CHAPTER-I

INTRODUCTION

1.1 Introduction

High levels of achievement and advancement nothing could have risen higher or moved more quickly if there had been no athletic competition.

Distance running remains one of the most interesting sports, despite recent trends in sports interests. It's the thrill of pitting one man against another in a drawn-out competition. Historically, there has been a lot of interest in the characteristics that allow the distance runner to handle such workloads. Distance runners' anatomical characteristics and the effects of altitude on physical performance have both been the subject of extensive research. However, when discussing success in distance running, the impact of endurance training must be given top priority.

In the modern world, a sport has gotten quite competitive. It takes more than just practicing or participating for someone to succeed. Thus, physiology, biomechanics, sports training, sports medicine, sociology, psychology, and other aspects all have an impact on the sporting life. The performance of the players for their nation is being improved by coaches, trainers, physical educators, and doctors. All athletes and players strive to represent their nations at international games by winning medals and honors **(Ghuman and Dhillon, 2000).**

Today, sport is a global phenomenon. Without the world's acknowledgment of the significance of sports and sports competitions, it would not have been feasible for sports to enjoy their unprecedented popularity and improved organisation. The relevance of sports to the advancement of modern civilisation has been recognised by all. Physical fitness promotion, which in turn promotes health and happiness, is one of physical education's key goals.

In contemporary society, sport plays a very important function. It matters to every person, every organisation, every nation, and even the entire world. Sport is an institutionalised competitive activity that requires intense physical effort or the use of relatively complex physical skills by participants who are motivated to participate by both the intrinsic satisfaction of the activity itself and the external rewards attained through participation. The pursuit of a predetermined objective through competition is the fundamental element

of sport. There must be guidelines and uniform requirements for this tournament **(Howell et al. 1994).**

Equivocal is the most nearly ideal training regimen for long-distance runners. Nearly as many track coaches as there are training programmes. It is rather improbable that one technique will develop into the undisputed best technique for training endurance runners. Too many people have probably adapted to various forms of stress. It is reasonable to expect to be able to demonstrate that some training methods are superior to others, nevertheless.

Training is frequently categorised as either speed work or distance work among distance runners. Speed training typically takes the form of interval training, which alternates relatively fast running with slower walking or jogging as recovery periods. Typically, distance training consists of lengthy, continuous runs that are slower than race speed. Both of these techniques for cross-country skiing training are widely employed. While individuals choose to use both training techniques to differing degrees, many trainers suggest using just one of these training techniques. The training pace system, which involves running at the pace you intend to keep during the race, is popular among distance runners.

Many renowned marathon runners, including Jim Peters, assert that "pace kills, not distance. Every workout is performed somewhat slower than race pace.

Since the beginning of time, human cultures all over the world have employed physical activities to build fitness for survival in their fight for existence. Resistance training, combat sports, physical activity, and offensive and defensive arts have all been practiced since antiquity with the goal of preparing young people for both the physical development of the company and national defense.

A player must determine whether any time is appropriate for that unique occasion because fitness plays a crucial function in sports. When an athlete gets fatigued, his motions become sluggish and discordant, which negatively affects his technique. At their anaerobic threshold, elite professional athletes run 10 km (on average at 80–90% heart rate). To stay balanced and handle the ball while being pressured by the rival, a runner needs a number

of explosive movements and powerful contractions. A team with a better overall fitness level is a superior team and plays harder when the game picks up speed, even though the teams have the same strategies and talents. **(Stolen et al., 2005).**

As a result of many sorts of study, a range of scientific advancements in general, and their application in the field of sports in particular, the world of games and sports has experienced several milestones. Athletes today are trained using highly advanced techniques to improve their performance in their chosen sports, and they are exposed to workouts and training methods that help them reach greater levels.

Today's sports are fiercely competitive; every time there is a match, records are broken. Individual achievement does not come from only participating or practicing for a few days; rather, it comes from years of hard work and training beginning in childhood as well as strong anthropometric factors.

Energy economy is the most crucial factor in long-distance races. Using a logical technique, all unnecessary and detrimental movements must be eliminated. The speed and length of your stride affect how your foot lands on the ground. Middle and long-distance runners place their foot close to the vertical body center of gravity projection when they make contact with the ground. The foot will be flatter when it hits the ground because of the longer distance. The top of the metatarsal will make initial touch with the ground for middle- and long-distance runners. The weight of the body briefly crushes the entire foot into the ground after initial contact. The extension of the leg on the posterior stance of the foot balances out the small flexion of the knee joint during the anterior stance of the foot. Running is aided rhythmically at an effective elbow angle by the upper body leaning only slightly or not at all forward (85 to 95 degrees). The arms always move either parallel to the torso or just in front of it, regardless of the tempo. Also acceptable is the usage of the shoulder girdle by runners in some way **(Sharma, 2016).**

Long-distance running is practiced for a variety of reasons in contemporary human society, including exercise, amusement, travel, economics, and culture. Running over long distances has the potential to enhance cardiovascular health. Running increases, the activity of enzymes and hormones that encourage your muscles and heart to operate more

effectively, which increases your aerobic capacity. In the past, military physical training has frequently included endurance running. Although professional racing is most frequently seen in sports, foot couriers used to race to deliver messages to far-off locations during the pre-industrial era. The Hopi and Tarahumara, among others, are recognised for their long-distance running customs and ceremonies. Distance running can be beneficial. Distance running has even been linked to nation-building and can be a great way to bring together family, friends, and coworkers. Distance running's social component has been associated with improved performance.

Long-distance running training aims to enhance the "big three" factors that affect performance: running economy (VO2 at a given submaximal running speed), fractional utilisation (the capacity to maintain a high percentage of VO2max while running), and maximal oxygen uptake (VO2max; the maximum rate at which the body can take in and use oxygen during strenuous exercise). All of these factors work together to manufacture adenosine triphosphate (ATP) aerobically and translate muscle exertion into power and speed **(Haugan et al. 2020).**

Training must be understood as a process that readys an athlete for the highest levels of performance on a technical, tactical, psychological, physiological, and physical level. Planning and foresight are key components of the training process. The goal of training is to maximize the effects of the training stimulus by utilising recognised principles of physics, physiology, and psychology because training is multifactorial in nature.

Sports training is a unique method of preparing athletes that is based on scientific principles and is intended to increase and maintain a higher level of performance in a variety of sports activities. It is a specific kind of training intended to enhance one's physical condition and sporting prowess. It consists of cardiovascular and conditioning activities, strength training, corrective and restorative exercises, and strength training. Additionally, it offers guidance on nutritional values as well as mental and psychological training.

A training regimen is an activity plan created to help athletes become better at what they do and have more energy to do it. Training is the entire process of preparing an athlete for a greater performance through various methods and techniques **(Singh, 1984).**

Sports training is not just a fun activity because it aims to push athletes as close as possible to their genetic limits. Given this idea, a good coach ought to be regarded in the same light as a good physician. The training procedure might therefore be viewed as a prescription.

In its most common and efficient form, sports training is a pedagogically organised activity with all the key characteristics of a rigorously guided process of teaching, education, and self-education. The methodological cornerstone of sports training is a system of workouts that are set up to achieve their maximal evolutionary effect under complete supervision of the improvement process. Athletes are trained through a multidimensional process that involves the efficient application of aggregate elements (means, techniques, and conditions) to an athlete's growth in order to ensure the required degree of physical fitness **(Matveyev, 1977).**

No longer a fiction, training for games and sports does not call for a careless attitude. It offers sufficient details for procedures and scientific validations. It is well acknowledged that sports training is a highly specialised science. With the use of electromyography, sports scientists are attempting to comprehend the many aspects impacting muscle and skeletal activity throughout a variety of human actions. They are also engaged in analysing the biomechanics of elite athletes' performances, with a skill-based focus. Sports. To better understand the intricacies of human movement and performance, researchers are continually examining several aspects that affect these movements, such as force, limb length, mass, inertia, angular and linear velocity ratios. The most current method tries to develop a mathematical representation of a talent in a format appropriate for computer analysis so that it may be simulated under many well-regulated settings to foretell more efficient methods for improved performance **(Miller and Nelson, 1973).**

The most well-known methods for getting athletes ready for effective performance and a healthy life are training and conditioning. The only way to perform effectively is through a carefully designed programme of progressive practice, which will improve coordination, cut down on pointless movement, produce results with the least amount of energy, and condition muscle structure and circulation to withstand high stress demands **(Koubova and Guarente, 2003).**

Sports training's pedagogical component is emphasised. If we consider that practically all sports require systematic training to begin in childhood in order to be considered performance sports. Therefore, it is even more crucial to teach kids and teenagers how to practice for sports to enhance their performance. Periodic assessments of the athlete's health and development are part of the training. The task's difficulty often increases during the course of training. The training implies that some of the initial movements may gradually improve their performance output over time. Training always requires a lot of work. Health must be connected to training. Training is an activity plan created to help athletes become better at what they do and have more energy to do it **(Edward L. 1984).**

Physical education instructors and coaches choose training techniques based on their fundamental beliefs in one or the other, not on any examination of which technique is better in general, which technique is best for a given athlete, or which technique is best for a given race event. The majority of research papers in this area that have been published over the years have focused on the comparative effects of continuous, intermittent, or even Fartlek running on specific physiological variables and running performance. However, there haven't been any published studies on how competition and testing methods affect performance. It was suggested that the current study compare and analyse the effects of interval training, competition, and test procedures on a few key variables, including resting heart rate, vital capacity, blood pressure, blood glucose, haemoglobin content, and performance in the 1500-meter race.

These components fit into four basic training zones, according to **Martin and Coe (1997)**. Longer, lower-intensity runs are a form of aerobic conditioning. This is typically defined as 55 to 75 percent of your maximum oxygen uptake (VO2 max), which is a comfortable racing pace at which you could have a conversation. The oxidative energy system is under stress from this type of action **(Baechle & Earle, 2008; Beck, 2005; Martin & Coe, 1996).**

Anaerobic capacity and aerobic fitness are heavily emphasised in current middle distance training trends. According to research, performing these high-intensity interval workouts boosts drive ability, promotes the activation of fast-twitch muscle fibers, and has other positive physiological effects **(Beck, 2005).**

Mirwald (1965) analysed the results of two different training programmes for the mile run. The first technique used interval training, while the second combined Fartlek and interval training. He came to the conclusion that the performance gains for running the mile would be identical with both methods of training.

Continuous training and interval training are the two main methods of running training most frequently used by middle- and long-distance runners. Furthermore, a lot of middle- and long-distance runners incorporate sprint and fartlek training into their training regimens **(Thompson, 2009).**

The advantages of this type of training include improving and increasing the capacity of different cardiovascular and respiratory systems, increasing maximal oxygen consumption, expanding the capillary network, expanding mitochondrial enzymes in aerobic energy systems, and expanding the enzymes that produce total body energy **(Smart & Steele, 2012).**

Building aerobic endurance is the key to successful distance running. The performance of the activity will be more constrained by the functioning of the heart, blood vessels, blood, and lungs the longer the duration of the activity and the degree of static muscular contraction involved. Exercise intensity is the key determinant of how much breathing and circulation interfere with performance. Running long distances is a relatively low-intensity, long-duration activity that mainly involves rhythmic, nonstate muscular contractions and is primarily governed by aerobic fitness **(Lamb 1983).**

The degree to which the various types of resistance have developed will largely determine the middle and long distance runners' maximal performance. A high level of fitness and coordination abilities, including speed, explosive strength, endurance strength, flexibility, agility, and relaxation ability, are required for optimal performance in a competition, depending on the race distance. Finally, the performance of middle and long distance runners can be positively impacted by anatomical, physiological, and morphological aspects.

The practice of exercising to improve endurance and stamina is known as strength training. Training the aerobic system as opposed to the anaerobic system is typically referred to as

"resistance training". Although simple cardiovascular and muscular endurance is frequently referred to as the prerequisite for endurance in athletics, the concept of endurance is actually considerably more complicated. Two types of strength can be distinguished: general strength and particular strength. It can be demonstrated that in sports, talent and execution method are closely related to resistance. Lifters who consistently and efficiently perform their technique with little effort are said to be in good shape.

A variety of meticulous training exercises will enhance motor abilities. All sports and activities are built on the concept of endurance. The main factors for the development of resistance parameters, such as cardiorespiratory resistance, speed resistance, and muscular resistance, with the improvement of physiological qualities, such as VO2 max, period apnea, and resting pulse rate, are the continuous method, the interval method, and the fartlek method. The goal of training is to identify an athlete's genetic potential and help them reach it without doing any harm. Two fundamental factors that give the knowledge and abilities to effectively apply the performance appraisal system make training important. People used to undergo organised training. It is possible that in recent years, the enhancement of the physiological goal through training has led to an increase in sports performance. Training aids in the development of an athlete's work while taking into account the development of strong mental traits. Training is a protracted, methodical sports activity with a dynamic, independent gradation. Training adaption is the degree of improvement achieved by carefully planned, recurrent activities (**Bompa, 2009).**

You’re breathing and pulse rate increase during endurance training, which is frequently called aerobic exercise. You may maintain your health, increase your fitness, and carry out your daily tasks with the aid of these activities. The health of the heart, lungs, and circulatory system are improved by resistance training. This kind of continuous, moderate-intensity training improves aerobic capacities that are meant to develop energy generating systems. Consider the ergo genesis of the sport between the anaerobic and aerobic components to understand the best way to increase specific endurance for any sport.

According to **Sloan et al. (2011),** endurance exercise increases fitness and recovery rate. All healthy persons between the ages of 18 and 65 are advised to engage in vigorous- or moderate-intensity aerobic physical activity for at least 20 minutes three days a week, according to the American College of Sports Medicine (**Haskell et al., 2007).** Resistance training has several health advantages, which is why many individuals strive to incorporate it into their regular routines. However, lack of time is the main reason why employees don't routinely attend training **(Booth et al., 1997).** As a result, it's important to offer them training plans that support both performance and aerobic fitness.

The goal of endurance training is to encourage physiological adjustments that enhance a runner's capacity for generating and utilising energy.

Continuous training

Continuous training is training that entails working continuously for a predetermined amount of time at a specific effort, typically a medium intensity. Boost physical stamina and muscular endurance for long-distance activities like running.

Running at roughly the same pace is what is meant by the term "continuous training," also known as "slow long distance" training. There are two possible formats for this training. The first involves long stretches of slow-paced running. Unless you are an experienced and extremely motivated runner or athlete, the second type of continuous running is incredibly successful but very challenging. These runs, referred to as supra-max runs, require you to run for an equal amount of time or longer than our designated race pace.

One of the most effective strategies to increase stamina is to continuously tan. This training strategy involves performing a lengthy activity continuously. As a result of the activity being done for a longer amount of time, the intensity is kept low with this manner. The finest example of exercise where the heart rate remains between 140 and 16 bpm is cross-country running. The exercise shouldn't last less than 30 minutes in total. Depending on the person's or the athlete's resistance, the duration of this exercise may be lengthened.

1. Increases the amount of glycogen in the liver and muscles.

2. Increases mitochondrial size and number.

3. It also makes the heart and lungs more effective.

4. It strengthens people's resolve and helps them remain focused when they are tired.

5. You can up the intensity for better outcomes.

6. It helps the person develop self-discipline.

Physical training that incorporates constant action is known as continuous training. This kind of exercise can be performed at high, moderate, or low intensities for long periods of time or as a fartlek. The following subcategories of continuous training, each with a somewhat different impact on the energy pathways, are possible **(Michalsik & Bangsbo, 2002).**

Physical training that doesn't involve breaks for rest is known as continuous training. There are three sections:

(1) Slow continuous Running,

(2) Fast continuous training,

(3) Variable pace

- The heart rate will be between 140 and 160 beats per minute with modest intensity.
- The length will be 15 to 20 minutes, with a heart rate of 160 to 180 beats per minute.
- 140 to 180 beats per minute for heart rate this is the result of the two runs combined.

This kind of training can be done at high or moderate intensities for a long time.

As much muscle mass as is feasible should be used during the training, at an intensity of roughly 75% of VO2 max. Examples include cross-country skiing, running, biking, tennis, jogging, and swimming. Since the effect of training on heart function can generally be applied to the use of many muscle groups, the training modality is not crucial in terms of fencing specificity. It is thought that swimming, with the water acting as a type of resistance, may adversely affect this neuromuscular coordination and reflex timing because fencing requires exquisite neuromuscular synchronisation with reflexes specific to the sport. It is advised that this training not be scheduled prior to a dodgeball session if the

athlete chooses to employ swimming to develop their aerobic base. It might be more acceptable to do this after your specific dodgeball training, or every other day **(Jack, 1977).**

Continuous training entails using 60–80% of one's energy for at least an hour, four or five times per week, at least. Long-distance sprinters, tennis players, etc., benefit from this strategy since it increases their levels of continuity and mimics how they often compete. Any athlete can increase their cardiovascular endurance levels through regular training. All other training methods, both anaerobic and aerobic, are meant to be used continuously **(Wilmore et.al, 1978).**

Continuous training typically doesn't call for bulky equipment, making it simpler for athletes and trainees to carry out the necessary tasks. Because it maintains the body at the oxygen threshold during exercise, this sort of training also significantly increases the trainees' aerobic capacity. The majority of the exercises are simple to reproduce and carry out, and they are beneficial for the heart and respiratory systems. Continual exercise can also assist trainees in weight loss or injury recovery.

Alternate Pace Training

Running for long time at a speed with a variation in progressive stretches in accordance with a plan is Alternative pace run. In general, for a person at slow pace for 1.0 km, the heart rate ranges from 130 to 150 beats per minute while considering fast pace for 0.5 km, the heart rate ranges from 170 to 180 beats per minute. The maximal oxygen intake at a subsequent distance of 1.0 km is stirred up.

The ability to adjust speed and consume oxygen are supported by the alternative pace run. Interval training ensures that trainees' recovery times are improving. Such training helps them to be more tenacious and resilient.

Our body can only "clean up" or convert a certain amount of lactic acid into energy before lactate floods our system and causes exhaustion, as you discovered in your brief lecture on lactic acid. We must instruct our bodies to rid themselves of lactate more effectively if we want to run faster.

By progressively raising the level of lactate in your system and letting your body to gradually adapt to elevated lactic acid levels, simple pace runs and threshold intervals aid in the development of this ability in your body. However, if we can run quickly to flood the body with lactic acid before slowing down to "catch up" at a half-marathon or marathon pace, the body will react by being more effective in excreting lactate during the fast run.

We are attempting to train the body to remove lactate more effectively when running at race pace, to put it simply. This enables you to run faster or farther with less exhaustion during the marathon and half marathon by more effectively using lactate as fuel.

The right pace is crucial in long races. Your pace, or how long it takes you to complete one mile or one km, can influence how quickly you finish the event. For instance, you might want to take it easy for the first few miles of your run. You can save your energy in this way and run hard for the final few kilometers. Elite runners may start an event at a slower pace and increase up speed as the race nears its conclusion. Try this fitness test and see how many miles your average pace is: On a flat area close to your home, mark out a mile, or run the distance on a nearby track. 5 to 10 minutes of heating. You should time your mile run. Plan to go at a rate that challenges you but doesn't force you to sprint. This mile might serve as a speed goal for your training. Return to a mile lap and repeat the timed mile as your speed and endurance increase.

Pace training aims to enhance both aerobic and anaerobic pathways' capacity to produce energy. The intensity corresponds to the lactate threshold and is just a little bit faster than race pace. The length often lasts 20 to 30 minutes while moving steadily. Another method of pace training is intermittent or interval exercise. The session consists of a series of shorter sets with brief recovery intervals, but the intensity is the same as steady pace training. Both methods of pace training require maintaining the effort at or just above the competitive pace. Progress should be made through increasing endurance as opposed to faster running, biking, swimming, etc. **(Chawak, 2018).**

Make sure you've completed a few pace runs and are prepared to manage the difference in stimulus before using an advanced training strategy like alternating pacing. I advise

alternating between a pace that is 10 seconds quicker than your marathon pace and a pace that is 5 to 10 seconds slower than your 10k pace when training for a full or half marathon.

While it is clear from the literature that pace running, interval running, and continuous running have all been the subject of extensive research as resistance training techniques, no attempt has been made to investigate the effects of competition and test method on physiological parameters and running. Shows numerous systematic research studies have been conducted as a result of the ongoing efforts of physical education and sports scientists to pinpoint the elements that contribute to improved performance.

Studies on the types and distribution of long-distance running training are generally scarce in Ethiopia. Additionally, there is minimal research-based training throughout the nation, and there are differences in the training system, training load distribution, and training method used by coaches. Therefore, depending on this kind of training and execution, more data should be requested. The long-distance running community will therefore greatly benefit from this study, especially in the Ethiopian athletic training system.

1.2 Statement of the Problem

The main purpose of the study was to determine the effect of continuous and alternate pace endurance training on selected physical and physiological variables of long-distance runners.

1.3 Objectives of the Study

The proposed study's following objectives are:

1. To compare the effects of continuous and alternate-pace endurance training on selected physical fitness variables.
2. To compare the effects of continuous and alternative pace endurance training on selected physiological variables.
3. To determine whether experimental training methods were be more successful in enhancing the selected physical and physiological characteristics of long-distance runners.

1.4 Delimitations

The study was taking the following delimitations into account:

1. Total 90 long distance runner were selected randomly from Surat distract.
2. The age of the subjects varied from 17 to 22 years.
3. The study was constrained to the designated physical variables (speed endurance, cardio respiratory endurance, endurance, abdominal strength endurance and leg strength), and physiological variables (Heart rate, vital capacity and blood pressure).
4. In this study, only two different training namely show continues training, alternate pace endurance training and control were used.

1.5 Limitations

- The student's socioeconomic background, dietary preferences, way of life, and differences in how they interact with their peers, all of which are uncontrollable by the researcher and may have had an impact on performance, were regarded as one of the limitations.
- Another limitation of this study is that no specific motivational techniques was used for collecting pre- and post-test data that could influence performance.

1.6 Hypotheses

1. There would be significant improvement on selected physical fitness variables due to the effect of slow continuous and alternate pace endurance training of long-distance runner.
2. There would be significant improvement on selected physiological variable due to the effect of slow continuous and alternate pace endurance training of long-distance runner.
3. There would be significant differences on selected physical and physiological variable among the slow continuous and alternate pace endurance training programmes and control groups.

1.7 Definition and Explanation of the Terms

Training

Changes in complicated sports motor performance, ability to act, and behaviour are made by measures of content, methods, and organisation throughout training, which is a planned and regulated procedure for reaching a goal. **(Singh, 1991).**

Slow Continuous Training

In the slow continuous approach, the athlete works out slowly without stopping for a very long time, keeping a heart rate between 140 and 160 beats per minute. Exercise shouldn't last less than 30 minutes and can go on for two hours or longer.

Pace Training

Pace training is running at certain predetermined pace until the subject reached his goal or fell below the pace.

Speed Endurance

Speed endurance is the ability to extend the duration of time while maintaining a close maximal speed.

Cardio Respiratory Endurance

Cardiovascular endurance refers to both the body's capacity to transport oxygen-rich blood to functioning muscles and tissues and its capacity for those tissues to make use of that oxygen.

Endurance

The ability to repeat a series of muscle contractions without fatiguing.

Abdominal Strength Endurance

Ability of a muscles group to contract over an extended time against moderate resistance

Leg Strength

The capacity of the lower limb to exert muscular force. Leg strength measures the limit of lifting resistance in lowering and arising from sitting position **(Johnson, 1982)**.

Heart Rate

"Measurement of heart rate when an organism is under physical and mental rest can be termed as resting pulse rate." **(Johnson and Nelson, 1982)**

Vital Capacity

Vital capacity is defined as maximal volume of air that can be forcefully exhaled from the lungs following maximal inspiration **(Shaver, 1981).**

Blood Pressure

The pressure measured in the vascular system that is associated with cardiac contraction (systolic) and relaxation (diastolic) **(Lawrence. E, et al., 1976)**

1.8 Significances of the Study

- The study might offer recommendations for middle- and long-distance runners looking to increase their performance.
- The study will help athletes, coaches, and physical education teachers improve athletes' performance in a methodical way.
- Nearly all track and field events might benefit greatly from the study's findings for athletes.
- The findings of this study may contribute to the body of knowledge in the fields of exercise, physiology, and exercise science as well as training techniques and fitness and wellbeing.
- The findings may be of considerable importance to people conducting research in the fields of coaching and physical education since they may influence future researchers' choice of relevant research questions.