (N=18) in each group. Group I circuit training (N=18), Group II interval training (N=18) and Group III (N=18) as control group. Both the experimental group (Group-I and Group-II) received treatments on circuit training and interval training respectively and control group (Group III) was informed to refrain from any special training except their regular practice and playing schedule. The criteria for participants in this study were that involvement in school football club, but those participate in other football club and had health problem would have excluded from the study. Purposive sampling techniques used to determine the sample size of population.

To know effects of circuit and interval training the following variables were selected. Physical fitness variables were flexibility, muscular endurance, speed and agility. The data were collected on physical fitness variables from all the three groups. Before treatment the pretest data was conducted after twelve weeks' treatment posttest data was conducted. The following tools (set and reach, ninety degree push up, 30meter dash and Illinois' test were used for physical fitness variables respectively. Procedures of administration of test were planned and prepared to meet the purpose of the study and accuracy of data. To analyze the data Descriptive statistics, paired sample t-test and ANOVA was applied to find out the significant difference if any, among the experimental groups and control group on selected fitness variables separately. Further Fishers least significance LSD post-hoc test was applied if significant difference exists. Level of significance was set at 0.05 The results show that there was significant improvement on the selected physical fitness variables of high school mall football players. The differences recorded for the performance characteristics of circuit training and interval training groups, circuit training showed better improvement on agility. It was recommended that football games coaches and players should adopt regimental training program and engage in strenuous physical training to achieve better performance suitable for competitive engagement in their various sports.

5.2 CONCLUSION
Based on the result and the findings of this study the following conclusions were drawn
> Both the circuit training and the interval training were found to be effective in improving

muscle development like abdominal muscle strength, spinal muscle, hamstring muscle, develop upper body muscle like deltoid ,pictorials, triceps, develop acceleration speed develop the ability to move fore ward ,back ward and side to side .

➢ While there is no significance difference from the control group in muscular endurance, flexibility, agility and speed variables following post-test.

➢ It is specifically noticed that the circuit training was found to be more effective in developing speed and agility of secondary school male football players.

➢ Interval training is found to be more effective in developing physical fitness of flexibility and muscular endurances of male football players.

➢ Generally, the circuit and interval training has showed significance change in improving the selected fitness variables of the experimental group when compare to control group.

5.3 Recommendations

Based on the results of the study the researcher recommended that:

The results clearly indicate that interval training and circuit training could enhance the performance of football players in almost all the selected physical fitness variables flexibility, muscular endurance, speed and agility**.**

➢ It is advised to coaches and physical educators in the game of football should give due importance to include interval training and circuit training in their schedules.

➢ It is better to recommended that a football team at any level should have knowledge about the interval training and circuit training to train the players for improving their performance and physical fitness levels.

➢ It is good if the football coaches to train their athletes to develop physical fitness by using circuit and interval training methods

➢ Similar study may be conducted by selecting female students as subjects; similar study may be conducted with large number of sample, similar longitudinal studies can be carried out by increasing the duration and intensity of the training program, similar study may be undertaken to see the effect of other physical fitness variables on different games and sports events.

➢ Advised to offer same study to be done by knowing detraining and retraining effects, The effects of both the circuit training and the interval training programmes on physical fitness, motor fitness, variables of full tenager and old group of subjects and for longer duration than 12 weeks may be studied and the effect of circuit training and interval training programmes on performance variables, physical characteristics of urban and rural school boys may be investigated.

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APPENDIX A

APPENDIX A

Physical Activity Readiness Questionnaire (PAR-Q)

(Adopted from Informed use of the PAR-Q: Reprinted from ACSM's Health/Fitness Facility Standards and Guidelines, 1997 by American College of Sports Medicine) http://www.memphis.edu/hss/pdf/par-q.pdf

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe form of people. However, some people should check with their doctor before they start becoming much more physically active. Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly:

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

YES ☐   NO ☐

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

YES ☐   NO ☐

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

YES ☐   NO ☐

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

YES ☐   NO ☐

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

YES ☐   NO ☐

6. Is your doctor currently prescribing drugs (for example, water pills) for your blood Pressure or heart condition?

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

YES ☐   NO ☐

I certify that the above statements are true and correct. I understand that a Doctor's note may be requested. I fantails requested, I should not proceed with this program until the note is received.

Signature: ……......Name:……………………… date………………

APPEDEX B

Participant information sheet and informed consent form

My name is **HUSSEN AHMED NURYE** I am working as a data collector for the study being conducted in this school and the purpose of partial fulfillment of Master's degree of JIMMA UNIVERSITY, the department of sport science in sport academy. I kindly request you to lend me your attention to explain you about the study and being selected as the study participant.

The study title

"The effect of circuit and interval training on selected physical fitness variables of male football project players in case of Marye general secondary and preparatory school."

Purpose of the study

The findings of this study would have a paramount importance for coaches, physical educators and trainees how to improve the physical fitness variables by participating circuit and interval training It also provides a basis for the development of specific training program and time for treatment. Moreover, the aim of the study is to fulfill Master's Degree in sport science for the investigator and desire to "the effects of circuit training and interval training on selected physical fitness variables of high school male football players."

Procedure and durations

There are four variables to be tested before and after training programs are given to you. Participation in this study will not exceed 60 minute per session three days per week for training. The experiment of the study takes twelve weeks. So I kindly request you to spare me this time for exercise training.

Risks and benefits

The risks of this research study were small. While administrating the tests and during training session, you may experience localized muscle fatigue in your thighs. You may also feel some muscle soreness and fatigue during and after the cessation of the exercise tests and training but it is not expected unusual risk as a direct result of the study. If any an expected physical injury occurs, appropriate first aid was provided, but no financial compensations were given.

There was no costs for participating in the research on part of you. Soap and packed water will be given to you during the training session. In addition, when you are participating in this exercise program you will improve your physical fitness. I hope that this will give you a clear picture of interval and circuit training on physical fitness variables development.

Rights

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

Confidentiality

If you consent to participate in this evaluation, your personal information will be kept confidential. Participant's individual scores will not be disclosed outside of the testing personnel without each participant's writing permission. However, the only researcher may review the study data without writing consent.

Agreement

I have read all the information provided on this form and consent to participate in this study.

Name_____signature_____

   date_____

If you do not consent to participate, you do not need to sign this form. Simply return it to the researcher.

Signature of investigator_____ date_____

Contacts address if there is any question any time about the study please contact

HUSSEN AHMED, at (0914078676) or E-mail: ha 298148@gmail.com

APPEDEX C

Circuit training schedule for experimental group

Warming up	Exercise	Repetition	No of circuit	Set	Rest interval	Rest interval	Speed of execution	Frequency	Intensity	Cooling down
Weak 1—4										

15 min	Sit up
	    Push up
	Jumping jack
	Zigzag
	    runnig
		16	**2**	**3 set**	30 sec
					b
					/
					n
						2 min	**Medium**	**3**	**60%**
									    of
									    1R
									    M
										10min

5 -- 8 weak										
15 min	Lungs calf raise Knee lifts Plank	**14**	**2**	**3 set**	1min b/n	**3 min**	**Medium**	**3**	**70%** **of** **1RM**	**10**
Weak 9-12										

15 min	Sit up
	    press up
	Fast knees
	Skinning
	    rope
		12	**2**	**3 set**	1min
					30 sec
					b/n
						3 min	**Medium**	**3**	**80%**
									of
									1RM
										10

Appendix D

Training schedule   interval training

Week	Warm up	Exercise	Set	Repetition/wee k	Duration	Rest	Intensity (HRR)	Cool down
1-4	10	Jumping jack	3	3	30s	30 sec	55-60%	5min
		Pushup	3	3	30s	30sec		5 min
		High knee	3	3	40s	15 sec	55-65%	5min
5-8	10	High knee	3	3	40s	15 sec	55-60%	5 min
		Mountain climber	3	3	40s5s	20 sec	55-60%	5min
		Burpees	3	3	45s	45sec	55-60%	
9-12	10	Jumping squat	4	3	45s	30sec	75-85%	5 min
		Zig zag running	4	3	30s	40sec		
		high knee	4	3	30s	20sec	75-85%	5min
		Luges	4	3	20s	20sec		
		Jumping jack	4	3	30s	20sec	75-85%	5min
		Burpees	4	3	30s	20 sec		

Appendix E

Training schedule for control group

Day	Week	Contents of exercise	Cycles	Exercise duration (s)	Rest period between stations (s)	Rest period between cycles (s)	Total duration (m)
Tuesday and Thursday	1-4	**Warming up exercise**(jogging, movements of hands and leg, stretch)					10
		Main part Playing football (2vs2),(3vs3),(4vs4)	2	60	30	2	20
		Cooling down (Cooling lower and upper body, starching ,breathing mediation)					5
Tuesday and Thursday	5-8	Warming up exercise (jogging, movements of hands and leg, stretch)					10
		Main part Playing football (2vs2),(3vs3),(4vs4),(5vs5),(6vs6)	2	60	30	2	25
		Cooling down (Cooling lower and upper body, starching ,breathing mediation)					5
Tuesday and Thursday	9-12	**Warming up exercise** (jogging, movements of hands and leg, stretch)					10
		Main part Playing football (2vs2),(3vs3),(4vs4), (5vs5), (6vs6),(7vs7),(8vs8) (9vs9)	2	60	30	2	30
		Cooling down (Cooling lower and upper body, starching ,breathing mediation)					5

Appendix F

Circuit training group student's profile

	Name	Age	Height in meter	weight in kg	Grade level
1	CEG1	16	1.51	49	9th
2	CEG2	16	1.56	50	10th
3	CEG3	16	1.51	51	9th
4	CEG4	17	1.47	52.6	10th
5	CEG5	18	1.55	49	11th
6	CEG6	16	1.56	52.3	9th
7	CEG7	16	1.58	49	10th
8	CEG8	17	1.58	51,3	11th
9	CEG9	16	1.60	48.9	10th
10	CEG10	16	1.58	51.3	9th
11	CEG11	18	1.53	51.4	12th
12	CEG12	16	1.48	48.4	9th
13	CEG13	16	1.58	51	9th
14	CEG14	17	1.62	48.4	10th
15	CEG15	17	1.63	51.1	10th
16	CEG16	16	1.58	52.9	9th
17	CEG17	17	1.59	51.2	11th
18	CEG18	18	1.60	52.5	12th

Key :CEG=circuit training expermental group

Appendix G

Interval training group student profile

	Name	Age	Height in meter	weight in kg	Grade level
1	IEG1	17	1.67	51	11th
2	IEG2	16	1.54	52.4	9th
3	IEG3	18	1.55	55.9	11th
4	IEG4	17	1.65	48.2	10th
5	IEG5	16	1.56	49..3	10th
6	IEG6	16	1.57	54.2	9th
7	IEG7	16	1.55	47.9	9th
8	IEG8	18	1.54	50.9	11th
9	IEG9	18	1.56	50.3	12th
10	IEG10	16	1.57	49.9	9th
11	IEG11	18	1.56	52.1	12th
12	IEG12	16	1.54	48.7	9th
13	IEG13	18	1.55	49.6	12th
14	IEG14	17	1.57	52.2	10th
15	IEG15	17	1.54	51.3	10th
16	IEG16	17	1.59	48.4	12th
17	IEG17	17	1.58	51.3	11th
18	IEG18	16	1.56	51.3	9th

Key: IEG=interval training experimental group

Appendix H
Control training group student profile

	Name	Age	Height in meter	weight in kg	Grade level
1	CG1	17	1.60	51.0	11th
2	CG2	17	1.59	52.3	11th
3	CG3	16	1.59	49.9	10th
4	CG4	17	1.57	51.5	11th
5	CG5	18	1.60	50.5	12th
6	CG6	17	1.56	53.2	10th
7	CG7	17	1.57	49.2	10th
8	CG8	17	1.65	49.1	11th
9	CG9	18	1.55	51.4	12th
10	CG10	18	1.57	50.1	12th
11	CG11	16	1.58	51.2	9th
12	CG12	16	1.61	49.3	9th
13	CG13	17	1.57	50.1	11th
14	CG14	17	1.63	50.1	11th
15	CG15	18	1.58	52.1	12th
16	CG16	18	1.59	53.3	12th
17	CG17	16	1.62	50.2	9th
18	CG18	15	1.56	50.2	9th

Key: CG=control group

Appendix I
Pre and post test result circuit training of physical fitness

	Flexibility (in cm)		Muscular endure (Repetition /min)		Speed (in second)		Agility (in second)	
	Per	Post	Pre	Post	Pre	Post	Pre	Post
1	14	18	13	19	6.5	5	18.9	14.2
2	2	9	8	15	6.7	4.4	17.1	15.0
3	8	15	8	14	6.2	4.7	20.7	14.9
4	5	12	17	20	6.8	5.29	18.0	13.6
5	6	13	16	19	6.2	5.09	17.3	12.6
6	9	15	4	10	5.7	4.3	16.9	12.2
7	3	8	8	14	6.6	5.10	17.0	12.8
8	14	16.5	5	12	6.7	5.29	20.1	16.3
9	12	12	12	15	6.3	4.80	21.7	15.9
10	4	8	14	17	6.7	5	17.0	13.0
11	1	5	11	16	6.5	5.2	18.9	14.2
12	11	17	9	13	5.5	4	19.3	17.1
13	7	12	5	12	6	5.0	18.4	13.8
14	15	16	9	14	6.3	4.6	17.5	14.5
15	16	19	7	15	5.7	4.9	18.2	13.7
16	11	13	12	14	6.4	5.22	17.1	15.1
17	14	17	14	17	5.7	4.4	18.0	14.1
18	14	19	8	12	6	4.7	19.7	14..2

Appendix J
Pre and post test result interval training of physical fitness

	Flexibility (in cm)		Muscular endure (Repitition/min)		Speed (in second)		Agility (in second)	
	Per	Post	Pre	Post	Pre	Post	Pre	Post
1	13	18	11	17	5.9	5.0	17.2	17.3
2	14	20	12	16	6.3	5.4	20.9	18.5
3	11	16	8	12	6.3	5.1	19.4	18.5
4	16	20	10	14	6.7	4.8	17.7	16.3
5	15	19	8	15	5.9	5.1	18.9	17.6
6	6	12	12	41	7	5.1	19.6	17.0
7	11	14	5	12	6.2	5.1	18.9	18.0
8	1	6	6	12	5.8	4.7	20.2	18.6
9	4	8	15	20	6.9	5.2	18.7	16.0
10	11.0	14	13	20	5.8	5.0	17.6	15.1
11	15	18	12	19	6.7	5.0	18.0	15.9
12	3	6	6	12	5.7	5.1	17.9	16.0
13	10	13	9	15	5.8	5.2	18.3	16.7
14	6	11	15	20	6.7	5.0	17.6	14.7
15	8	14	12	39	7	5.1	17.7	15.6
16	7	11	11	17	5.4	5.2	18.0	16.6
17	2	7	8	13	5.8	5.1	18.1	17.0
18	11	19	12	17	6.2	5.1	17.1	14.9

Appendix K
Pre and post test result control group of physical fitness variables

	Flexibility (in cm)		Muscular endure Rep /min		Speed Sec		Agility Sec	
	Per	Post	Pre	Post	Pre	Post	Pre	Post
1	7	7	11	10	7.1	7.1	18.8	18.9
2	8	8	8	10	6.8	6.7	19.8	19.1
3	5	3	14	14	7.0	7.0	19.2	19.3
4	9	10	4	5	5.2	5.2	19.4	19.1
5	7	9	9	8	5.9	6.0	16.9	16.9
6	8	6	12	11	7.7	7.7	19.3	20.2
7	1	1	17	16	7.2	7.3	20.7	21.1
8	13	13	18	16	5.6	5.7	19.3	20.1
9	9	9	4	5	7.2	7.2	19.5	19.5
10	8	9	8	8	6.8	6.8	19.7	17.8
11	17	16	10	9	6.6	6.7	16.5	17.7
12	11	11.5	12	12	5.1	5.1	17.2	15.4
13	6	6	13	15	4.8	4.9	15.9	18.3
14	17	16	7	6	5.1	5.2	17.4	17.1
15	15	16	12	11	6.2	6.2	17.1	17.0
16	6	5	8	9	5.4	5.4	18.2	18.3
17	6	5	9	9	6.8	6.6	18.1	19.3
18	12	11	7	7	6.2	6.3	18.7	17.1

Appendix L Normative data of the selected physical quality test of players
Table1. Normative data of the 30-meter test for 15 to 18 years' old

Gender	Excellent	Above average	Average	Below average	Poor
Male	< 4.0	4.2 – 4.0	4.4 – 4.3	4.6 – 4.4	> 4.6
Female	< 4.5	4.6 – 4.5	4.8 – 4.7	5.0 – 4.9	> 5.0

Source: Davis B. et al; Physical Education and the study of sport; 200

Table2. *Normative* data of *Illinois Agility Run Test for 15 to 18years'* old

Gender	Excellent	Above average	Average	Below average	Poor
Male	<15.2 sec	15.2 - 16.1 sec	16.2 - 18.1 sec	18.2 - 19.3 sec	>19.3 sec
Female	<17.0 sec	17.0 - 17.9 sec	18.0 - 21.7 sec	21.8 - 23.0 sec	>23.0 sec

Source: Davis et al. 2000

Table 3. *Normative data of Sit & Reach test for 15 to 18-year-old*

Gender	Excellent	Above average	Average	Below average	Poor
Male	>14	14.0 - 11.0	10.9 - 7.0	6.9 - 4.0	<4
Female	>15	15.0 - 12.0	11.9 - 7.0	6.9 - 4.0	<4

Source: Davis et al. 2000, p. 126

Table4: push-up test norms for MEN

Age	17-19	20-29	30-39	40-49	50-59	60-65
Excellent	> 56	> 47	> 41	> 34	> 31	> 30
Good	47-56	39-47	34-41	28-34	25-31	24-30
Above average	35-46	30-39	25-33	21-28	18-24	17-23
Average	19-34	17-29	13-24	11-20	9-17	6-16
Below average	11-18	10-16	8-12	6-10	5-8	3-5
Poor	4-10	4-9	2-7	1-5	1-4	1-2
Very Poor	< 4	< 4	< 2	0	0	0

Descriptive of pre test

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
pre test flexibility	Circuit	18	9.2222	4.88160	1.15061	6.7947	11.6498	1.00	16.00
	Interval	18	9.1111	4.70155	1.10817	6.7731	11.4491	1.00	16.00
	Control	18	9.1667	4.27372	1.00733	7.0414	11.2919	1.00	17.00
	Total	54	9.1667	4.53810	.61756	7.9280	10.4053	1.00	17.00
pre test muscular endurances	Circuit	18	10.0000	3.81945	.90025	8.1006	11.8994	4.00	17.00
	Interval	18	10.2778	2.96659	.69923	8.8025	11.7530	5.00	15.00
	Control	18	10.1667	3.86918	.91198	8.2426	12.0908	4.00	18.00
	Total	54	10.1481	3.50960	.47760	9.1902	11.1061	4.00	18.00
pre test speed	Circuit	18	6.2500	.40475	.09540	6.0487	6.4513	5.50	6.80
	Interval	18	6.2278	.49918	.11766	5.9795	6.4760	5.40	7.00
	Control	18	6.2611	.88593	.20882	5.8205	6.7017	4.80	7.70
	Total	54	6.2463	.62002	.08437	6.0771	6.4155	4.80	7.70
pre test agility	Circuit	18	18.4333	1.41380	.33324	17.7303	19.1364	16.90	21.70
	Interval	18	18.4333	1.04488	.24628	17.9137	18.9529	17.10	20.90
	control	18	18.4278	1.32878	.31320	17.7670	19.0886	15.90	20.70
	Total	54	18.4315	1.24807	.16984	18.0908	18.7721	15.90	21.70

Descriptive of post test

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
post test flexibility	Circuit	18	13.5833	4.09537	.96529	11.5468	15.6199	5.00	19.00
	Interval	18	13.6667	4.80196	1.13183	11.2787	16.0546	6.00	20.00
	Control	18	8.9722	4.40078	1.03727	6.7838	11.1607	1.00	16.00
	Total	54	12.0741	4.88780	.66515	10.7400	13.4082	1.00	20.00
post test muscular endurances	Circuit	18	14.8889	2.72005	.64112	13.5362	16.2415	10.00	20.00
	Interval	18	18.3889	8.36758	1.97226	14.2278	22.5500	12.00	41.00
	Control	18	10.0556	3.47211	.81838	8.3289	11.7822	5.00	16.00
	Total	54	14.4444	6.37112	.86700	12.7055	16.1834	5.00	41.00
post test speed	Circuit	18	4.8328	.37349	.08803	4.6470	5.0185	4.00	5.29
	Interval	18	5.0722	.15265	.03598	4.9963	5.1481	4.70	5.40
	Control	18	6.2833	.86245	.20328	5.8544	6.7122	4.90	7.70
	Total	54	5.3961	.83758	.11398	5.1675	5.6247	4.00	7.70
post test agility	Circuit	18	14.2778	1.29277	.30471	13.6349	14.9207	12.20	17.10
	Interval	18	16.6611	1.20349	.28367	16.0626	17.2596	14.70	18.60
	Control	18	18.4556	1.43249	.33764	17.7432	19.1679	15.40	21.10
	Total	54	16.4648	2.15461	.29320	15.8767	17.0529	12.20	21.10

ANOVA of pre test

		Sum of Squares	df	Mean Square	F	Sig.
	Total	1986.537	53			
pre test flexibility	Between Groups	.111	2	.056	.003	.997
	Within Groups	1091.389	51	21.400		
	Total	1091.500	53			
pre test muscular endurances	Between Groups	.704	2	.352	.028	.973
	Within Groups	652.111	51	12.786		
	Total	652.815	53			
pre test speed	Between Groups	.010	2	.005	.013	.987
	Within Groups	20.364	51	.399		
	Total	20.374	53			
pre test agility	Between Groups	.000	2	.000	.000	1.000
	Within Groups	82.556	51	1.619		
	Total	82.556	53			

ANOVA FOR POST TEST

		Sum of Squares	df	Mean Square	F	Sig.
post test flexibility	Between Groups	259.843	2	129.921	6.584	.003
	Within Groups	1006.361	51	19.733		
	Total	1266.204	53			
post test muscular endurances	Between Groups	630.333	2	315.167	10.568	.000
	Within Groups	1521.000	51	29.824		
	Total	2151.333	53			
post test speed	Between Groups	21.769	2	10.885	36.018	.000
	Within Groups	15.412	51	.302		
	Total	37.182	53			
post test agility	Between Groups	158.125	2	79.062	45.863	.000
	Within Groups	87.918	51	1.724		
	Total	246.043	53			

Multiple Comparisons for post test

LSD

Dependent Variable	(I) experimental group	(J) experimental group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
post test flexibility	Circuit	Interval	-.08333	1.48071	.955	-3.0560	2.8893
		Control	4.61111*	1.48071	.003	1.6385	7.5838
	interval	Circuit	.08333	1.48071	.955	-2.8893	3.0560
		Control	4.69444*	1.48071	.003	1.7218	7.6671
	control	Circuit	-4.61111*	1.48071	.003	-7.5838	-1.6385
		Interval	-4.69444*	1.48071	.003	-7.6671	-1.7218
post test muscular endurances	Circuit	Interval	-3.50000	1.82036	.060	-7.1545	.1545
		Control	4.83333*	1.82036	.011	1.1788	8.4879
	interval	Circuit	3.50000	1.82036	.060	-.1545	7.1545
		Control	8.33333*	1.82036	.000	4.6788	11.9879
	control	Circuit	-4.83333*	1.82036	.011	-8.4879	-1.1788
		Interval	-8.33333*	1.82036	.000	-11.9879	-4.6788
post test speed	Circuit	Interval	-.23944	.18324	.197	-.6073	.1284
		Control	-1.45056*	.18324	.000	-1.8184	-1.0827
	interval	Circuit	.23944	.18324	.197	-.1284	.6073
		Control	-1.21111*	.18324	.000	-1.5790	-.8432
	control	Circuit	1.45056*	.18324	.000	1.0827	1.8184
		Interval	1.21111*	.18324	.000	.8432	1.5790
post test agility	Circuit	Interval	-2.38333*	.43766	.000	-3.2620	-1.5047
		Control	-4.17778*	.43766	.000	-5.0564	-3.2991
	interval	Circuit	2.38333*	.43766	.000	1.5047	3.2620
		Control	-1.79444*	.43766	.000	-2.6731	-.9158
	control	Circuit	4.17778*	.43766	.000	3.2991	5.0564
		Interval	1.79444*	.43766	.000	.9158	2.6731