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EFFECTS OF CONTINUOUSAND NON-CONTINUOUS TRAININGS ON AEROBIC ENDURANCE CAPACITY OF LONG DISTANCE ATHLETES: THE þÿ C A S E O F B E R U H T E S F A þÿ A T H L E T I C S P R O J E C T D E M B E

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EFFECTS OF CONTINUOUSAND NON-CONTINUOUS TRAININGS ON AEROBIC ENDURANCE CAPACITY OF LONG DISTANCE ATHLETES: THE CASE OF "BERUH TESFA ATHLETICS PROJECT" DEMBECHA.

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Declaration

I Mr. Assefa Yosef, conducted this research thesis entitled "Effects of Continuous and Non-continuous Training on Athletes Physical Fitness Level in "Beruh Tesfa Athletics Project" Dembecha Woreda, West Gojjam, Northwest Ethiopia" is my own original work and did not submitted or presented for the purpose of any academic promotion previously. Sources of back ground information included in the document are also acknowledged dually.

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List of Abbreviations

- ✓ **ACSM**: American college of sport medicine
- ✓ **AT**: Threshold test
- ✓ **ATP**: Adenosine triphosphate
- ✓ **BOC**: Board of certification
- ✓ **CAAHEP**: Commission on accreditation of allied health education program
- ✓ **CAATE**: Committee for accreditation of athletic training education
- ✓ **CAHEA**: Committee on allied health education and accreditation
- ✓ **CI**:Confidence interval
- ✓ **HO**: Null hypothesis
- ✓ **JAC-AT**: Joint review committee on athletic training
- ✓ **LSD**: Long slow distance
- ✓ **NATA**: National athletics training association
- ✓ **PEC**: Professional education committee
- ✓ **POT**: Post-test
- ✓ **PET**: Pre-test
- ✓ **VO2Max**: Maximum oxygen consumption
- ✓ **WHO**: World health organization

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Abstract

The present study aimed to determine the effects of continuous and non-continuous training methods on athletes' aerobic endurance levels among 30 long distance athletes at Dembecha Beruh Tesfa U-17 athletics project. 15athletes were assigned to continuous training group and the rest 15 grouped in to Non-continuous training. The researcher was employed quasi experimental research design and purposive sampling was used for this research, Then the mean chronological age and training age for continuous training group were found to be 15.73 and 3.2 respectively whereas15.733 and 3.33 for non-continuous training group. This study also used performance evaluation test, viz., 3 minute step test, 12 minute run test and 2.4km run test to measure the aerobic endurance level of athletes. Paired sample t-test was employed so as to compare the effect of these training methods whether there was a significant difference between pre and post test results after 8 weeks continuous and non- continuous training. In addition to examine the difference between the two groups result on athletes aerobic fitness, an independent sample t- test at alpha value of ≤ .05 was employed. The findings of this study revealed that non-continuous training group produces significant improvements in aerobic fitness tests better than continuous training method(i.e. in 3minute step test the mean score of non-continuous training group was84.2±1.567 and 86.4±1.549 at p=0.000 for continuous group , in 2.4 km run test the mean for non-continuous group was 0:07:05.34± 0:00:02.66 and 0:07:09.72± 0:00:03.65 at p=0.000 for continuous group, and in 12minute run test the mean for Non-continuous group was 2695.4 ±27.4 and 2673.5± 20.487 at p=0.000 for continuous group). Then the researcher concluded that 8 weeks of non-continuous training method was better in improving athlete's aerobic fitness than continuous training method. So the recommendations are forwarded when outlining training sessions using non-continuous training method, coaches and athletes should consider the volume, intensity and durations of the recovery activities based on the intensity of work intervals.

Keywords:-*training methods, continuous training and non-continuous training*

CHAPTER ONE

1. INTRODUCTION

1.1. Background of the study

Fundamental movements of man, which they have achieved from their pre-human ancestors, are walking, running, jumping, climbing, throwing, pulling, pushing etc. By permutation and combination of these basic fundamental movements, man has developed various secondary movements essential for day-to-day living and for the use in games and sport(Reddy, 2012).

Aerobic fitness is an important fitness quality for exercises which require oxygen for energy production. Ben (2005) states that aerobic fitness is the measure of how much oxygen your body can use during maximal exertion. changes in aerobic fitness highly depends on how much oxygen carrying blood your heart pumps to the working muscle with every beat and the ability of the muscle to use the delivered oxygen for energy production.

Sport training is a physical, technical, moral and intellectual participation of an athlete with the help of physical exercises. It is a planned process for the participation of athlete and players to achieve top level performance (Hardayal, 1984) The purpose of the training programme is to produce metabolic, physiological and psychological adaptation that allows the sportsperson to achieve top level performance.

When the training increases the demand for aerobic energy, the number and size of muscle mitochondria will increase, so that in these chemical factories where aerobic metabolism takes place becomes larger and more numerous. These will help athletes to provide more energy from aerobic metabolism. There are three steps of adaptation: the first involves creating the need for more aerobic energy. Training must be sufficient in both duration and intensity to accomplish. The second step is to provide nutrients to build and repair mitochondrial tissues. Third is that the athlete must be given enough rest to regain the energy as super compensation. There are different types of training by which one can attain the required development. Each of the training has its own specific effect (Hardayal, 1984).

Sport training has important role in maintaining the cardio respiratory system including the organs of heart and lung (Kenney et.al, 2015). Physiologically, the training brings physical stress at the body that able to produce adaptation responses. The physical training suggested along the body able to adapt toward excessive load.

Training at high intensity able to induce specific adaptation that enable to body to function more efficiently (McArdle, et.al, 2010).To get maximum benefit, all the trainings also be done by considering the training dosage with FIT or frequency, intensity or tempo principle (Kusmana, et.al, 2006). Frequency: several times in a week to be done so bring training effect. The ideal frequency is 3-5 times a week. Training less than 3 times a week show no training adaptation, while training more than 5 times a week give no chance for body to recover. Intensity: training load weight given.

Aerobic training done with light to moderate intensity According to (Kusmana,et.al, 2006), sport also increase significantly the heart capacity to be given weight between 60-80% from the maximum work capacity or with training pulse 70-85% from the maximum pulse. Tempo: duration of training. Research showed the duration 20-30 minutes is sufficient to give ability increase of 35% if done 3 times a week in one and half month. Training method to increase the cardio respiratory capacity: interval and continuous training. Interval training is a form of training done alternately between work and break. With interval training the body able to adapt well to the nervous system or at the metabolism system. Continuous training is training done without interval at the training session. Continuous training done with constant speed (moderate) or high intensity at certain time. Training intensity should sufficiently stimulate the stimulation threshold value of aerobic so the physiological adaptation will occurs.

Continuous training or ongoing training, namely training at the distance of each category is sustainable (Greene, Laurence, and Russell, 2014).Training with interval training method is done with interval or break period. (Kent, 2006) states that interval is a training system done alternately between training and work with low intensity activities break period in a training stage.

(Fox,et.al, 1998)explained several benefits of interval training system as follows:Careful in control the strain occurred,As the systematic approach day to day will enable and easy to observe

the progress, Further in improving the potential energy than the other condition method and The training program can be implemented everywhere and no need special instruments.

Five principles done for interval training explained by (Fox, and Bowers, 1998) as follows: Size and distance of work interval, Repetition of each training, Interrupt Interval or time between work intervals, Activities during the interrupt interval and Training frequency per week several factors are associated with success in sport endurance in athletes (Fajar 2017).

Performance and training is a major part of it. In fact, Coaches and athletes are always looking for the athlete's endurance, according to the type of exercise, is traditional training methods to improve physical affected by factors such as aerobic power, efficiency, capabilities of athletes more and more. Therefore, different biomechanical, neuromuscular and cardiovascular training methods have been developed and used based adaptations, anaerobic power, lactate threshold and on the science of physiology and exercise science(, Astorino, et al, 2012). So much of the Continuous and interval training are long used in practice physiological differences between elite and novice to increase aerobic and anaerobic capacity of athletes.

athletes' endurance depend on training methods they use Continuity exercises that have a longer history (Chou,et al, 2016). Aerobic interval training is one of the most common interval exercises commonly use to increase aerobic training methods to improve athletes' endurance and capacity and endurance of cardio–respiratory system (Chou, et,al, 2016).Performance in pre-competition's season (Greene,& Russell, 2014).

The Example of continuous practices is when the athlete runs continuous training also works on endurance continuously without a break from long distance during performance, but continuous exercise may increase a given workout, or run continuously up to the given time.

Vo2max, capillary density, oxidative enzyme activity of this type of training is to improve plasma volume in individuals but are not increase the capacity of the various sources of cardio -effective on athletes in which interval training is more vascular and respiratory, increase maximum oxygen efficient (Hottenrott, et.al, 2012).

However, the effect of resistance exercise on uptake, increase capillary network and increases endurance is also an issue that has received considerable mitochondrial enzymes in

aerobic energy systems and attention in recent years. Some evidence suggests that also increase the energy producing system enzymes the addition of resistance training exercise for athletes,

(Astorino.et al, 2012). Another type of exercise which is commonly used in various sports is interval training. This training subjects were introduced to the gym, weightlifting hall method is alternate periods of exercise - rest - exercise – weight lifting methods and devices that would be used in rest. These exercises are performed with a greater the exercises intensity than continuous exercises.

The subjects were asked to avoid any intense Producing systems are being pressurized as well as physical activity in the period of 2 days prior to pre-test.

The speed of 8 Km/h of treadmill, increasing every 3 minute because of rest periods between exercises there is time for minutes was the method of Vo2max calculation. Structural energy sources such as CP and functional heart parameter measuring was performed ATP to be replaced and by a cardiologist using an echocardiogram.

Many benefits that attended three sessions per week for eight weeks of can be gained by doing interval training are improving training levels of anaerobic capacity anaerobic energy creating enzymes (Greene & Russell, 2014).

1.2. Statement of the Problem

Sport training has important role in maintaining the cardio respiratory system including the organs of heart and lung (Kenneyet.al, 2015). Physiologically, the training brings physical stress at the body that able to produce adaptation responses. The physical training suggested along the body able to adapt towards excessive load so that training at high intensity able to induce specific adaptation that enable to body to function more efficiently (Lippincott & Wilkins, 2010).

(Hardayal, 1984) states, The purpose of the training programme is to produce metabolic, physiological and psychological adaptation that allows the sportsperson to achieve top level performance and Intensity seems to be an important predictor of the effectiveness of fitness training programmes. Moderate-intensity continuous training methods and high-intensity interval training are typically prescribed to increase Cardio respiratory fitness. Continuous or long, slow distance training involves steady paced prolonged exercise at either moderate or high aerobic intensity, usually 60-80%Vo2max.

Continuous exercise may increase Vo2max, capillary density, oxidative enzyme activity and plasma volume in untrained individuals, (Mazoochi, et.al, 2013). However, both continuous training and non-continuous training have been shown to improve aerobic fitness, when I was observed at the time of coaching practice course dembecha athletics project athletes have been low in aerobic endurance level so this is the research gaps and also it is still not clear yet which training methods are better for improving their aerobic endurance performance. Hence this study aims to find out the effects of continuous and non -continuous training modes on their aereiobic endurance level, so as to predict which is more better for improving cardiovascular fitness so that we can make recommendations on how to improve fitness level so as to maximize training effects and provide a shortened fitness program to promote a better Fitness level of an athlete. So it needs to examine or identify the better training methods.

1.3. Objectives of the Study

1.3.1. General Objective

The general objective of this study was to compare the effects of continuous and non-continuous training on athletes' aerobic Endurance level.

1.3.2. Specific Objectives

- To identify the effect of continuous training on athlete's aerobic endurance level.
- To examine the effect of non-continuous training on athletes aerobic endurance level.
- To determine the better methods of training for improvement of athletes' aerobic endurance level from the two training methods.

1.4. Hypotheses

To assess the research objectives and insure the present research process is becoming reliable, the following hypotheses are formulated.

H01: there is no significance difference between continuous training and athletes' aerobic endurance level following with eight weeks training intervention.

H02: there is no significance difference between non- continuous training and athletes' aerobic endurance level following with eight weeks training intervention.

H03: Continuous and non-continuous training interventions have similar (equal) effect on athlete's aerobic performance

1.5. Significance of the Study

The purpose of this study was to enhance the Idea of continuous and non- continuous training on athletes in this athletics project on their aerobic endurance performance level.

Therefore the study has been the following significances:

- To provide clear information for athletics coaches, sport professionals and investigators about the effects of continuous and non- continuous training on, their cardio vascular endurance of these athletics project athletes and add knowledge on the area of continuous and non- continuous training.
- Help to increases the capacity of coaches and sport professionals for outlining training plan during the training sessions.
- To support athlete's physical fitness performance.
- The study may provide valuable literature for the researchers who want to conducts further studies in different dimensions on the field of continuous and non- continuous training by changing different variables.

1.6. Scope of the Study

Scope is the area that the researcher was concentrated and what the investigator prove or identify from this study. So this study was delimited on Dembecha Beruh Tesfa U-17 athletics project all athletes (N=30).The study was also delimited only on aerobic endurance of the athletes performance tests of the athletes as dependent physical fitness variables and continuous and non-continuous training as an independent variable, this is my intention to find out the problem concerning on the above mentioned point. Experimental group was performed continuous and non-continuous training as a treatment was3 days per week for eight consecutive weeks but in this study there was no controlled group because the study was comparison between continuous and non-continuous training, so no need of controlled group here.

1.7. Limitation of the Study

- In the process of investigating data in this study, equipment to measure aerobic fitness of athlete's was very difficult for the researcher.
- It takes too much time to analyze and also it is difficult to analyze within a short period of time.
- The corona virus also makes the challenges for precede the process of this study.

1.8. Operational Definition of key Terms

- **Project**- U-17 athletics group.
- **Project athlete:** An athlete participating in athletics projects whose age is less than or equal to 17.
- **Sport Training**- Systematic process of athletic preparation for the greatest and highest sports Achievements, (Hardayal, 1984).
- **U-17**-age category of athletics project.
- **Non- continuous**– it is an interval between work and rest periods. (Kent,2006)
- **Continuous training**-steady-paced, prolonged exercise (McArdle, et al. 1996)
- **Aerobic Endurance–** the nature of the activity is dependent upon the strength and efficiency of the heart supplying oxygen
- **Exercise:** is planned and structured physical activity performed either in continuous or non-continuous method.
- **Recovery activity:** is an exercise performed during recovery periods following to work intervals.
- **Training Method-** Systematically planned and effective procedures adopted for the formulation of training process and are characterized by utilization of methods for imparting training content so as to ensure development of performance.

1.9. Organization of the study

This research has been organized in to five chapters. The first chapter deals with introduction, statement of the problem, objectives of the study, study hypothesis, significance of the study, delimitation, limitation and operational definition of terms, the second chapter deals with the review of related literatures pertinent for the study. The third chapter covers with experimental site, target population, sampling techniques and sample size, study design, experimental materials, sources of data methods and procedures of data collection, methods of data analysis, and ethical consideration of the study participants. Chapter four presents the result and discussion of the data collected and the fifth chapter deals with summary, conclusion and recommendations

CHAPTER TWO

REVIEW RELATED LITERATURE

2.1. Basic Concepts of athletics

Athletics is a term encompassing the human competitive sports and games requiring physical skill and the systems of training that prepare athletes for competition performance, (David (1992). Athletics has gained significant importance at educational institutions; talented athletes may gain entry into higher through athletic scholarships and represent their institutions in athletic conferences. Since the Industrial, people in the developed world have adopted an increasingly sedentary lifestyle. As a result athletics now plays a significant part in providing routine physical exercise. Athletic clubs worldwide offer athletic training facilities for multitudes of sports and games.

The first athletic training curriculum approved by NATA was in 1959 and the amount of athletic training programs began to grow throughout colleges and universities in the United States. In the early development of the major, athletic training was geared more towards prepping the student for teaching at the secondary level, emphasizing on health and physical education. This program was first introduced at an undergraduate level in 1969 to the schools of Mankato State University, Indiana State University, Lamar University, and the University of New Mexico (Delforge, et.al 1999*).*

Once athletic training was recognized as an allied health profession the process of accrediting programs began. NATA's PEC was the first to take on this role of approving athletic training educational programs. The AMA's CAHEA was given the responsibility in 1993 to develop requirements for the programs of entry-level athletic trainers. At this time all programs had to go through the CAHEA accreditation process. A year later CAHEA was broken up and replaced with the CAAHEP, which then lead the accreditation process. In 2003 JRC-AT, Joint Review Committee on Athletic Training completely took over the process and became an independent accrediting agency like all other allied health professions had. Three years later JRC-AT officially became the CAATE, which is fully in charge of accrediting athletic training programs in the United States. NATA produced the NATABOC in 1969 in order to implement a certification process for the profession for an entry-level athletic trainer. In 1989, became an

independent non-profit corporation and soon later changed its name to the BOC (Delforge, et.al 1999).

Athletics has gained significant importance at educational institutions; talented athletes may gain entry into higher education through athletic scholarships and represent their institutions in athletic conferences. Since the Industrial Revolution, people in the developed world have adopted an increasingly sedentary lifestyle. As a result athletics now plays a significant part in providing routine physical exercise. Athletic clubs worldwide offer athletic training facilities for multitudes of sports and games (Pucciarelli& Kaplan, 2016).

2.2. AEROBIC Exercise and Athletics

Aerobic exercise stimulates heart, lungs and all working group of muscles and produces valuable changes in body and mind. Many physiological changes are determined by daily aerobic exercises (Shahana et al, 2010). According to many research studies finding physical inactivity is one of the causes for development of chronic disease and poor fitness.

Regular physical activity, fitness, and exercise are critically important for the health and wellbeing of people of all, whether they participate in vigorous exercise or some type of moderate health-enhancing physical activity. Even among frail and very old adults, mobility and functioning can be improved through physical activity (Butler, et al, 1998).

Regular aerobic exercise will produce beneficial effects for any age group providing the exercise is specific and appropriate to the level of fitness of the individual. Progressive exercise correctly performed will increase the level of fitness and improve health. It will also create a sense of well-being, produce greater energy and reduce the risk of developing many diseases. Exercise makes demands on the body systems over and above normal every day activities and as result the systems adapt anatomically and physiologically (Rosser, 2001).

Appropriate regular daily physical activity is a major component in preventing chronic disease, along with a healthy diet and not smoking. For individuals, it is a powerful means of preventing chronic diseases; for nations, it can provide a cost effective way of improving public health across the population. Available experience and scientific evidence show that regular physical activity provides people, both male and female, of any conditions including disabilities with a wide range of physical, social and mental health benefits.

(WHO 2003) Fitness for living in the house or on the farm or at office or factory or in work places or in any service implies freedom from disease, enough strength, endurance and other abilities to meet the demands of daily living. Doing physical activity everyday contributes to optimum health and quality of life. Life styles can be changed to improve health and fitness through daily exercises.

On the other hand athletes lead a physically active life as their academic curriculum itself includes daily physical exercise and outdoor games (Choudhary,et.al, 2015). It has been documented physical inactivity as a major health problem.(Blair , 2009) and regular exercise is important for health and wellbeing (Penedo& Dahn 2005). Physical inactivity is contributing factor in several chronic diseases and conditions (Durstinea, et.al, 2013).

Physiology of Exercise offers the athletes an opportunity to observe the effect of training and helps to evaluate the Cardio- vascular system. This has created a great enthusiasm in our mind to undergo this study. The present study was undertaken to investigate effect of continuous and non-continuous training on Cardio-vascular endurance parameters of the athletes.

Aerobic exercises performed by moderate intensity produce significantly greater positive psychological outcomes than does either high intensity aerobics exercise or anaerobic exercise (Cohen & shamus, 2009). Regular aerobic exercises will produce beneficial effects for any age group. Providing the exercise is specific and appropriate to the level of fitness of the individual and also Progressive exercises correctly performed will increase the level of fitness

2.3. Sport Training

Sport training is very important to improve the VO2 max. The given training to increase the V̇O2max will impact to the respiration system and cardiovascular system. The system will adapt, so the performance will increase. Adaptation occurs at the lung that is at the tidal volume value, inspiration and expiration value average, and pulmonary ventilation value for the oxygen exchange, also will occur the heart size and plasma volume increase at the cardiac output, so the oxygen stroke volume also will increase. Sakthivelavan and Sumathilatha (2009).

Sport training has important role in maintaining the cardio respiratory system including the organs of heart and lung (Kenney, et.al 2015).Physiologically, the training brings physical stress at the body that able to produce adaptation responses. The physical training suggested along the body able to adapt toward excessive load. Training at high intensity able to induce specific adaptation that enable to body to function more efficiently (Lippincott & Wilkins, 2010).To get maximum benefit, all the trainings also be done by considering the training dosage with FIT or frequency, intensity or tempo principle (Kusmana, et.al, 2006) Frequency several times in a week to be done so bring training effect. The ideal frequency is 3-5 times a week. Training less than 3 times a week show no training adaptation, while training more than 5 times a week give no chance for body to recover. Intensity: training load weight given. Aerobic training done with light to moderate intensity.

According to (Kusmana,et.al, 2006) sport also increase significantly the heart capacity to be given weight between 60-80% from the maximum work capacity or with training pulse 70-85% from the maximum pulse. Tempo: duration of training.

Research showed the duration 20-30 minutes is sufficient to give ability increase of 35% if done 3 times a week in one and half month. Exercise training can be defined as a systematic process of preparing for a certain physical goal. This goal used to be synonymous with peak physical performance; however, exercise training is also used to achieve targets for health-related fitness. As society evolves and becomes more active (Dollman, et al. 2005) there is greater emphasis on habitual physical activity with the aim of reducing obesity, adult onset diabetes, hypertension and the risk of heart disease. Indeed, there are specific guidelines which have been written for prescribing exercise for these conditions (A C S M 1998).

An understanding shared by coaches and athletes alike, all over the world, is the general concept that physical performance improves with training (Foster, et al. 1996). The specific guidelines on how to achieve peak performance are not so clear, because of the diverse capabilities, goals and types of sport. For example, a sedentary person may have a goal of training to develop sufficient fitness for running 5 km without stopping. This can be compared to the goal of a professional athlete who trains according to a program with the aim of reducing his 5-km time by 3 s. However, irrespective of the goal, there are basic principles of training which can be applied to plan training programs.

Training for peak sporting performance includes training for physical development (general and sport-specific factors), and technical and tactical training. Athletes also have to train psychological aspects and in team sports athletes have to train for the development of team compatibility to ensure harmony within the team structure. To complete the requirements for achieving peak performance, athletes need to be healthy and free of injuries and have theoretical knowledge of their training in preparation for their sport so that they can take some responsibility for their progress (Bompa 1999).

Long-term planning for the career of an elite athlete covers 10–15years (Smith 2003). However, the age at which competitors reach their peak varies according to the sport. For example, in sports such as gymnastics, figure skating, and swimming competitors reach their peak in their late teens or early twenties, in contrast to other sports such as soccer, rugby, and distance running where competitors reach their peak success in their late twenties or early thirties (Bompa 1999).

The specific types of changes that occur after training depend on the type of stimulus, defined by the mode of exercise, intensity, and volume of training (Brooks, et al. 2005; Coyle 2000). For example, the outcome of a resistance training program can increase muscular endurance, hypertrophy, strength, or power. This depends on the manipulation of the training variables:

- ✓ Muscle action;
- ✓ Loading and volume;
- ✓ Selection of exercises and the order in which they are performed;
- ✓ Rest periods(recovery);
- ✓ Repetition velocity; and
- ✓ Frequency (Bird, ET al.2005).

The choice of the application of the training load (free weight vs. machine weights) can also influence the type of adaptation (Stone, et al, 2000a). The overt symptoms of training adaptations are shown by well-defined muscles, low body fat and skilful movements. The covert symptoms of training are increased mitochondria in skeletal muscles (Irrcher, et al. 2003), increased Capillarization (Henriksson, 1992), cardiac hypertrophy (Urhausen Kindermann 1992), and increased density of bones (Chilibeck, et al. 1995). The first signs of increased Capillarization occur about 4 weeks after starting a training program (Jensen, et al.2004), while

it takes at least 4 weeks for the mitochondrial mass in the skeletal muscle to increase(Lambert &Noakes 1989). A few days after starting an endurance training program there is an increase in plasma volume(Green, et al. 1990), while an altered muscle recruitment is the earliest adaptation that occurs after resistance training (Carroll, et al. 2001; Gabriel, et al. 2006). This is followed by muscle hypertrophy which occurs after about 8 weeks, depending on the training status of the athlete.

2.4. The Purpose of Sports Training

The purpose of the training programme is to produce metabolic, physiological and psychological adaptation that allows the sportsperson to achieve top level performance. When the training increases the demand for aerobic energy, the number and size of muscle mitochondria will increase, so that in these chemical factories where aerobic metabolism takes place becomes larger and more numerous. These will help athletes to provide more energy from aerobic metabolism. There are three steps of adaptation: the first involves creating the need for more aerobic energy. Training must be sufficient in both duration and intensity to accomplish. The second step is to provide nutrients to build and repair mitochondrial tissues. Third is that the athlete must be given enough rest to regain the energy as super compensation. There are different types of training by which one can attain the required development. Each of the training has its own specific effect (Hardayalsingh, 1984).

2.5. Training Structure

All training should follow some well-established principles. The first principle is to train initially to increase weekly training duration. Once the appropriate weekly training duration has been reached, then specific training sessions of high intensity can be introduced. An athlete should gradually and systematically increase training distance until the maximum training load that the athlete can tolerate has been reached. Signs that the maximum training load has been reached is a failure to adapt to a new, higher training load, an increase in muscle fatigue, a feeling of "tired, heavy legs," an increase in the time taken to complete a given training session (i.e., getting slower, rather than faster), or the appearance of a mild injury or illness (Noakes 2001). The total training load that can be tolerated depends on genetic factors and careful increase in the training distance, and takes years to develop fully. Ignoring signs that the body is failing to adapt to the training load can result in overtraining.

2.6. Universal Principles of Training

In planning a training program there are some basic principles that need to be considered. They are discussed under the following headings.

2.6.1. Overload

An athlete has to be exposed to an overload stimulus at regular intervals for the induction of training adaptations. An overload stimulus can be manipulated by changing the mode of exercise, duration, frequency, intensity, and recovery period between training sessions (Bompa 1999). An overload training stimulus can also be imposed by altering nutrition and influencing the intracellular milieu before the training session. For example, to mimic the metabolic stress in the muscles towards the end of a marathon an athlete could start the training session with a low muscle glycogen concentration. This can be achieved by reducing carbohydrate intake about 24 hours before the training session. The athlete then begins the training session with lower than usual glycogen levels in the liver and muscles. After about 20 –30 km of the training run the metabolic flux will be similar to the metabolism that occurs towards the end of a marathon. An advantage of this strategy is that a metabolic overload can be imposed without the same mechanical muscle stress and damage that occurs towards the end of a marathon.

2.6.2. Specificity

The principle of specificity states that adaptations are specific to the type of training stress. It follows that the type of training must be structured and planned in accordance with the requirements of the competition. However, this principle can be applied inappropriately if it is assumed that all training should simply mimic the demands of competition (Young 2006). In certain sports the physical demands of competition can induce muscle imbalances and the risk of injury is also higher in many types of competition compared to training for the competition. Therefore, it is necessary to vary training and structure it so that the athlete develops a good base of fitness.

Specificity is one of the main principles of resistance training in preparation for sports performance. This principle is not as important for general health and well-being, as most resistance training programs will lead to improved strength and muscle mass. Specificity in resistance training for sport is designed to train the body to react in a similar way to that required

during competition (Field 1988). As an example, it is inappropriate for a power athlete who needs explosiveness to train exclusively for maximum 1 RM strength. Becoming stronger at slow velocities will not ensure that strength necessarily improves at the same rate for ballistic movements such as jumping. To develop strength at faster velocities an athlete would need to include high speed resistance training activities to address this component of strength development before attempting the more high risk, competition-specific fitness.

2.6.3. Progression

Progressive overload is an essential component of any resistance training program whether it may be for improving muscle size, strength, or power (Pearson, et al. 2000; Winett & Carpinelli 2001). To sustain increases in muscle development and performance one constantly needs to progress the program by gradually increasing the demands placed on the body (American College of Sports Medicine 1998, 2002; Evans 1999; Kraemer &Ratamess 2004; Pearson, et al. 2000; Rhea, et al. 2003; Winett & Carpinelli 2001). This can be incorporated into a training program by manipulating any of the following training variables appropriately: increasing the frequency of training; increasing the repetitions in each set; increasing the number of exercises; decreasing the rest periods between sets and/or exercises; increasing the load utilized; or changing the speed of movement (American College of Sports Medicine 2002; Fleck 1999; Haff 2004a; Hass, et al.2001; Kraemer &Ratamess 2004; Pearson, et al. 2000).

2.7. Regularity of Training

Training regularly through the season is an important concept that has been emphasized by many of the great coaches of endurance sportsmen and women. While this concept may have been derived from experience gained over many years of prescribing training, there is now supporting physiologic evidence. Therefore, even if the training load is modest, such as when an athlete starts a training program for the first time, the training sessions should be undertaken regularly to achieve the best possible increase in fitness. In the case of the elite performer, training regularly is an obvious element of the training schedule, and in this case regularity of training is synonymous with consistency. Specifically, the training schedule should be consistent in terms of the nature of the various training sessions undertaken. Thus, in any given 1–2 week cycle of training, a similar training structure should be followed, including the nature of the high intensity sessions. The “pattern” and the type of workouts should be retained for some time before any

change is made to the fundamental components of the sessions. It is inappropriate to have an inconsistent approach as this will produce unpredictable results and also increase the risk of injury. Although training should be consistent, it should not be followed blindly based on the assumption that any program will guarantee success. Rather, the effects of the program on the individual's performance must be constantly assessed and appropriate modifications made where necessary. Such an approach allows for varying rate of change and adaptations which are attributed to the genetic variance between athletes. Therefore, every training program must be tailored and continuously adjusted to the individual who will be following it.

2.7.1. Volume of Training

Under prescription of training volume may lead to not achieving the desired improvements in strength and muscle performance, and over prescription of training volume may lead to overtraining and overuse injuries (Rhea, et, al. 2003). As a result, the optimal number of sets still remains an extremely controversial topic (American College of Sports Medicine 2002; Carpinelli& Otto 1998; Feigenbaum& Pollock 1997; Kraemer &Ratamess 2004; Pearson, et al. 2000; Wolfe, et, al. 2004). Of all the training variables, most of the research around resistance training has focused on volume, and more particularly single vs. multiple set training (Rhea, et al. 2003).

2.7.2. Intensity of Training

It is only ever necessary and possible to train at a intensity for 5 –10% of the total training time (Daniels, 1998). For example, most of the best marathon runners do most of their training at a speed of 30–50 s·km–1 slower than their race pace. While training, the effort should be perceived as "comfortable." A good way of testing this is the "talk test." It should be possible to maintain a conversation with training companions. If it is not possible to talk, then the training intensity is too high and the session should be continued at an easier pace. Training intensity will be addressed in more detail subsequently.

2.7.3. Frequency of Training

When someone starts a training program for the first time, training should only be on every second day. In high impact sports such as running, this ensures adequate time for adaptation and repair between training sessions, specifically to the load bearing bones of the legs. Bone

adaptation is particularly slow. In fact, for approximately 3 months after the start of a weight-bearing training program, bone loses strength. Thereafter, the osteo blasts become very active and new bone is laid down (Scully &Besterman 1982). Thus, until this time, the risk of developing a bone stress injury if the training load becomes too high, too rapidly, is greatly increased. The number of training sessions each week should be increased only once the duration of each training session performed every second day has reached an appropriate time. This depends on the sport type and training time available. For example, in the case of a running program in which weight-bearing stress is high, a more cautious increase in training frequency should be followed than in a sport such as cycling. In cycling, limitations are more likely to be related to the rate of muscle adaptation, which occurs more rapidly than bone adaptation (Margulies, et al. 1986). The progression from training every second day to more frequent training should proceed systematically. Training every second day should be increased to training for two successive days followed by a recovery day of no training. This should be followed by three successive days, then four successive days, etc., with an appropriate amount of time at each successive "step" before proceeding to the next. On the extreme end of high training load, it is quite common for elite athletes to train every day, with twice daily training sessions 5 or 6 days each week.

2.7.4. Training Duration

Initially, it is more useful to prescribe training duration based on the time spent training each week, rather than the distance covered. The concept of time taken to complete a single training session needs to be considered even in the case of someone who has been training for many years. Consider elite versus a slow "club" runner. The elite runner will cover a distance of approximately 16 km in 60 min in training, whereas the average club runner may cover approximately 12 km in the same time. Alternatively, to complete 16 km would take the same club runner approximately 1 hour 20 min. Yet 1 hour 20 min of running probably imposes more biomechanical stress to the slower runner than that experienced by the fast elite runner whose training session of 16 km is complete after just 60 min in this example. Thus, at least initially, measuring training load based on time rather than distance is preferable.

2.8. Factors Affecting Physical Fitness Training

The principles of training are guidelines that can be used to customize a training program. A deviation from, or inappropriate application of these guidelines, has consequences that can negatively affect performance. Common basic factors in training that detract from achieving peak performances include the following (Smith 2003):Recovery is neglected; Demands on the athletes are made too quickly; After a break in training because of illness or injury, the training load is increased too quickly; High volume of maximal and sub maximal training; Overall volume of intense training is too high when the athlete is training for endurance events; Excessive time is devoted to technical or mental aspects, without adequate recovery; Excessive number of competitions – this includes frequent disturbances of the daily routine and insufficient training time that accompanies competition; Bias of training methodology; and The athlete has a lack of trust of the coach because of inaccurate goal setting.

Endurance can be developed using continuous and interval training. Aerobic Endurance: a sound basis of aerobic endurance is fundamental for all events. Aerobic means 'with oxygen'. During aerobic work the body is working at a level that the demands for oxygen and fuel can be meet by the body's intake. The only waste products formed are carbon dioxide and water. These are removed as sweat and by breathing out. Aerobic endurance is developed through the use of continuous running training method (duration runs) to improve maximum oxygen uptake (VO2 max) and interval training to improve the heart as muscular pump. This can be achieved through different aerobic activities or exercises details of which are given later in this section.

2.9. Training Methods

A training method is the form of exercise you select to improve your fitness. The training method selected has a significant impact on training outcomes. Training must be relevant to your goals; this refers to the training principle of specificity. Those interested in improving someone wanting to improve their cardiovascular fitness may use continuous or on-continuous training.

2.9.1. Non- Continuous Training Method and Aerobic Endurance of Athletes

Non-Continuous training is a form of training done alternately between work and break? With interval training the body able to adapt well to the nervous system or at the metabolism system.

Training with interval training method, the run training done with interval or break period, Kent (2006) explained that interval is a training system done alternately between training and work with low intensity activities break period in a training stage (Fox and Bowers,1998) explained several benefits of interval training system as follows:Careful in control the strain occurred, As the systematic approach day by day will enable and easy to observe the progress ,Further in improving the potential energy than the other condition method, The training program can be implemented everywhere and no need special instruments,

Five principles done for interval training explained by (Fox and Bowers, 1998) as follow s: Size and distance of work interval, Repetition of each training, Interrupt Interval or time between work intervals, Activities during the interrupt interval and Training frequency per week.

Gerschlers great contribution was his understanding of the importance of cardiovascular conditioning and his devising a training scheme that would maximize cardiovascular fitness. That is, he realized that strong legs alone do not make a great runner. He sought a system that would increase the heart's stroke volume, and hence its ability to deliver blood and oxygen to the legs. With Rein dell's help, he devised interval training-relatively fast runs over relatively short distances repeated a number of times.

The name of the system comes from the 'interval', or rest period, between the fast runs. Gerschlers and Rein dell considered this the most important part of the workout, and they controlled it carefully. Believing that the heart adapted and grew stronger during the interval, they would not allow runners to begin the next repeat until their pulse rate had returned to 120 beats per minute. If this did not occur within 90 seconds of the end of the previous repeat, the workout was too difficult and had to be adjusted. Otherwise, the heart would be overworked, leading to fatigue and exhaustion, rather than to the desired training effect. Interval training involves alternating short bursts of intense activity with what is called active recovery, which is typically a less – intense form of the original activity.

Interval training is built upon alternating short, high intensity bursts of speed with slower, recovery phases throughout a single workout. The interval workouts can be highly sophisticated and structured training that is developed for an athlete, based upon his or her sport, event and current level of conditioning. An interval training workout may even be developed based upon

the results of anaerobic threshold testing that includes measuring the blood lactate of an athlete during rigorous exercise.

Interval training is a type of physical training that involves bursts of high-intensity work interspersed with periods of low intensity work. The high-intensity periods are typically at or close to anaerobic exercise, while the recovery periods may involve either complete rest or activity of lower intensity. Interval training can refer to organization of any cardio vascular workout (e.g. cycling, running, rowing, etc.), and is prominent in many sports' training. It is a technique particularly employed by runners, but athletes from several backgrounds have been known to use this type of training.(http://en.wikipedia.org/wiki/Intervaltraining)

Interval training is an excellent way to burn more calories, build endurance quickly and make work outs more interesting. Interval training involves alternating high intensity exercise with recovery periods and there are a variety of ways to set up interval workouts. One option is measured by periods of work followed by instrumented periods of rest. An example would be one minute of high intensity work (such as a sprint), followed by two minutes of low intensity exercise (e.g. walking) and alternating that several times for 15-30 minutes.(http://exercise.about.com/cs/cardioworkouts/g/intervaltrainin.htm)

According to James (1988) "Interval training is a form of progressive conditioning in which the intensity of the activity, the duration of each bout, the number of bouts, the time or kind of rest period between bouts or the order of the bout is varied".

Interval training is appropriate to repeated, but short intermittent periods of physical activity with recovery. Fox and Mathews (1974) viewed that the key to success in interval training is utilizing the proper intensity of exercise followed by a rest period. The rest interval prevents accumulation of fatigue products, permitting more intensive workouts, without the additional pains of fatigue. Interval training can be best described as bouts of exercise which include short rest intervals. It is based on the concept that more work can be completed data relatively higher intensity, compared to continuous-type training.

The intensity and duration of the work intervals and the length of the rest periods formulates the training response. All-out bouts of work coupled with longer rest periods are used for speed and speed endurance development. Short, very intense work intervals with short rest periods will predominantly tax the fast glycol tic energy system. Conversely, longer, lower intensity exercise

bouts and short rest intervals can be used to develop aerobic endurance. Rest intervals are a critical component of the interval training programmed sign.

2.9.2. Types of Non -continuous Training

1. Long interval Training

Doherthy (1964) described three types of interval training. In the first type, one runs half or three quarters of the actual distance at competition speed or even faster, which requires a longer interval of slow jogging. This is called long Interval Training.

2. Short interval Training

The second type is short interval training. In this method there are two types of workouts: pace endurance work out and speed endurance work out. In pace endurance, distance pace and interval are kept constant and the number of repetitions is increased as condition improves. In the speed endurance type, distance interval and number of repetitions are fixed and pace varied, in this, the interval is comparatively shorter.

3. Middle Time Interval Method

Middle Time Interval Method: In this method the duration of each bout of load is between 2 to 8 minutes.

2.9.3. Factors that Affects Interval Training Method

Intensity of stimulus (speed of work), Density of stimulus (interval of recovery), Duration of stimulus (duration of work), Frequency of stimulus (number of repetitions) and Mode of recovery (nature of recovery) this above factors can be manipulated to increase or decrease the load. Manipulating only one of the above factors or even all the factors can increase this load. The important point to be recognized is the mode of performing recovery. Between two bouts of load, walking or jogging or combination of walking and jogging could perform the recovery. Sitting and lying between two repetitions of training load are not recommended.

Interval running method has been recommended for improving specific endurance in cyclic sports e.g. track and field events, swimming events, cycling and the like. This

method has been also used to the best advantage in improving specific endurance in different team games, combative and racket sports

2.9.4. Effects of Interval Training Method

1. **Physiological Effect:**
   - Improves efficiency of cardio respiratory system,
   - Development of aerobic capacity,
   - Development of anaerobic capacity,
   - IncreasedVO2max, Increased muscle glycogen,
   - Capillarization and Improved compensation capacity.
2. **Training Effect:**
   - Development of basic endurance,
   - Development of strength endurance
   - And Development of strength.
3. **Psychological Effect**:
   - Improvement of determination and will power,
   - Enhancement of tolerance ability in respect of pain and discomfort
   - And enhanced ability to work under fatigue conditions.

2.10. Continuous Training and Aerobic Endurance of the Athletes

Continuous training is Involving training without resting periods. The activity may include long distance running or jogging, swimming, cycling or rowing. It also involving long slow distance exercise and it can be performed at a constant rate without rest. If It is performed correctly continuous training improves cardio vascular Endurance and muscular stamina. Training at first should be at 60% of maximum heart rate, increasing 75-80% of maximum heart rate.

'Steady' runs may be used to develop aerobic capacity i.e. to improve the efficiency of the relation between oxygen uptake and energy output they are best carried out over a varied undulating (rising and falling) terrain (environment) and on not too hard a surface If roads are

used, extra care should be taken to wear well cushions shoes that give protection against the jar of the hard surface.

Continuous training is training done without break interval at the training session. Continuous training done with constant speed (moderate) or high intensity at certain time. Training intensity should sufficiently stimulate the stimulation threshold value of aerobic so the physiological adaptation will occurs. Continuous training or ongoing training, namely training at the distance of each category sustainable (Greene, et.al, 2014).Continuous training, as the name implies, involves continuous activity, without rest intervals. This has varied from high intensity, continuous activity of moderate duration to low intensity activity of an extended duration.

The long-distance runner maintains a pace that is just below his running pace, although this will depend on the competition distance and the distance of the training runs. This has been a very effective way6 of training endurance athletes without requiring high levels of work that are stressful and uncomfortable for the athlete. One advantage of this type of training for the competitive runners the constant pace at near competition levels. Running at an even pace during a race appears to be the most efficient way, physiologically to attain the runner's best time. Therefore, this type of training greatly aids the runner in preparing himself for actual competition. It is suggested by the sports training experts that slower-paced variations, such as LSD or Fatlike, be introduced periodically, e.g., twice per week, to give the athlete some relief from the exhaustive, high-intensity, continuous training.

Continuous training is Involves low-intensity exercise for long periods of time without a rest or break. A performer normally performs continuous training for a minimum of 20 minutes in their aerobic training zone (60-80 % of heart rate max). An example continuous training workout could be a 30 minute run at 60 % heart rate max. Adjusting the pace or effort of the activity can vary the exercise intensity, for example instead of running at 60 % heart rate max, increase to 70 %.

2.10.1.Classification of Continuous Running

The continuous method has four variations which are slow continuous method, fast continuous method, variable pace method, and fartlek method.

1. **Slow continuous method**: - In this method the speed or pace of exercises is determined according to heart rate. For trained sportsperson the heart rate during the exercise should be from 140 –160 beats per minute. The volume in terms of total duration should not be less than 30 minutes, and endurance athletes can go up to 2 hours or even more.
2. **Fast continuous method**: -In this variation the work is done at fast but unchanging pace for durations without any break. Heart rate is normally between 160-180 beats/minutes. Total volume or duration should not be less than 20 minutes for trained sports persons.
3. **Variable pace method**: - In this method the exercise is done continuously but with changing pace or speed. The heart rate normally ranges between 140-180 beats/minute. The total duration or volume ranges from about 15 minutes to 1 hour. It can be used by trained sportsman only.
4. **Fartlek Method**: - It is a variation of variable pace method. In fartlek change of pace or speed is not pre planned. The sportsman changes the speed on his own during the activity, according to the terrain, surrounding and his felling. The heart rate fluctuates between 140-180 beats / minute.(Hutchinson, et.al 1986).

2.10.2.Effects of Continuous Training Methods

1. Physiological Effect:

- Improves efficiency of cardio respiratory system,
- Development of aerobic capacity,
- Development of anaerobic capacity,
- IncreasedVO2max Increased muscle glycogen, Capillarization and Improved compensation capacity.

2. Training Effect:

- Development of basic endurance
- and Development of strength endurance

3. Psychological Effect:

- Improvement of determination and will power,
- Enhancement of tolerance ability in respect of pain and discomfort.

CHAPTER - THREE

RESEARCH METHODS

3.1. Study Area (site)

The study was conducted among Dembecha Beruh Tesfa under-17 athletics project which is located in Dembecha woreda, West Gojjam zone, Amhara regional State, Ethiopia. The woreda is located at 349 Km North West of Addis Ababa and 205 Km south of the regional capital Bahir Dar. So the geographical location of the study area is shows below.

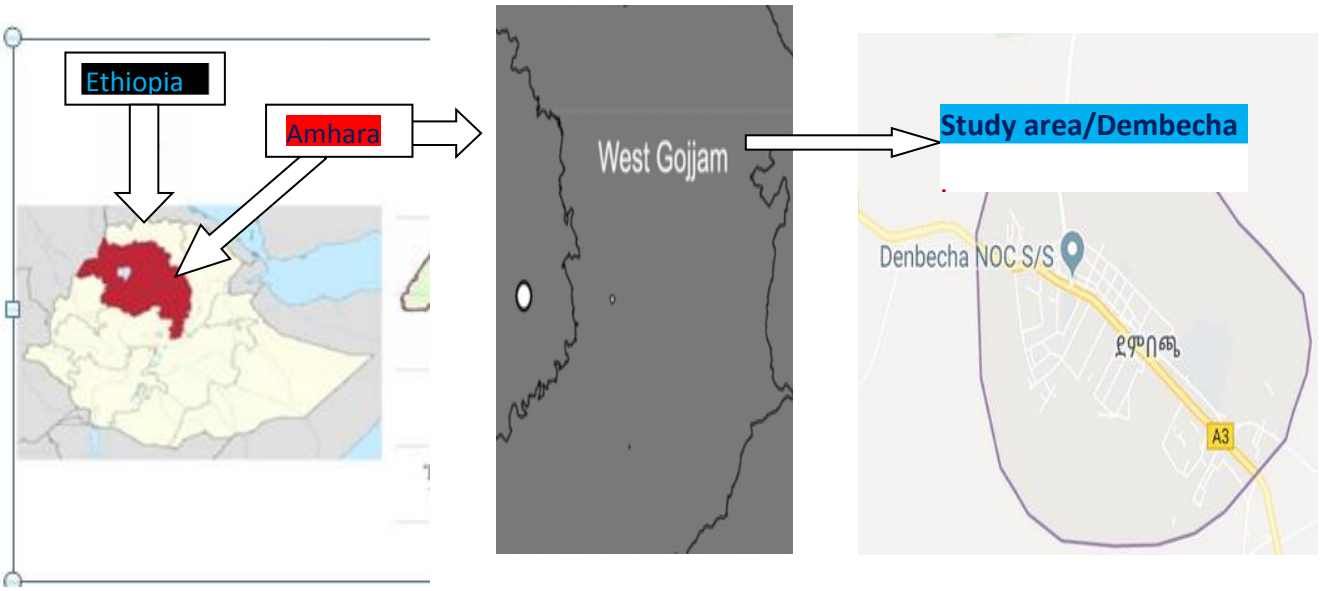

Figure-1: Map of the study area

3.2. Research Design

A quasi experimental research design was employed to determine the causal impact of treatment on target population. The study participants were categorized in to two groups namely continuous and non-continuous. In both study groups, different variables were measured over time for a period of eight weeks before and after the treatments.

3.3. Population, Sample and Sampling Techniques

Table 1:

Table 1. Dembecha Athletics Project study participant Athletes

Dembecha Athletics Project study participant Athletes

EVENT	
LONG DISTANCE	NO OF PARTICIPANTS
Continuous group	12male&3 female athletes
Non-continuous group	12 male &3female athletes
Total	30 athletes are participated

The researcher selected all long distance runners purposively used for this study. Then, at the first of training intervention, the researcher was measured their fitness level result of all 30 athletes and they were assigned into two groups through randomization (i.e.15 for continuous training group and 15 athletes for non-continuous training group).

The reason for selecting those athletes was to examine the aerobic endurance nature of the training intervention which was delivered during the study. And the nature of the dependent variable (aerobic endurance) which was measured in this study was more directly associated with long distance running performance than other events.

Due to potentially confounding results related to greater physical training volume, subjects who undertake in additional training outside of this study were forced to stop their extra training.

To this specific study the writer was followed purposive sampling technique. In this research the writer was preferred to used small number of participants hence this is experimental research, on the basis of the participant knowledge, so the size of the participant are small enough we can use the whole subjects participate on aerobic exercises training both in continuous and non-continuous training methods for maximizing The skills or performance of athletes. The sample size of this study was contained 30 selected male and female athletes between the age's of15-17 years in dembecha beruh Tesfa U-17 athletics project at dembecha Woreda, w/ gojjam, Amhara region.

3.4.Sources of data

Dembecha Beruh Tesfa U-17 athletics project athletes are the primary source of data to collect performance test results from pre and post-tests.

3.5.Data Collection Instrument

As data collection instrument, the researcher was used the following aerobic endurance tests before and after continuous and non-continuous training interventions;

- Twelve Minute Run (Cooper's) Test
- Three Minute Step Test
- The 2.4 km Run Test

So this data was collected from the results of performance tests from pre to post test of experimental groups of dembecha beruh Tesfa U-17 athletics project. The data was collected through the appropriate Performance test such as 12 minute run test (cooper test), three minute step test and 2.4km run test for measuring aerobic endurance level of athletes. For measuring this physical quality, material like cones, stop watch, whistle, record sheets, pen, and chalk were used.

3.6.Data Collecting Procedure and administration of skill tests

1. Twelve Minute Cooper's Test

According to Mackenzie, (2005), the purpose of the distance runs is to measure maximal functional fitness level and endurance of the cardio respiratory system. Subjects were instructed to run with their maximum speed or as fast as possible in twelve minutes. The objective of cooper's twelve minute run test (Cooper, 1968) is how much distance the athletes cover, measuring aerobic fitness level of the athletes and they become competitive. When the researcher used this test, the following materials were used.

- Stopwatch,
- 400m track marked in every 100m,
- Assistant and
- Data recording sheet.

This fitness test will be initially used to estimate the VO2 max. Cooper found that there is a very high relationship between the distance someone can run or walk in twelve minutes and their VO2 max value, which measure the efficiency with which someone can use oxygen while exercising. This is measuring the distance covered in twelve minutes, involves running for twelve minutes around the 400 meter track marked out area and register how far covered in that time with the nearest 50 meters. After warm up for five minutes, the player began by the signal. Participants were continued to run until a whistle blown at twelve minutes. Walking was permitted, and covers as much distance as possible during the twelve minutes run. By comparing the results of pre and post test the analysis indicate that the effects of continuous and non-continuous training on all project athletes' endurance performance.

2. Step Test

According to Mackenzie, (2005), the objective of the test is to measure the recovery rate of heart after exercise and to measure cardiovascular endurance of athletes. The subjects were conducted a warm up for 10 minutes. Step test is designed to measure cardiovascular endurance by using a 12 inch high bench. Athletes who have high level of cardio respiratory fitness will have a lower heart rate during recovery from three minutes of bench stepping than less fit athletes. The step test works on the rational that individuals with a high level of cardio respiratory fitness will have a lower heart rate during recovery. To undertake this test, material were necessary.

- Stopwatch,
- 12 inch high bench,
- Assistant
- Pen and data recording forms.

The subjects were started by steps up and down on the platform at a given rate for three minutes. This action /up-up-down-down/ was repeated and test continued until the given time completed. Immediately after the 3 minutes of stepping, the subject sits down on the bench and finds pulse (at neck) and count the number of heart beat (pulses) that occur during 60 second's period. By comparing the results of pre and post test the analysis indicate effects of continuous and non-continuous training on all athletics project runners 'physical fitness performance.

Figure 2. Step Test

Adopted from Mackenzie 101 performance evaluation tests, (2005)

Analysis: Analysis of the result is by comparing it with the results of previous tests. It is expected that, with appropriate training between each test, the analysis would indicate an improvement of aerobic fitness.

Reliability: Reliability would depend upon how strict the test is conducted and the individual's level of motivation to perform the test.

Validity: There are published tables to relate results to a potential level of fitness and the correlation is high.

3. 2.4 km run Test

The objective of this test is to monitor the development of the athlete's aerobic endurance.

Required resources to undertake this test the following resources requires:

- 400metre track
- Stop watch
- Assistant.

The test is conducted as follows:

Athlete to complete a 10 minute warm up Athlete to run 2.4 km (6 laps of a 400m track) as fast as possible Assistant to keep athlete informed of the number of laps remaining to complete the test Assistant to record the time taken for the athlete to run 2.4km.

Analysis: Analysis of the result is by comparing it with the results of previous tests. It is expected that, with appropriate training between each test, the analysis would indicate an improvement.

Target group: This test is suitable for active athletes but not for individuals where the test would be contraindicated.

Reliability: Reliability would depend upon how strict the test is conducted and the individual's level of motivation to perform the test.

Validity: There are no published tables to relate results to potential performance in competition

3.7. Methods of Data Analysis

The Analysis of the data collected from both continuous and none-continuous groups was carried out using SPSS V-21 data analysis software. Paired t-test and independent t-test were employed to compare both training groups over time and between different groups using the data collected from pre-tests and post-tests results. The significance level of the data considered when P-value less than 0.05 at a 95% confidential interval.

3.8. Ethical consideration

Ethical clearance letter was obtained from Sport Academy of Bahir Dar University. The letter submitted to Dembecha woreda youth and sport for notification and Regarding to ethical consideration, the researcher was governed by the research code of ethics in maintaining privacy and other related values. Before starting to do the research, the researcher got information from all project members about their Willingness for the participation on the study and got recognition from Dembecha woreda sport office. Dembecha woreda sport offices also have given recognition to the researcher with filling of cooperation.

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3.9. Training protocols

Table 2: Training protocols of the study

Treatments	**Aerobic Exercise Program**
Frequency of training	3 days/weeks
Total duration of training	2 months (8 weeks)
Intensity	High/moderate (55-69) MHR
Exercise days of training	Monday(morning), Wednesday(afternoon) and Friday(morning)
January(1-3)/2012E.C	pre-test
Training intervention (janu4-mar4/2012E.C)	Training program
March 5-6)/2012e.c	Post –test

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1. Introduction

The main target of the study was attention on to examine the effects of continuous and non-continuous training on aerobic endurance level of athletes in the case of dembecha beruh Tesfa U-17athletics project. This part also deals with the analysis of pre and post test data collected from experimental group ,that is continuous group (n=15) and non-continuous group (n=15) on the study. The tests were to know the performance level of 12minute run, 2.4km run and 3 minute step test. And all tests were adopted from Mackenzie 101 performance evaluation tests, (2005). The pre test data was recorded the experimental group was taken before and after the treatments of both continuous and non-continuous training groups. The collected pre and post-test data were analyzed using both paired t-test and independent sample t-test at 95% significant level for experimental groups and the results are listed below

4.2. Results

4.2.1 Demographic Characteristics of the study participants

Table 3: Demographic Characteristics of the study participants

Group	**N**	**Training age**		**Chronological age**		**Height**		**Weight**	
.		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Con	15	3.2	0.676	15.73	0.799	1.62	0.061	59.67	4.57
Noc	15	3.3	0.488	15.73	0.799	1.60	0.058	58.53	4.55

NB:- Con= continuous; SD =Standard deviation; Noc=non-continuous; N=Number

According to the above table, the demographic characteristics of the study participants showed the mean training age of both groups was 3.20 for continuous and 3.3 for non-continuous. The mean chronological ages of the participants in both groups were also found to be 15.73 years and 15.73 years respectively. Similarly the mean height of the participants was 1.62m and 1.6m. as well as the mean weight were 59.67km and 58.53km for continuous and non-continuous respectively (Table 3).

4.2.2. Paired sample T-Test Results of Aerobic Fitness Tests

Table 4: Paired sample T-Test Results of Aerobic Fitness Tests

Aerobic endurance tests	Groups	Paired differences		95% CI		T	Sig.
		Mean	SD	Lower	Upper		
3minute Step test	Continuous	4.80	1.0823	4.2001	5.3997	17.2	.000
	Non-continuous	6.5333	1.8074	5.5324	7.5534	14.00	.000
12 minute test	Continuous	-15.200	8.96182	-20.16289	-10.23711	-6.569	.000
	Non-continuous	-55.6667	26.36195	-70.26543	-41.06791	-8.1780	.000
2.4km run test	Continuous	0:00:10.48	0:00:03.3	0:00:08.65	0:00:12.31	10.779	.000
	Non-continuous	0:00:10.60	0:00:2.50	0:00:09.47	0:00:11.74	12.293	.000

A paired sample t test results on athletes aerobic Endurance shows that, after 8 weeks training intervention schedule for continuous training group post-test results of 3 minute step test revealed (M =86.4, SD =1.54919) produced statistically significant (P<0.05) less than their pretest results (M =91.2, SD = 1.78083) with t (28) = 17.2, CI = 4.2001, 5.3997, paired difference M = 4.8 and SD= 1.0823.Fornon- continuous training group of the 3 minute step test post test results were (M = 84.20, SD = 1.56753) was also significant (P = .000) less than their pretest result (M = 90.733, SD = 1.2228) with t (28) = 14.00, CI = 5.5324, 7.5534, paired difference M = 6.533 and SD = 1.8074 (table 4 and 5).

A paired sample t test results for 12 minute run test time trial test shows that continuous training group post test results (M = 2673.400, SD = 20.48646) were significantly (P= .000) greater than their pretest results (M = 2658.267, SD= 22.9268) with t(28) = -6.569, CI= -20.16289, -10.23711, paired difference M = -15.2and SD = 8.96182. Similarly non-continuous training group posttest results (M = 2695.400, SD = 27.42991) was significantly (P = .000) greater than their pretest result (M= 2639.733, SD = 14.10404) with t (28) = -8.178, CI= -70.26543, -41.06791, paired difference M = -55.6667 and SD = 26.36195 (table 4, and 5).

At the last, to examine the effect of continuous and non- continuous training methods on 2.4km run aerobic fitness test, paired sample t test were conducted and results Shows that both group was found to be significant (p = .000) in pre and post test results (*i.e*., continuous training group pretest M =0:07:20.20, SD=0:00:05.50 and posttest M= 0:07:09.72, SD =0:00:03.65 with t(28) =20.032, CI =0:00:08.65, 0:00:12.31, paired difference M =0:00:10.48 and SD =0:00:03.3; non-continuous training group pretest M =0:07:15.96, SD =0:00:03.13 and posttest M =0:07:05.4, SD =0:00:02:66 with t(28) =12.293, CI =0:00:09.47,0:00:11.74 , paired difference M =0:00:10.60 and SD =0:00:02.50(t able 4 and 5)

4.2.3. Independent t-test Results of Aerobic endurance Tests

Table 5: Independent t-test Results of Aerobic endurance Tests

Aerobic tests	Levine's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. 2 tailed	Mean Diff.	Std. error Diff	95% CI of the diff.	
									Lower	Upper
3minute step test	Equal variances assumed	0.024	0.878	3.866	28	0.001	2.2	0.569	1.03437	3.365
	Equal variances not assumed	-	-	3.866	27.99	0.001	2.2	0.569	1.03436	3.366
12minute run	Equal variances assumed	0.035	0.853	-2.481	28	0.019	-21.93	8.839	-40.0406	-3.82
	Equal variances not assumed	-	-	2.481	25.95	0.020	-21.93	8.839	-40.1065	-3.760
2.4km run	Equal variances assumed	1.700	0.203	3.739	28	0.001	0:00:04.36	0:01:16.64	0:00:01.97	0:00:06.75
	Equal variances not assumed	-	-	3.739	25.59	0.001	0:00:04.36	0:01:16.64	0:00:01.96	0:00:06.76

An independent-samples t-test was conducted to compare the effect of continuous training and non- continuous training on athletes' aerobic endurance. In 3minute step test result the independent samples t-test result revealed that athletes who were participated in non-continuous training method score better results than athletes who were participated in continuous training group As it was assessed by Leven's Test for equality of variances homogeneity of variances was not violated, so equal variance assumed were used. Because the Sig. Value is greater than

.05, means that the variability in two training group is about the same or there is homogeneity of variances. So, the 3 minute step test scores for continuous group (M=4.8, SD=1.0823) and non-continuous group (M=6.533, SD=1.8074); t (28) =3.866, 95% CI is (1.0344, 3.3656) p = 0.001. These results suggest that non-continuous training group really does have a better effect on athletes' aerobic endurance as compare to continuous training group (P < .05).

An independent-samples t-test was conducted to compare the effect of continuous training and non- continuous training on athletes' aerobic endurance. In 12minute step test result the independent samples t-test result revealed that athletes who were participated in non-continuous training method score better results than athletes who were participated in continuous training group As it was assessed by Leven's Test for equality of variances homogeneity of variances was not violated, so equal variance assumed were used. Because the Sig. Value is greater than .05, means that the variability in two training group is about the same or there is homogeneity of variances. So, the 12 minute run test scores for continuous group (M= -15.2, SD= 8.962) and non- continuous group (M=-55.667, SD=26.36); t (28) =-2.481, 95% CI is (-40.04, -3.826) p = 0.019.Therefore there was a significance difference between non-continuous and continuous training groups (P < .05)

An independent-samples t-test was conducted to compare the effect of continuous training and non- continuous training on athletes' aerobic endurance Based on independent sample t- test results, 2.4km run aerobic fitness test was found to be statistically significant. As it was assessed by Leven's Test for equality of variances, so equal variance assumed were used; So, the 2.4km run test scores for continuous group (M= 0:00:10.48, SD= 0:00:3.3) and non- continuous group (M= 0:00:10.60, SD=0:00:2.50); the 95% CI is (0:00:01.97, 0:00:06.75) which doesn't contain 0; this result doesn't violet P value of the significance test. These results indicate that athletes in the Non-continuous training group scores better result than athletes in the continuous group in 2.4km run aerobic fitness test.

4.3. Discussion

The Purpose of this study was to examine the effects of 8 weeks of non-continuous training compared to continuous training on athlete's aerobic endurance. Based on the findings of this study, both non-continuous and continuous training method significantly improves athlete's aerobic fitness. However, athletes who train with non-continuous training method significantly

improve aerobic fitness greater than those athletes who train with continuous training method. As the researchers have seen on the result of each individual test, therefore, the formulated null hypotheses were rejected.

Recent work shows that the cardiovascular endurance adaptations to HIIT are similar to and in some cases superior to those of continuous endurance training (Helgerud et al., 2007; Ellingsen, &Kemi, 2009). Helgerud et al. showed that 4 repetitions of 4-minute runs at 90-95% of heart rate max (HRmax) followed by 3 minutes of active recovery at 70% HRmax performed 3 days per week for 8 weeks resulted in a 10% greater improvement in stroke volume when compared to a long, slow distance training group. Additional research by Slordahl et al. (2004) demonstrated that high intensity aerobic training at 90-95% of maximal oxygen consumption (VO2max) increased left ventricle heart mass by 12% and cardiac contractility by 13%, which is comparable to cardiovascular changes observed in continuous aerobic exercise.

The fitness industry is currently experiencing a surge of interest and growth in high intensity interval training (HIIT). This method of training involves repeated bouts of high intensity efforts that range from 5 seconds to 8 minutes followed by recovery periods of varying lengths of time. Billat (2001). As the knowledge of HIIT increased, exercise scientists demonstrated that this type of exercise provides performance benefits for athletes. But it may also be a suitable alternative to endurance training, or continuous aerobic exercise. To improve cardiovascular fitness the belief has always been to increase the volume of exercise, whether it's longer runs, bike rides, or extended time on an aerobic machine (e.g., stair stepper, elliptical, cycle, treadmill). The breadth of current research has revealed that HIIT improves numerous physiological parameters, often in less time when measured against high volume continuous exercise (Daussin et al., 2008). Therefore, the purpose of this article is to discuss and compare the HIIT versus continuous endurance exercise. Additionally, research examples of HIIT and continuous endurance training workouts are included in this article.

Sakthivelavan and Sumathilatha (2009) Suggested that the given aerobic training to increase the V̇O2max will impact to the respiration system and cardiovascular system. The system will adapt, so the performance will increase. Adaptation occurs at the lung that is at the tidal volume value, inspiration and expiration value average, and pulmonary ventilation value for the

oxygen exchange, also will occur the heart size and plasma volume increase at the cardiac output, so the oxygen stroke volume also will increase.

To get maximum benefit, all the trainings also done by considering the training methods by considering training principles specially with FIT or frequency, intensity or tempo principle,(Kusmana, et.al, 2006) and also (Soulas,et al,(2005)) Conducted a study to evaluate the qualitative aspects of training that elite middle and long distance runner's employ throughout their yearly training season to improve performance. Additionally we examined how their training methods correspond with the relevant research. We collected information about the usage of non-continuous training, continuous training, during the week throughout the seasonal training phases. Ten Spanish coaches, chosen according to their athletes' performance in International Events, took part in the present investigation. Continuous running at 75-85% of VO2max and repeated running up to 85% of VO2max are mostly used in the build-up phases and less in the precompetitive and competitive phases, whereas interval running at 85-95% of VO2max repeated running above 85% of V O2max, and interval sprinting were mainly used in the pre-competitive or maintenance phase.

Karthikeyan (2011) studied the effect of Non –continuous and continuous running on cardio respiratory endurance. The criterion variable cardio respiratory endurance was tested on selected dependent variable at prior to and immediately after the eight (8) weeks training programme. The result of the study revealed that there was a significant difference among non-continuous training group, continuous running group on cardio respiratory(aerobic) endurance. And also it was found that there was a significant improvement on cardio respiratory endurance due to non- continuous training and continuous running whereas the improvement was in favor of non-continuous group on all aerobic endurance tests of 12 minute cooper's test, so this was confirmed the result revealed on the above table 5.

After 8 weeks both continuous and non- continuous training intervention both are significant but non continuous training was better to improve athletes aerobic fitness in between the pre to post test scores when assessed by 12 minute run cooper's test, three minute step test and 2.4km run test of athletes endurance performance.

The data on table 5 showed that there were significance differences after 8 weeks of continuous and non-continuous training on dembecha beruh Tesfa U-17 athletics project of athletes. The

result on 12 minute run cooper's test suggests that, there was significant change found on As it was assessed by Leven's test for equality of variances, so equal variance assumed were used; t(M= -15.2, SD= 8.962) and non- continuous group (M= -55.667, SD=26.36); t (28) =-2.481, 95% CI is (-40.04, -3.826) p = 0.019 which doesn't contain 0; this result doesn't violet P value of the significance test. Therefore there was a significance difference between non-continuous and continuous training groups at 0.05 significant level of confidence. From this result the researcher suggested there was better improvement on athletes aerobic performance level found in non-continuous training as compare to continuous training.

So this was also confirmed by Chidambararaja (1992) conducted a study to investigate the effect of continuous running and non- continuous running on cardio respiratory endurance, and muscular endurance. The criterion variables chosen namely cardio respiratory endurance was measured by cooper's 12 minutes run/walk test, SO, the findings of the study showed that both the training groups improved the cardio respiratory endurance and muscular endurance. Since the non-continuous running improves the performance rapidly than that of continuous running. The non-continuous running group showed a significant difference when compare to continuous running on selected criterion variables. And also it is confirmed that there was significant difference in-between the pre to post test score. The improvement in performance was due to the aerobic exercise in which they were engaged in. The mean score value for 12minute run/walk test. aerobic exercise on continuous group was 1393.8,during training test was 1737.6m and training mean score value on the non-continuous group was 2118.6m,. When we compare the mean value score of continuous group and non-continuous group with the mean score values of after 12 weeks aerobic exercise, the mean difference value in non-continuous group increased by 724.8m (52%).This result indicated the effective change was observed on participants cardiovascular fitness(aerobic fitness) level(Selvam and sudha 2008).

In 3minute step test result the independent samples t-test result revealed that athletes who were participate in non-continuous training method score better results than athletes who were participate in continuous training group. As it was assessed by Leven's Test for equality of variances homogeneity of variances was not violated, so equal variance assumed were used (M=4.8, SD=.1.0823) and non- continuous group (M=6.533, SD=1.8074); t (28) =3.866, 95% CI is (1.0344, 3.3656; p = 0.001) this agree with P value of the significance test. Thus, it is possible

to say that there were significance differences between non-continuous and continuous training groups ($P < .05$).

In support of the above justification by Sevvel and Karthikeyan (2011) studied the effect of aerobic interval training on selected endurance parameters such as aerobic endurance. The selected criterion variable at prior to and immediately after the training programme by using bend knee step ups test. The results of the study revealed that there was a significant difference between aerobic interval running group and continuous running group on selected aerobic endurance parameter. A significant improvement on selected criterion endurance variable was also noticed due to aerobic interval running programme

In case of 2.4km run aerobic fitness test was found to be statistically significant. As it was assessed by Leven's Test for equality of variances, so equal variance assumed were used; (M= 0:00:10.48, SD= 0:00:3.3) and non- continuous group (M= 0:00:10.60, SD=0:00:2.50); the 95% CI is (0:00:01.97, 0:00:06.75) which doesn't contain 0; this result doesn't violet P value of the significance test. These results indicate that athletes in the Non-continuous training group scores better result than athletes in the continuous group in 2.4km run aerobic fitness test.

SO it can be confirmed by, Hoff and Helgerud (2004) conducted study to determine the effect of endurance interval training using an intensity at 90-95% of maximal heart rate in 3- to 8-minute bouts have proved to be effective in the development of aerobic endurance, and for performance improvements in athletics as compare to continuous training group.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATION

5.1. Summary

The main target of this study was to compare the effects of Non- continuous training and continuous training methods on athlete's aerobic endurance at Dembecha Beruh Tesfa U-17 athletics project athletes. For this purpose, the researcher reviewed the available literatures in order to settle on the focus of the study.

So to achieve the purpose of the study, 30 Dembecha Beruh Tesfa U-17 athletics project athletes were selected. Subjects were grouped in to two groups (15 for continuous group and 15 for non-continuous) based on their pretest result through randomization. And both groups were train 3 days per week for 8(eight) consecutive training intervention programs. Because the measured dependent variable (aerobic endurance) is highly associated with aerobic metabolism and performance, all the subjects were long distance runners in dembecha athletics project.

In order to examine significances on athlete's aerobic endurance of those groups, three Mackenzie performance evaluation tests, (2005) were used as a data collection instrument (i.e., 3 minute step Test, ,12minute run test and 2.4 km run test)**.**

After collecting data from athletes through these testes, paired and independent one sample t- test was used to analyze and examine whether there is a significant improvement in aerobic fitness after interventions. In all case, an alpha value ≤ 0.05confidence interval or level of confidence was used to test the significance.

Generally, results of the study revealed that in aerobic endurance tests of non-continuous training group were significantly better than continuous group results. (i.e., in 3 minute step Test the mean score of non-continuous training group was 84.2 and 86.4 for continuous group, $p = 0.001$; in 12minute run test the mean score of non-continuous training group was 2695.40 and 2673.46 for continuous group, $p = 0.019$; and in 2.4 km run test the mean score for non-continuous training group was 0:07:05.34 and 0:07:09.72 for continuous training group, $p = .001$). Generally, the study was confirmed that non- continuous training method was significantly better than continuous training method for improvement of athlete's aerobic endurance level.

5.2. Conclusions

Based on the key findings of the study the following generalizations were made.

The present study was done to compare the effect of non-continuous training and continuous training methods on athlete's aerobic fitness. Based on the major findings of the study the following points were stated as conclusions.

- Eight weeks non-continuous and continuous training method has a positive significant effect on the enhancement of aerobic endurance of dembecha beruh Tesfa U – 17 long distance athletes.
- But there was a better improvement on non- continuous training group and both non-continuous and continuous aerobic training methods were effective in improving athlete's aerobic fitness after 8 week training programmes.

- Even though both training groups exercised at an average of equal intensities, non-continuous training group was better in aerobic fitness parameters.
- This result lies on the adaptations with intensity of work intervals and active recovery activities which produces significant changes in cardio respiratory systems (aerobic endurance) of the athletes after training interventions.

5.3. Recommendations

Based up on the major findings and conclusions of this study, the following recommendations were forwarded to investigate more on the effect of non-continuous and continuous training on athlete's aerobic endurance level.

- As noted in the results of this study, non-continuous training method is more advantages than continuous training method to improve athlete's aerobic endurances. So, athletes are highly recommended to use this training method with high intensity nearest to competition phase for aerobic endurance improvement.
- When outlining training sessions using non-continuous training method, coaches and athletes should consider the volume, intensity and durations of the recovery activities based on the intensity of work intervals.

- While doing non-continuous training, it is important to make sure recovery activities are more dynamic, the whole session is more rhythmic of pace, rather than depending on a stopwatches it is recommended for other researchers that further study should be conducted to examine effect of continuous and non-continuous training on other fitness variables, like strength, power and speed so on etc.
- For the competence of result and drown conclusions, it is recommended that investigators who conduct their study on the comparative effect of non-continuous and continuous training require to make sure that the training work load given for both training methods is the same.

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Appendix-A: Training programs

Eight (8) weeks of continuous and non- continuous training intervention

Monday Week -1**@moderate intensity**

Exercises		
Warming up exercise and dynamic stretching		
Hill training	26min	continuous
Step exercise	12 min	training
Rope jumping	10 min	
Track work out	12minrun ------	

Monday week -1(non-continuous training)

Exercise	set & reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5min, reps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Wednesday week -1@moderate intensity

Exercises		
Warming up and dynamic stretching		
Hill training	18min	continuous
Step exercise	20 min	training
Rope jumping	10 min	
Track work out	12min run	

Wednesday week -1 (non-continuous training)

Exercise	set & reps	recovery b/n set &reps
Warming up and dynamic stretching		
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Friday **week -1@moderate intensity**

Exercises		
Warming up and dynamic stretching		
Hill training	18min	continuous
Step exercise	20 min	training
Rope jumping	10 min	
Track work out	12minrun	

Friday **week -1 (non-continuous training)**

Exercise	set & reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Monday Week -2 @moderate intensity

Exercises		
Hill training	18min	continuous
Step exercise	20 min	training
Rope jumping	10 min	
Track work out	12minrun	

Monday **week -2 (non-continuous training)**

Exercise	set & reps	recovery b/n set &reps
Warming up and dynamic stretching		
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Wednesday **Week -2 @moderate intensity**

Exercises

Warming up and dynamic stretching

Hill training	18min	continuous
Step exercise	20 min	training
Rope jumping	10 min	
Track work out	12minrun	

Wednesday **week -2 (non-continuous training)**

Exercise	set & reps	recovery b/n set &reps
Warming up and dynamic stretching		
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Friday **Week -2 @moderate intensity**

Exercises

Warming up and dynamic stretching

Hill training	18min	continuous
Step exercise	20 min	training
Rope jumping	10 min	
Track work out	12minrun	

Friday **week -2 (non-continuous training)**

Exercise	set & reps	recovery b/n set &reps
Warming up and dynamic stretching		
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Monday week -3@moderate intensity

Exercises

Warming up and dynamic stretching		
Hill training	18min	continuous
Step exercise	20 min	training
Rope jumping	10 min	
Track work out	12minrun-------	

Monday **week -3**

Exercise	set& reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n rep
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Wednesday **week -3 @moderate intensity**

Exercise

Warming up and dynamic stretching		
Hill training	18min	continuous
Step exercise	20 min	training
Rope jumping	10 min	
Track work out	12minrun	

Wednesday **week -3 (non-continuous training)**

Exercise	set & reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Friday **week -3 @moderate intensity**

Exercises

Warming up and dynamic stretching		
Hill training	18min	continuous
Step exercise	20 min	training
Rope jumping	10 min	
Track work out	12minrun	

Friday **week -3 (non-continuous training)**

Exercise	set & reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Monday **week -4 @moderate intensity**

Exercises

Warming up and dynamic stretching		
Hill training	18min	continuous
Step exercise	20 min	training
Rope jumping	10 min	
Track work out	12minrun	

Monday **week -4 (non-continuous training)**

Exercise	set & reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Wednesday **week -4 @moderate intensity**

Exercises		
Warming up and dynamic stretching		
Hill training	18min	continuous
Step exercise	20 min	training
Rope jumping	10 min	
Track work out	1x12minrun	

Wednesday week -4 (non-continuous training)

Exercise	set & reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Friday **week -4 @moderate intensity**

Exercises		
Warming up and dynamic stretching		
Hill training	18min	continuous
Step exercise	20 min	training
Rope jumping	10 min	
Track work out	12minrun	

Friday **week -4 (non-continuous training)**

Exercise	set & reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Monday **week -5 @moderate intensity**

Exercises

Warming up and dynamic stretching

Hill training	18min	continuous
Step exercise	20 min	training
Rope jumping	10 min	
Track work out	12minrun	

Monday **week -5(non-continuous training)**

Exercise	set & reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Wednesday **week -5 @moderate intensity**

Exercises

Warming up and dynamic stretching

Hill training	18min	continuous
Step exercise	20 min	training
Rope jumping	10 min	
Track work out	12minrun	

Wednesday **week -5(non-continuous training)**

Exercise	set & reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Friday **week -5 @moderate intensity**

Exercises

Warming up and dynamic stretching

Hill training	18min	continuous

Step exercise	20 min	training
Rope jumping	10 min	10sec
Track work out	12minrun	-------

Friday **week -5(non-continuous training)**

Exercise	set & reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Monday **week -6 @moderate intensity**

Exercises

Warming up and dynamic stretching

Hill training	18min	continuous
Step exercise	20 min	training
Rope jumping	10 min	
Track work out	1x12minrun	

Monday **week -6(non-continuous training)**

Exercise	set & reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Wednesday **week -6 @moderate intensity**

Exercises

Warming up and dynamic stretching

Hill training	18min	continuous
Step exercise	20 min	training
Rope jumping	10 min	
Track work out	1x12minrun	

Wednesday **week -6(non-continuous training)**

Exercise	set & reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Friday **week -6 @moderate intensity**

Exercises

Warming up and dynamic stretching

Hill training	18min	continuous
Step exercise	20 min	training
Rope jumping	10 min	
Track work out	12minrun	

Friday **week -6(non-continuous training)**

Exercise	set & reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Monday **week -7@moderate intensity**

Exercises

Warming up and dynamic stretching

Hill training	18min	continuous
Step exercise	20 min	training
Rope jumping	10 min	
Track work out	12minrun	

Monday **week -7 (non-continuous training)**

Exercise	set & reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep

100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Wednesday **week -7@moderate intensity**

Exercises

Warming up and dynamic stretching
Hill training 18min
Step exercise 20 min
Rope jumping 10 min
Track work out 12minrun

} continuous training

Wednesday **week -7 (non-continuous training)**

Exercise	set & reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Friday **week -7@moderate intensity**

Exercises

Warming up and dynamic stretching
Hill training 18min
Step exercise 20 min
Rope jumping 10 min
Track work out 12minrun

} continuous training

Friday **week -7 (non-continuous training)**

Exercise	set & reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Monday **week -8@moderate intensity**

Exercises

Warming up and dynamic stretching

Hill training	18min	**continuous**
Step exercise	20 min	**training**
Rope jumping	10 min	
Track work out	12minrun	

Monday **week -8 (non-continuous training)**

Exercise	set & reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Wednesday **week -8 @moderate intensity**

Exercises

Warming up and dynamic stretching

Hill training	18min	**continuous**
Step exercise	20 min	**training**
Rope jumping	10 min	
Track work out	1x12minrun	

Wednesday **week -8 (non-continuous training**

Exercise	set & reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Friday	**week -8**	
	Exercises	
Warming up and dynamic stretching		
Hill training	18min	**continuous**
Step exercise	20 min	**training**
Rope jumping	10 min	
Track work out	12minute	

Friday	**week -8 (non-continuous training)**	
Exercise	set & reps	recovery b/n set &reps
Rope jumping	3x15reps	2min b/n sets 5minreps
400m	2x4	15sec b/n sets & 4min b/n rep
100m	2x6	5secb/nsets&5minb/n reps
800m	2 sets	4min b/n sets
Step exercise	2x30	5min b/n sets

Appendix-B: continuous training group data both pre & post- test result

Athletes code	**Step test (b/m)**		**12minute run(meter)**		**2.4km run test(min)**	
	Pre	**Post**	**Pre**	**Post**	**pre**	**Post**
AX	92	85	2669	2686	7.45	7.25
BX	93	87	2664	2667	7.35	7.15
CX	93	88	2683	2700	7.35	7.20
DX(F)	94	90	2589	2620	7.55	7.25
EX	91	87	2669	2664	7.35	7.20
FX(F)	93	87	2637	2655	7.35	7.10
GX(F)	92	87	2642	2649	7.25	7.15
HX	90	86	2658	2673	7.25	7.15
IX	88	85	2671	2685	7.25	7.12
JX	90	85	2659	2686	7.35	7.13

KX	91	86	2683	2695	7.25	7.12
LX	90	86	2668	2690	7.25	7.08
NX	88	84	2656	2675	7.25	7.10
OX	92	88	2658	2677	7.35	7.15
PX	91	85	2668	2680	7.45	7.28

Appendix-C: non-continuous training group data both pre and post results

MX(F)	92	85	2644	2675	7.30	7.08
QX	90	84	2657	2705	7.20	7.05
RX(F)	91	88	2635	2691	7.30	7.10
SX	92	85	2633	2692	7.30	7.08
TX	91	86	2654	2690	7.30	7.06
UX	90	83	2649	2696	7.35	7.10
VX	91	85	2651	2692	7.25	7.04
WX	91	84	2611	2680	7.25	7.09
XX(F)	93	84	2617	2671	7.20	7.05
YX	89	84	2657	2710	7.25	7.11
ZX	91	82	2629	2703	7.23	7.10
A1	89	83	2632	2676	7.30	7.12
B1	89	85	2650	2690	7.21	7.01
C1	90	82	2644	2785	7.35	7.05
D1	91	83	2633	2675	7.20	7.07

Appendix -D: Demographic Characteristics of the Participants

From no.1 - no.15 for continuous Group and from no.16 – no.30 for non-continuous Group are Listed Below

No	Athletes code	Sex	Training age	Chronological age	Weight	Height
1	B.LM	M	3	16	54	1.65
2	BM	M	4	15	60	1.70
3	AB	M	4	15	54	1.52
4	MH	M	2	17	55	1.64
5	MB	M	3	16	65	1.67
6	ET	M	3	15	56	1.65
7	LT	M	4	16	54	1.70
8	HM	M	3	17	63	1.60
9	BA	M	3	15	61	1.54
10	MB	M	4	15	64	1.56
11	YM	M	3	16	65	1.67
12	TA	M	2	15	60	1.56
13	EB	F	4	17	55	1.54
14	TY	F	3	16	66	1.62
15	BM	F	3	15	63	1.65
16	BK	M	3	16	54	1.65
17	SM	M	3	15	60	1.70
18	AB	M	4	15	54	1.52
19	MH	M	3	17	55	1.64
20	MB	M	3	16	65	1.67
21	TE	M	4	15	56	1.65

22	TL	M	3	16	54	1.70
23	AB	M	3	17	63	1.60
24	BS	M	4	15	61	1.54
25	YM	M	3	15	64	1.56
26	TA	M	4	16	65	1.67
27	EB	M	3	15	60	1.56
28	YT	F	3	17	55	1.54
29	BS	F	4	16	66	1.62
30	FT	F	3	15	63	1.65

Appendix-E Group Statistics Results From Aerobic Fitness Tests

Table4: Group Statistics Results From Aerobic Fitness Tests

	Group	**N**	**Mean**		**Std. Deviation**	
			Pre	Post	Pre	Post
3 minute Step test	Continuous	15	91.2	86.4	1.7808	1.5492
	Non-continuous	15	90.733	84.2	1.2228	1.5675
12 minute test	Continuous	15	2658.267	2673.460	22.9268	20.48646
	Non-continuous	15	2639.733	2695.400	14.1040	27.4299
2.4 km run test	Continuous	15	0:07:20.20	0:07:09.72	0:00:05.50	0:00:03.65
	Non-continuous	15	0:07:15.96	0:07:05.34	0:00:03.13	0:00:02.66