Effect of Continuous and Alternate Pace Endurance Training on Selected Physical and Physiological Variables of Long-Distance Runners

लंबी दूरी के धावको के चयनित भौतिक और शारीरिक चरो पर निरंतर और वैकल्पिक गति सहनशीलता प्रशिक्षण का प्रभाव।

A

Thesis

Submitted for the Award of the Ph.D. degree

of

PACIFIC ACADEMY OF HIGHER EDUCATION AND RESEARCH UNIVERSITY

By

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2023

DECLARATION

I, **Warli Sunitaben Jivanbhai**, S/o Shri Jivanbhai D. Warli, resident of 11, Swamiatmanand Society, Ramnagar, Rander Road, Surat – 395005 Gujarat, hereby declare that the research work incorporated in the present thesis entitled, **"Effect of Continuous and Alternate Pace Endurance Training on Selected Physical and Physiological Variables of Long-Distance Runners",** (लंबी दूरी के धावको के चयनित भौतिक और शारीरिक चरो पर निरंतर और वैकल्पिक गति सहनशीलता प्रशिक्षण का प्रभाव।) is my original work. This work (in part or in full) has not been submitted to any University for the award or a Degree or a Diploma. I have properly acknowledged the material collected from secondary sources wherever required.

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WARLI SUNITA

DEDICATED TO

DEDICATED

My Beloved Parents

And

Family

Whom I Love the Most

Who were behind the screen for my present study.

Abstract

The purpose of the current investigation, in brief, was to determine an effect of continuous and alternate pace endurance training on selected physical and physiological variables of long-distance runners. To achieve this purpose, ninety (n=90) male long-distance runners from the Surat district who have competed at least once in distance running competitions longer than 3000 meters were selected at random and they were in 17 to 22 years of age. The selected subjects were divided randomly into three equal groups of thirty (n=30), including experimental and control groups. Group - I (n = 30) participated in slow continuous training, Group - II (n = 30) participated in alternate pace endurance training, and Group - III (n = 30) served as the control group. Physical and Physiological variables name as; speed endurance, cardio respiratory endurance, endurance, abdominal strength endurance, leg strength, heart rate, vital capacity and blood pressure. The two experimental groups were participating in the training given 3 days a week for 8 weeks. The regular curriculum was offered to the control group. All groups were retested on all selected variables after the conclusion of the eight-week training programme, and the results were kept as a post-test score. The collected data were analysed using analysis of covariance (ANCOVA) and the post hoc pair wise comparison using the LSD test analysis. For testing the hypothesis, the level of confidence was set at 0.05 levels. The result of the study showed that there was as significantly improvement was found in physical and physiological variables among the experimental group when compared with control group. The result also so that the alternating pace endurance training had a significantly stronger impact on the group concerned than the slow continuous training in enhancing the performance of speed endurance, endurance, cardio respiratory endurance, abdominal strength endurance, leg strength and vital capacity and slow continuous training group's considerable improvement in systolic and diastolic blood pressure than the alternating pace endurance training.

Key Words: Continuous training, alternate pace endurance training, physical, and physiological

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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.

CHAPTER-II

REVIEW OF RELATED LITERATURE

2.1 Review of Related Literature

In order to acquire a complete picture of what has been done and proposed with reference to the subject under study, a review of pertinent and related literature is a necessary first step. Such a review results in greater understanding and a clearer perspective of the entire field. A brief summary of the research articles that have been published in connection with the current study has been provided by the researcher.

Kumar (2022) study is to determine the effects of various repetition endurance training packages on the physiological, psychological, and physical fitness of middle distance runners from polytechnic institutions. 60 male middle distance runners between the ages of 16 and 18 were chosen as subjects for the purpose from different polytechnic institutes in the Kanchipuram District of Tamil Nadu. Three experimental groups and one control group were divided equally into four groups. Before the training began, pre-tests were administered to all subjects on a set of dependent variables. Experimental group I received package I of repetition-based endurance training, experimental group II received package II of repetition-based endurance training, experimental group III received package III of combined repetition-based endurance training, and control group received no additional training beyond their regular routine. The experimental groups could only train for a total of 12 weeks. After a 12-week training session, post-tests were administered. The gathered data were analysed using ANCOVA and Scheffe's post hoc test. According to the study, compared to all other groups, the combined repetition endurance training package significantly improved on the selected dependent variables, including speed endurance, aerobic endurance, resting pulse rate, respiratory rate, vital capacity, anxiety, stress, and aggression.

Assefa (2020) in this study, 30 long distance runners from the Dembecha Beruh Tesfa U-17 athletics project were examined to see how continuous and non-continuous training methods affected their levels of aerobic endurance. The remaining 15 participants were divided into two groups: continuous training (15) and non-continuous training (15). The mean chronological age and training age for the continuous training group were determined to be 15.73 and 3.2, respectively, whereas 15.733 and 3.33 for the non-continuous training group. In order to gauge the athletes' level of aerobic endurance, this study also included performance evaluation tests, such as the 3-minute step test, 12-minute run test, and 2.4-kilometer run test. To determine whether there was a significant difference between pre- and post-test results after 8 weeks of continuous training and non-constant training, a paired sample t-test was used to assess the effects of both training modalities. An independent sample t-test with an alpha value of p .05 was used to compare the results of the two groups on athletes' aerobic fitness as well. The results of this study showed that non-contiguous training groups produce greater improvements in aerobic fitness tests than continuous training methods (i.e., in the 3 minute step test, the non-continuous training group's mean score was 84.21.567 and 86.41.549, respectively, at p=0.000; in the 2.4 km run test, the non-continuous group's mean was 0:07:05.340:00:02.66 and 0:07:09.720:00:03. The study therefore came to the conclusion that an 8-week non-continuous training programme was more effective than a continuous programme at increasing an athlete's aerobic fitness.

Krishnan et al. (2020) study's objective was to determine how continuous training and interval training affected university and college-aged male students' resting pulse rates, vital capacities, and VO2 max. To fulfil the study's objectives, 45 male students from Delhi University College in Delhi, India, were chosen at random to serve as subjects. The person is between the ages of 18 and 25. Three groups—Experimental group I, Experimental group II, and Control group III—were formed from the subject. Group III served as the control group; they only engaged in their regular activities. Experimental groups I and II had continuous training, while experimental group III underwent interval training. Using a conventional test, the following physiological factors were evaluated. Digital Heart Rate Measuring Machine, Model No. EW, measures resting pulse rate. Astrand-Rhyming Nomogram Test unit of measurement ml/kg/min, Vital Capacity assessed in millilitres by the spirometer, and VO2Max measured in beats per minute (bpm). Data from three groups' pre- and post-experimental periods were gathered. Using Analysis of Covariance (ANCOVA), the raw data for Resting Pulse Rate, Vital Capacity, and VO2 Max was statistically analysed. To ascertain the differences between the paired adjusted means that were statistically significant, Scheffe's post hoc test was used. The 0.05 level of significance was set in each case. The study's findings indicated that the resting pulse had greatly improved. The study's findings indicated that, when comparing the experimental group to the control group, there was a substantial improvement in resting pulse rate, vital capacity, and VO2 max.

Kumar and Kumar (2020) study aims to determine how specific physiological factors in long-distance runners are affected by uphill training. Male long-distance runners from the Hyderabad district are used as the research's data sources in this study. It was decided to focus on 30 male long-distance runners who had competed in collegiate competitions for this study's subject matter. The subject matter's age ranged from 18 to 25 years old. Below are the criteria measurements used in the study to measure the physical and physiological characteristics. The effect of uphill training on specific physical variables and physiological variables among long-distance runners was examined using the independent "t"-test with a 0.05 level of significance to measure the physical variables, 600 m run for speed endurance, 12 min run and walk for cardio respiratory endurance, pulse count for resting pulse rate, and Harvard step test for VO2 max. The experimental groups differed significantly in terms of VO2 max, resting heart rate, cardiopulmonary endurance, and speed endurance.

Paavolainen et al. (2020) 10 experimental (E) and 8 control (C) endurance athletes trained for 9 weeks to examine the impact of concurrent explosive-strength and endurance training on physical performance attributes. Both groups received the same amount of training overall, but 32% of the training in group E and 3% of the training in group C were substituted by explosive-style strength training. On a track, measurements were taken during a 5-km time trial (5K), running economy (RE), maximal 20-m speed (Vo2 max), and 5-jump (5J) tests. Maximal oxygen uptake (VO2 max) and maximal velocity in the maximal anaerobic (VMART) and aerobic treadmill running tests were calculated. Compared to C, E showed improvements in the 5K time, RE, and VMART (P 0.05). V20m and 5J were found to be higher in E (P 0.01) and lower in C (P 0.05). V O2max rose in C (P 0.05), but E showed no changes. The increases in RE (O2 uptake (r = 0.54) and VMART (r = 0.55) during the nine weeks of training were correlated (P 0.05) with the changes in 5K velocity in the pooled data. The present concurrent explosive-strength and endurance training, in well-trained endurance athletes, enhanced the 5K time without affecting their

VO2 max. This improvement was brought about by better neuromuscular traits, which also led to better VMART and running economy.

Vigneshwaran and Sundar (2020) study is to determine how long distance athletes' fitness levels are affected by interval training and strength endurance training. The athletes competing in intercollegiate athletic competitions were the subjects chosen. The courses were chosen at the Alagappa Government Arts College and the Alagappa University College of Physical Education in Karaikudi. The students are chosen at random, and they range in age from 18 to 23. The chosen subjects (N=30) were proportionately and randomly split into three groups. College distance runners were put into two equal groups at random. Each group had ten participants. Group II experienced strength and endurance training, Group III served as the control group, and Experimental Group I underwent interval training. For an eight-week period, the experimental groups received their respective instruction for one and a half hours per day, three days each week. Speed, Cardio respiratory Endurance and Muscular Strength are all measured in seconds, metres, and counts, respectively. To ascertain the variance in group means, the dependent 't' test was used. to determine whether the experimental and control groups differed in any way that was significant. A predetermined level of confidence of 0.05 was used to examine the level of significance of the difference between the means. The study's findings indicate that long-distance athletes' speed, cardio respiratory endurance, and muscular strength have all significantly improved. Conclusion: Long distance athletes benefit from consistent practise of Interval and Strength Endurance training since it improves speed, cardio respiratory endurance, and muscular strength.

Arunprasanna et al. (2019) study is to determine the effects of continuous running, running at a different pace, and combined training on the selected motor fitness variable (muscular endurance), physiological variable (breath holding time), and hematological variable (red blood cells) in male athletes from colleges that are affiliated with Alagappa University. A total of 40 athletes between the ages of 17 and 25 were chosen at random for the study, and they were separated into four equally sized groups: experimental groups A, B, C, and D, which each contained 10 athletes. The groups underwent the training exercises for a total of twelve weeks on a three-a-week schedule, while the control group did nothing.

Analysis of Covariance was used to analyse the data collected before and after the training programme, with a fixed level of significance set at 0.05. In order to assess the differences that occur significantly between the paired means, Scheffe's test was conducted at the significance of the F ratio. The results of the study showed that the combined group with the two endurance trainings outperformed the other groups in the selected variables.

Mena (2019) Effect of resistance training on high-level 800 m athletes' physical performance. A comparison between circuit training with high-speed resistance training. This study investigated how two resistance training regimens affected high-level 800 m athletes' physical performance and hormonal reaction over the course of 25 weeks. The high-speed resistance training group (RTG) (n = 6) and the circuit training group (CTG) (n = 7) were each made up of 30 male athletes. Sprint and 800 m running, strength training, and blood hormone testing were all part of three tests (T1, T2, and T3).The 800 m performance of both groups improved. Hoverer, RTG, improved further in 200 metres. Squats and countermovement jumps (CMJ), whereas CTG reached unclear/possibly negative effects in the other strength metrics examined. In terms of hormones, RTG caused a likely increase in testosterone (from T1 to T3), while CTG shown a likely increase in cortex (from T2 to T3), leaving the remaining hormones analysed undetermined. These findings show that high-speed, low-volume resistance training, as opposed to circuit training, improved strength and running performance more effectively and with less change in hormone response.

Panneerselvam (2019) study looked at the effects of step aerobic exercise and uphill training alone and in combination on a number of long distance runners' physical, physiological, and hematological characteristics. Sixty long distance runners from the Pudukkottai area of Tamil Nadu state, India, were chosen for this study's goal. The subject was between the ages of 18 and 25. The chosen participants were separated into four equal groups, each with fifteen participants, including a control group made up of long-distance runners and three experimental groups. For a period of twelve weeks, the experimental groups I and II conducted step aerobics training, uphill training, and step aerobics training with uphill training, respectively. The control group wasn't participating in any of training. Before the exercise period, a pre-test was conducted, and immediately following the twelve-week training session, a post-test was conducted. The training session lasted 90 minutes and involved three training groups. The four groups' collected data were statistically examined for significance using the analysis of covariance (ANCOVA), and the F ratio was calculated. To ascertain the paired mean when there are discrepancies, the Scheffe's test is used as a post-hoc test. For all situations, the level of significance was set at the.05 level of confidence. Long distance runners who underwent the chosen three training interventions significantly differed from the control group in terms of selected physical, physiological, and homological measures.

Prasanna and Vaithianathan (2019) study is to ascertain the impact of fartlek, continuous run, and alternative pace run training on the physiological variable (resting pulse rate) in male athletes from colleges that are associated with Alagappa University. 50 athletes between the ages of 17 and 25 were chosen at random for the study, and they were divided into five equally sized groups: experimental groups A, B, C, and D, each with 10 athletes, and control group E. The groups underwent the training exercises for a total of twelve weeks on a three-a-week schedule, while the control group did nothing. Analysis of Covariance was used to analyse the data collected before and after the training programme, with a fixed level of significance set at 0.05. In order to assess the differences that occur significantly between the paired means, Scheffe's test was conducted at the significance of the F ratio. The results of the study showed that the combined group with the three endurance trainings outperformed the other groups in the physiological variable that was chosen.

Engel et al. (2018) to evaluate original studies on HIIT's potential to improve anaerobic and endurance performance in juvenile and teenage athletes. The following were the inclusion requirements: (i) controlled trials comparing HIIT to an alternate training programme with a pre-post design; (ii) healthy young athletes (under the age of 18); and (iii) measuring variables relating to exercise performance and endurance. For the purpose of comparing any outcome between the experimental (HIIT) and alternative training protocols, Hedges' g effect size (ES) and related 95% confidence intervals were computed. This evaluation comprised 24 studies that involved 577 athletes with a mean age of 15.5 2.2 years. Peak oxygen consumption (VO2peak), running performance, the ability to sprint repeatedly, jumping performance, and sub maximal heart rate were not affected by HIIT or only slightly. Although the average increase in VO2peak from pre to post HIIT-interventions was 7.2 6.9% compared to 4.3 6.9% with any other alternative intervention, the mean ES for changes in VO2peak with HIIT is minimal (mean g = 0.100.28). Running speed and oxygen consumption at different lactate- or ventilator-based thresholds, as well as sprint running performance, were significantly and favorably influenced by HIIT. Calculations revealed negative mean ES for peak blood lactate concentrations (small) and change-of-direction abilities (big). The average length of each training session for HIIT was less time (28 15 min vs. 38 24 min) than for control therapies. The current research suggests that young athletes who engage in HIIT may enhance several critical elements of aerobic and anaerobic performance. When compared to other training methods, HIIT improved the majority of endurance-related metrics more than those others. HIIT did not, however, clearly outperform the alternative training protocols based on ES. However, because HIIT requires less time per training session, it may assist young athletes since it frees up more time for developing sport-specific skills.

Kumar (2018) study is to determine how hill training and fartlek training affect middle- and long-distance runners' development of aerobic fitness. 45 middle and long-distance runners between the ages of 18 and 20 who have competed in several middle and long-distance competitions over the past three years make up the study's sample. Three equal groups of 15 were formed by randomly dividing the chosen subjects. Experimental Hill Training Group, Experimental Fartlek Training Group, and Control Group make up Group I, Group II, and Group III, respectively. For 12 weeks, in addition to their regular practice on other days, the experimental groups received training on alternate days. The Control Group received customary instruction. The 12 Minute Run Cooper Test was used to collect data for the Pre-Test and Post-Test for all groups. ANCOVA was used to statistically analyse the data that had been gathered. According to the study's findings, the experimental groups' aerobic fitness significantly increased as a result of hill training and fartlek training. Conclusion: Hill running and fartlek running are good for intermediate and long-distance runners because they make their lower body muscles stronger and increase their resistance to exhaustion, among other things. It promotes the growth of aerobic fitness.

Beattie et al. (2017) study was to examine the impact of a 40-week strength training intervention on competitive distance runners' strength (maximal and reactive strength), V-O2 max, economy, and body composition (body mass, fat mass, and lean mass). Twenty competitive distance runners were split into a control group (n = 9) and an intervention group (n = 11; 29.5 10.0 years; 72.8 6.6 kg; 1.83 0.08 m). Each participant underwent three examinations at weeks 0, 20, and 40. At weeks 20 (p 0.05) and 40 (p 0.05), the intervention group demonstrated significantly improved maximal and reactive strength characteristics, RE, and VO2max. At either time point, the control group didn't exhibit any discernible changes. Body composition characteristics did not differ significantly across or among groups. This study shows that 40 weeks of strength training can considerably enhance RE, VVO2max, and maximal and reactive strength qualities in competitive distance runners without causing concurrent hypertrophy.

G. Molina et al. (2017) study compared the impact of concurrent plyometric and running training for 8 weeks on rookie runners' spatiotemporal characteristics and physiological variables. 25 male participants were divided into two training groups at random: a running group (RG) with 11 participants and a running + plyometric group (RPG) with 14 individuals. Only the RPG conducted a concurrent plyometric training programme (two sessions per week), whereas both groups engaged in an 8-week running training regimen. Before and after the intervention, anthropometric, physiological (VO2max, heart rate, and RE) and spatiotemporal characteristics (contact and flight times, step rate, and length) were registered. When compared to RG, the RPG decreased step rate and lengthened flight times while maintaining the same running speeds (P .05), but contact times did not change. RPG for the squat jump and the five-bound test showed significant increases between pre- and post-training (P .05), whereas RG remained unaltered. Although peak speed and VO2max increased more in the RPG than in the RG, peak speed, ventilator threshold (VT) speed, and respiratory compensation threshold (RCT) speed increased (P .05) for both groups. In summary, concurrent plyometric and running training results in a decrease in step rate as well as gains in peak speed, VT speed, RCT speed, and VO2max. Plyometric exercise could be beneficial for athletes to increase their strength, which would help them run faster.

Periadurai (2017) study was to determine the impact of rigorous interval and fartlek training on a number of the physical and physiological characteristics of football school boys. In order to fulfil the study's objectives, 45 football players from the Tirunelveli district of Tamil Nadu, India, who competed at the district level, or n=45, were chosen. The chosen participants were divided into three equal groups of fifteen (n=15), including experimental and control groups. Analysis of covariance (ANCOVA) was performed to determine the significant difference between the experimental and control groups. The 't' test was employed to determine the significant improvement between pre and post-test means of both groups. The Scheffe's test was used as a post-hoc test to determine the paired mean difference whenever the adjusted test's 'F' ratio was determined to be significant. The 0.05 level of significance was set in each case to test the hypothesis. For district level school football players, the intensive interval training group had a much stronger impact on speed, speed endurance, and muscle endurance than fartlek training.

Sharma et al. (2017) identify the impact of training at 2100 m natural altitude on running speed (RS) during workouts of various intensities relevant to middle-distance running performance. Methods: In an observational study, 19 elite middle-distance runners (mean SD age 25 5 y, VO2max, 71 5 mL • kg-1 • min-1) completed either a 4- to 5-wk natural altitude-training camp living at 2100 m and training at 1400-2700 m (ALT, n = 12) or 4-6 weeks of sea-level training (CON, n = 7). A GPS watch was used to record each training session, and athletes also submitted a session rate of perceived exertion (sRPE) score. Groups of training sessions were created based on their length and rigour. Within ALT, RS (km/h) and sRPE were compared from paired training sessions finished at sea level and 2100 m, with sessions finished at sea level in CON indicating normal variance. Results: RS decreased in ALT when compared to sea level, with the highest decreases occurring during threshold and VO2max intensity sessions (5.8% and 3.6%, respectively). At a substantially higher sRPE (P =.04 and.05, respectively), the velocity of low-intensity and race-pace sessions done at a lower altitude (1400 m) and/or with additional rest was maintained in ALT. At any intensity in CON, there was no variation in either velocity or sRPE. Conclusion: At 2100 m natural altitude, RS in top middle-distance athletes is severely affected, with the degree of impairment varying with training load. A greater sense of exertion may be felt if RS is maintained at particular intensities when training at altitude.

Silva et al. (2017) examined how a 4-week high-intensity interval training programme affected the pacing tactics used by runners during a 5-km running trial. A total of 16 male recreational long-distance runners were randomly allocated to either the high-intensity interval training (HIIT) or control groups (CON, n=8). While the CON group continued their regular training regimen, the HIIT group engaged in twice-weekly high-intensity interval training. The runners underwent an incremental exercise test to exhaustion before and after the training period in order to gauge the start of blood lactate accumulation, their maximum oxygen uptake (VO2max), and their peak treadmill speed (PTS). A 5-km running trial on an outdoor track to determine pacing strategy and performance as well as a sub-maximal constant-speed test to assess running economy (RE) were also completed. Rating of perceived exertion (RPE) and time to complete the 5-km trial (T5) were recorded during the 5-km running trial. The HIIT group showed significant improvements of 7 and 5% for RE (P=0.012) and PTS (P=0.019) during the training period. VO2 max (P=0.495) and the start of blood lactate buildup (P=0.101) did not significantly differ across the groups. The parameters assessed during the 5-km trial conducted prior to the training period did not differ between HIIT and CON (P>0.05). These results indicate that 4 weeks of HIIT can enhance some physiological indicators that are traditionally connected to endurance performance (RE and PTS), but it has no effect on perceived effort, pace, or overall performance during a 5-km running trial.

Lum et al. (2016) impact of plyometric and intermittent sprint training on endurance running performance. The plyometric training group (n = 7) or the intermittent sprint training group (n = 14) was assigned to the moderately trained male endurance runners. For the preliminary testing, participants had to complete a 10-kilometer time trial, a countermovement leap test to determine peak power, and a treadmill-based graded exercise test. Twelve sprint or plyometric training sessions, done twice a week, were part of the workout. Post-tests were administered after the intervention was complete. During the intervention period, both groups demonstrated a significant decrease in weekly training mileage from pre-intervention. Peak power and performance in the 10-kilometer time trial both saw considerable gains. Additionally, both groups' relative peak power significantly increased. There was a moderate inverse connection between the 10-km time trial performance and relative peak power. These results demonstrated that, despite a decrease in training mileage, both intermittent sprint and plyometric training enhanced 10-kilometer running performance. Peak power also improved along with the improvement in running performance, and it exhibited an inverse connection with relative peak power.

Mallol et al. (2016) study was to look into how a 4-week HIIT programme affected the performance of runners and cyclists. Four conventional training weeks were completed by twelve skilled triathletes as a control period. Then, at random, they were placed in a run or cycle HIIT programme, completing two HIIT sessions per week. Prior to and following the HIIT programme, participants completed a 20-minute cycling time trial and a maximal aerobic power test on the treadmill. Both the bike and run HIIT groups increased their velocity at 2 mm by 6.7 and 2.1% and decreased their heart rate at 2 mm by 6.4 and 8.4%, respectively. The run HIIT group's peak velocity fell by 1.9%, and the HR at 4 mm group's fell by 1.8%. In the bike group, the velocity peak dropped by about 2% while the HR maximum stayed the same, whereas there was a slight decline in the run group. In a cycle time trial, the cycling HIIT group showed a considerable gain in average speed (8.8%), whereas the run training group's speed was significantly lower (-3.5%). In triathletes with moderate to good training, a 4-week cycling HIIT programme enhanced running performance. However, in our study, a 4-week HIIT running programme did not improve bike performance. This may be because of the run group participants' accumulated weariness.

Etxebarria et al. (2014) Coaching cyclists to train well for triathlons is difficult. We investigated the impact of two cycles of high-intensity interval training (HIT) on the cycling and running specific to triathlons. Fourteen men triathletes with moderate training ([Formula: see text]) O2peak: 58.7 8.1 mL kg (-1) min(-1); mean SD; maximal incremental test peak and maximal aerobic power done on separate occasions; 16 20 s sprints on the bike; a 1-hour triathlon-specific cycle followed immediately by a 5-kilometer run time trial. Following pair-matching, participants were randomly allocated to either a long high-intensity interval training (LONG) (6–8–5–min efforts) or a short high-intensity interval training (SHORT) (9–11–10–20–40–s efforts) HIT cycle training intervention. Participants went through six training sessions spread out over three weeks before repeating the baseline assessment. O2peak increased by about 7% in both groups (SHORT 7.3%, LONG 7.5%, LONG 7.5%, 1.7%) (Formula: see text). The last eight 20-second sprints saw a modest increase in mean power for both the SHORT (10.3%, 4.4%) and LONG (10.7%, 6.8%) groups. During the 1-hour triathlon-specific riding, both groups experienced a slight to moderate decrease in heart rate, blood lactate, and perceived exertion, but only the LONG group experienced a significant decrease in the time required to complete the subsequent 5-km run (64, 59 s). Short and extended high-intensity intervals should be used by moderately trained triathletes to enhance their cycling physiology and performance. Performance over a 5 km run is more likely to be improved by longer 5-min cycling intervals.

Gleason et al. (2014) depending on the available pertinent research, offer training regimens for improving performance on 1.5- and 2-mile runs. Design: A succinct review piece. Methods: Used search terms like "aerobic power," "military physical fitness test," "strength training, resistance training, endurance training, high intensity interval training," "running economy," "3 km run," "5 km run," and "1.5/2 mile run" to gather relevant research papers. Results: The combination of conventional strength training, high intensity interval training, and distance training has been found to increase running performance. Conclusion: To improve running performance on the 1.5 and 2-mile run tests used by the military, a mix of conventional strength training, high intensity interval training, and distance training should be used.

Chtara et al. (2005) to investigate the effects of tailored intermittent endurance training and muscle strengthening on aerobic capacity and performance. Methods: Based on their maximum aerobic speeds (V O2MAX), 48 male sport students (mean (SD) age 21.4 (1.3) years) were sorted into five homogenous groups. Four groups participated in the following training regimens for a total of 12 weeks (two sessions per week): Running endurance training (E) (n = 10) and strength circuit training (S) (n = 9) were mixed in different orders within the same training session, as were E+S (n = 10) and S+E (n = 10) respectively. As a control, Group C (n = 9) was utilised. Four tests were used to assess each subject both before (T0) and after (T1) the training period: (1) a time trial over 4 kilometres. Four tests—a 4 km time trial run, an incremental track test to estimate VO2MAX, a time to exhaustion test (tlim) at 100% VO2MAX, and a maximum cycling laboratory test to determine V O2MAX—were used to evaluate each individual before (T0) and after (T1) the training period. Results: With an interaction effect, training significantly increased performance and aerobic capacity throughout the 4 km time trial (p 0.001). The E+S group showed considerably greater improvements than the E, S+E, and S groups: 8.6%, 5.7%, 4.7%, and 2.5% for the 4 km test (p0.05); 10.4%, 8.3%, 8.2%, and 1.6% for VO2MAX (p0.01); and 13.7%, 10.1%, 11.0%, and 6.4% for VO2MAX (ml/kg0.75/min) (p0.05). Tlim and the second ventilator threshold (VO2MAX) both showed statistically significant outcomes in a similar manner. Conclusions: The 4 km time trial and aerobic capacity improved more after circuit training followed by customised endurance training in the same session (E+S) than they did after doing the training plans individually or in the opposite order.

Brandon (1995) popular race distances are included in middle distance running, and performance depends on a variety of physiological parameters. Successful runners have different physiological traits than sprinters and long-distance athletes. Long-distance running performance has been demonstrated to be constrained by maximal oxygen uptake (VO2max), running economy, and the anaerobic threshold, whereas sprinting performance has been constrained by quick velocity and anaerobic factors. The integration of aerobic and anaerobic factors is necessary for middle distance runners to succeed since it enables them to sustain a high speed throughout a race. Distance, intensity, and the runner's physiological capabilities all affect how much one energy system contributes relative to the other. This distinguishes middle distance runners from long distance runners because middle distance runners can succeed with physiological profiles that encompass a variety of aerobic and anaerobic capabilities.

CHAPTER-III

METHODOLOGY

3.1 Introduction

The methodical process by which the researcher begins with the first identification of the problem and conclusion with it is known as research methodology. The methodology's part is to conduct the research in a reliable and scientific way.

The methodology used in the selection of subjects, selection of variables, selection of tests, orientation to the subjects, competence of the tester, reliability of the instruments, reliability of the data, pilot study, training programme, collection of the data, administration of the tests, experimental design and statistical techniques were discussed in this chapter.

3.2. Selection of Subjects

To accomplish this objective, 90 male long distance runners from the Surat district who have competed at least once in distance running competitions longer than 3000 meters were selected at random and they were in 17 to 22 years of age. The selected subjects were divided randomly into three equal groups of thirty (n=30), including experimental and control groups. Group - I (n = 30) participated in slow continuous training, Group - II (n = 30) participated in alternate pace endurance training, and Group - III served as the control group.

Table – 3.1

Characteristics of Participants by Group

Name of the Groups	Total Numbers of Players	Age (Yr)
Slow Continuous Training Group	30	20.17 ± 1.21
Alternate Pace Endurance Training Groups	30	20.90 ± 1.37
Control Group	30	20.60 ± 1.16

The kind of training and assessment schedule employed in the study was explained to the players. They followed the same lifestyle, dietary habits, exercise regimens, and ambient conditions; therefore there was no need to exert any control over these variables.

3.3. Selection of Variables

The researcher examines the scientific literature from books, journals, periodicals, magazines, and research papers that is relevant to the subject. The following physical and physiological variables were selected while taking the feasibility criteria into account.

3.3.1 Depended Variable

- **Physical Variables**
  - Speed Endurance
  - Cardio Respiratory Endurance
  - Endurance
  - Abdominal Strength Endurance
  - Leg Strength
- **Physiological Variables**
  - Heart Rate
  - Vital Capacity
  - Blood Pressure

3.3.2 Independent Variables

- Slow continuous Training
- Alternate Pace Endurance Training

3.4. Selection of Tests

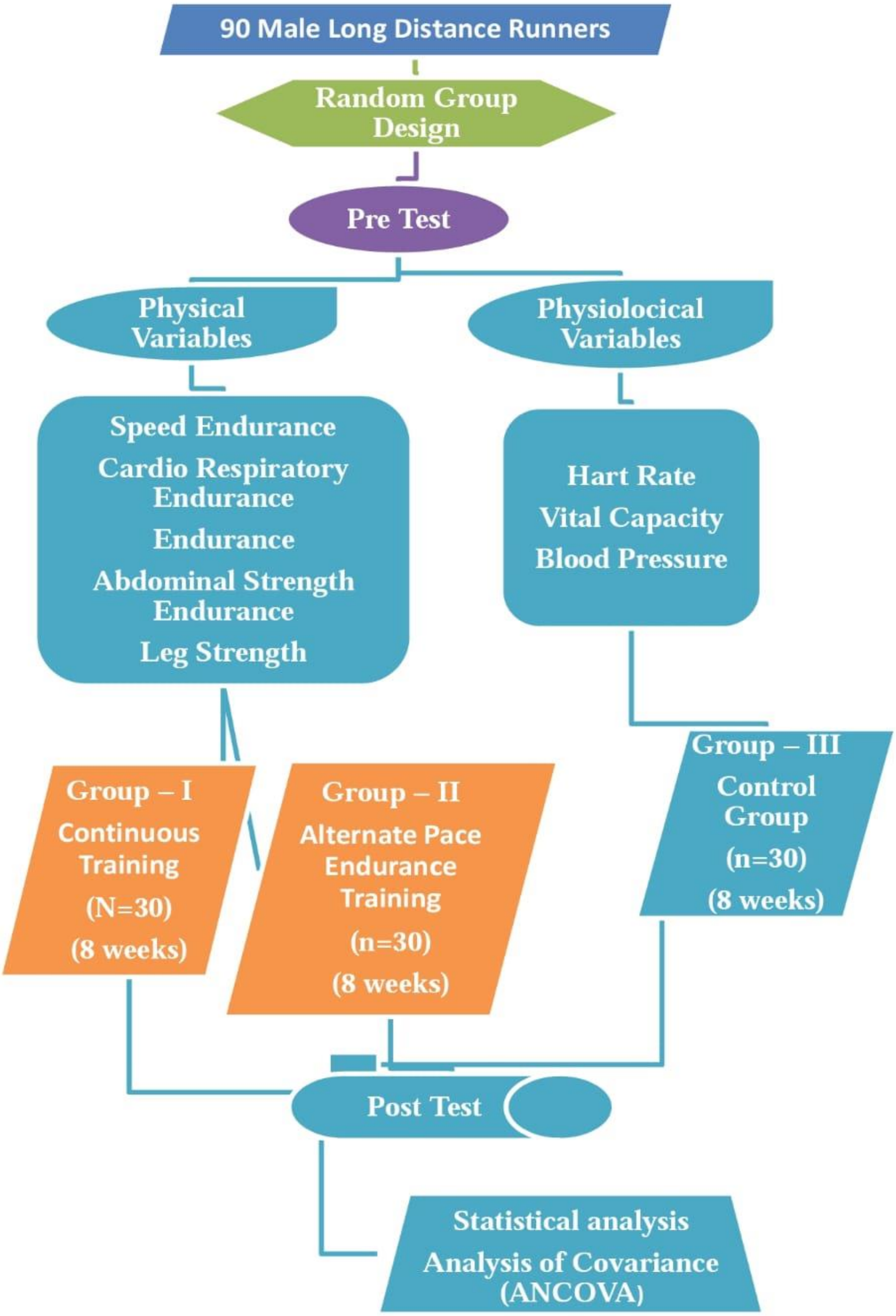
The following standardised tests were used to test the selected variables in accordance with the literature, and the results are shown in Table 3.2.

Table – 3.2

Selection of variables and tests

Sr. No	Criterion Variables	Test Items	Unit of Measurement
Physical Variables			
1	Speed Endurance	300 m Run	In second
2	Cardio Respiratory Endurance	Coopers 12 minutes Run	Distance covered In Meters
3	Endurance	1600 m Run	In Minutes
4	Abdominal Strength Endurance	Bent Knee Sit Ups	Number of correctly Sit-ups in One minute
5	Leg Strength	Leg Dynamometer	Kilogram
Physiological Variables			
5	Heart Rate	Digital Heart Rate Monitor	Number of beats per Minute
6	Vital Capacity	Digital Dry Spirometer	Score was recorded in Liter
7	Blood Pressure (Systolic and Diastolic)	Sphygmomanometer	Millimeters of mercury (mm Hg)

3.5 Research Flow Chart



Selected 90 long distance runners were initially pre-tested by the researcher. The subjects' pre-test performance (raw score) was converted into a composite score and based on this the subjects were randomly divided into three equal groups of thirty (n=30) each including experimental and control groups. Group - I (n = 30) participated in slow continuous training, Group - II (n = 30) participated in alternating pace endurance training, and Group - III (n = 30) served as the control group.

The two experimental groups were participating in the training given 3 days a week for 8 weeks. After taking into account the advice of knowledgeable coaches and sports training experts, the slow continuous training and alternate pace endurance training programmes were created. The regular curriculum was offered to the control group. All groups were retested on all selected variables after the conclusion of the eight-week training programme, and the results were kept as a post-test score. The collected data was then analysed using the appropriate statistical techniques.

3.6 Reliability of Data

By establishing the instrument reliability, tester competency, tester's reliability and the subjects' dependability, the data's reliability was ensured.

3.6.1 Instrument Reliability

Stopwatches, measuring steel tapes, leg dynamometer, digital heart rate monitor, digital dry spirometer and Sphygmomanometer were among the tools purchased for this study's evaluation of the dependent variables from the Navyug Arts College, Surat and Physiotherapy College, Surat. The instrument calibrations had been reviewed and approved as authentic for use in achieving the study's objectives.

3.6.2 Tester Competency

In this study, the investigator conducted physical measurements with the assistance of professionals in the fields of physical education and sports, and a student from the College of Physiotherapy in Surat assisted in the assessment of physiological variables. The investigator and his assistant practiced conducting tests in accordance with protocol multiple times to ensure that they were both comfortable with the procedures.

3.6.3 Reliability of Data

The reliability of the data was established using the test and retest procedure with nine players selected at random from each of the three groups. The same team tested all of the dependent variables selected for the current study twice under identical circumstances. The dependability of the data was determined using the Co-efficient correlation and the findings are shown in table 3.3.

Table 3.3

Correlation Co-Efficient of Test-Retest Score

Sr. No	Variables	Reliability Co-efficient
1	Speed Endurance	0.83*
2	Cardio Respiratory Endurance	0.84*
3	Endurance	0.86*
4	Abdominal Strength Endurance	0.87*
5	Leg Strength	0.84*
6	Heart Rate	0.89*
7	Vital Capacity	0.91*
8	Blood Pressure (Systolic and Diastolic)	0.92*

***Significant ($p < 0.01$) N-09 r – 0.01 (07) = 0.798**

3.6.4 Subjects Reliability

Since the same tester had administered the test-retest for the same subjects under the same circumstances, the coefficient correlation values obtained from test-retest scores also supported the reliability of the subjects.

3.7. Orientation to the Subjects

The researcher gave the subjects an explanation of the study's purpose and their role in it. The investigator provided directions on how to conduct tests on the selected dependent variables and detailed the method to be followed in order to collect the data. The subjects underwent four sessions to become familiar with the methodology needed to carry out the slow continuous and alternate pace endurance training. Additionally, the control group was specifically directed, counseled, and controlled to avoid the special practice of any of the unique training programmes until the end of the experimental period. This helped them to do the given training flawlessly and avoid injuries. During training and assessment, all of the participants were adequately motivated to give their best effort.

3.8 Training Porgramme

The experimental groups were underwent eight weeks of slow continuous training (Group – I) and alternative pace endurance training (Group - II) on three alternative days of the week. Each training programmes had duration of 60 to 90 minutes and a morning routine from 6.30 to 8.00. The control group did routine workouts without any specialised training. Prior to and throughout each session, the individuals were strictly supervised as they completed their various programmes. Ten minutes of stretching and jogging activities served as their warm-up and cool-down. Throughout the entire training programme, the subject's stature was regularly assessed. No injuries were noted, however muscle discomfort from earlier weeks decreased in the final phase.

3.8.1 Slow Continuous Training

The slow continuous groups adhere to a personal training programme during the training session in addition to their regular daily activities as scheduled. The slow continuous training group trained three days per week Monday, Wednesday and Friday for an eight weeks training period from 6.30 am to 8.30 am at the Botawala Hostel Ground in Surat.

The intensity of the training was 50 to 70% of their maximum heart rate up to 120-140. The subjects began training by running for 30 to 45 minutes each day including warm up. Training always began with a few minutes warm up and was followed by outdoor continuous slow running.

Week	Monday	Wednesday	Friday	Load intensity %
1-2	Progressive Run	Strides Run	Hills workout	40% to 60%
3-4	Progressive Run	Track Running	Resistance Workout	40% to 60%
5-6	Progressive Run	Strides Run	Fartlek Workout	50% to 70%
7-8	Progressive Run	Track Running	Hills and Resistance Workout	50% to 70%

- **Progression Run**: Progression running is a type of speed work that involves beginning a run at a comfortable, slow pace and ending the run at a faster pace.
- **Strides Run:** Strides refer to very short run with mordent and long that are usually done before running or workout or else immediately after running.
- **Hills Training:** Hills are simply the best way to build running strength. Up and Speed hills, short hill sprints.
- **Track Running:** Track refers to a session that includes a series of speed intervals.
- **Resistance Training:** it should refer resistance training with send weight, resistance band running of mordent level and parachute run.
- **Fartlek Training:** Fartleks work on speed and strength by alternating distance and paces during run.

3.8.2 Alternate Pace Endurance Training Group

The alternate pace endurance training group adhere to a personal training programme during the training session in addition to their regular daily activities as scheduled. The slow alternate pace endurance training group trained three days per week on Tuesday, Thursday and Saturday for an eight weeks training period from 6.30 am to 8.30 am at the Botawala Hostel Ground in Surat.

The alternate pace endurance training group was trained for 3 days per week up to 8 week. In this training exercise is done continuously but with changing pace or speed. The Intensity of the training will be 65 to 75 % of their maximum Heart rate range between 130-140 beats/minute. The total duration ranges from about 15 minutes to 1 hour. Because of change of speed which is pre-planned.

Weeks	Tuesday	Thursday	Saturday	Intensity
1-2	**Progressive Run:** Progression Runs improve stamina and allow the body to adapt to the load of running.	**Split Intervals Training:** Running two different paces in one interval.	**Hills Training:** running two different paces in one interval	55 % to 65 %
3-4	**Progressive Run:** Build your pace over the course of each run by starting at a slower than Recovery Pace and finishing at a faster than Recovery Pace.	**Tempo:** controlled pace that can be run as long intervals	**Fartlek Training:** Fartleks work on speed and strength by alternating distances and paces during a continuous run.	55 % to 65 %
5-6	**Progressive Run:**	**Split Intervals Training**	**Resistance: Training:**	65 % to 75 %
7-8	**Progressive Run:**	**Space Turn**	**Fartlek Training:**	65 % to 75 %

3.9 Administration of Tests

3.9.1 Physical Variables

1. Speed Endurance

Test: 300 meter run test

Purpose: This test is intended to measure acceleration and speed.

Equipment: Stopwatch, clapper and score card.

Procedure: A single, 300-meter maximum sprint is done as part of the test, and the timing is recorded. Four subjects were tested simultaneously for this test. Every subject had taken a standing position behind the starting line. The commands "on York mark" and "go" were used in the heading. The stopwatches were started at the beginning, and the time was recorded when the competitors crossed the finish line.

Scoring: Time was recorded in the nearest 1/100thof a second.

2. Cardio Respiratory Endurance

Test: Coopers 12 minutes run test.

Purpose: The test's objective was to gauge measure subject's level of aerobic fitness.

Equipment: Ground, stop watch, marking cones and score sheet.

Procedure: The 200-meter track was marked at regular intervals of 10 meters. After being instructed to take a position behind the starting line, the subjects began to run after hearing the words "set, Go." The participants were instructed to travel the most distance possible in 12 minutes by either running. During the test, the subjects were informed that there was one minute left after the eleventh minute. When the whistle blew to signify the conclusion of the twelve minutes, the participants halted long enough for the researcher or her helper to record the distance travelled.

Scoring: The overall distance covered was expressed in meters.

3. Endurance

Test: 1600 m Run

Purpose: The test measures aerobic fitness and leg muscles endurance.

Equipment: Running track, marker cones, stopwatch.

Procedure: The objective of this exam is to finish the 1600 meter run in the quickest amount of time. All competitors are required to form a line behind the starting line at the beginning. The athletes were start running at their own pace on the order "go," at which point the stopwatches were started at the beginning, and the time was recorded when the competitors crossed the finish line.

Scoring: Each athletics overall time for finishing the race, time was noted in minutes and seconds.

4. Abdominal Strength Endurance

Test: Bent Knee Sit Ups

Purpose: To evaluate the abdominal muscles' endurance

Equipments: Yoga mat, stopwatch and scorecard.

Procedure: On a mat, the subjects were instructed to lie on their backs with their legs bent. Her elbows were tucked in and her hands were clasped behind her neck. The partner was instructed to maintain a flat heel on the mat while keeping the ankles down. The partner was instructed to maintain a low stance with the heel still in touch with the mat. The subjects were instructed to sit, exhale, elevate their upper bodies towards their thighs, and then slowly touch their bodies to the ground while inhaling. One minute was spent repeating the activity.

Scoring: The score for abdominal muscle strength was the number of sit-ups done to the nearest whole number.

5. Leg Strength

Purpose: To measure leg strength.

Equipments: Leg strength dynamometer

Procedure: The participant was instructed to stand on the dynamometer's base with their legs spread wide and their knees bent about between 100 and 120 degrees. Straightening your arms while holding the bar in the middle with your palms facing your body and your head straight was advised. The height of the subject was taken into consideration when adjusting the chain and bar attachment. The tester set the dial back to zero before starting the test. The patient was then instructed to pull the bar with all of his or her might in order to straighten their legs without bending their backs. During the exam, jerky movements were not permitted.

Scoring: The best three performances, which were measured in kilograms.

3.9.2 Physiological Variables

1. Heart Rate

Purpose: To measure Resting heart rate

Equipment: Digital Heart Rate Monitor, scorecard

Procedure: In the morning, the subjects' heart rates were recorded while they were seated. The patients were instructed to sit in a chair and rest for 30 minutes prior to taking their heart rates. During a minute of rest, the resting heart rates of all subjects were recorded using digital heart rate monitor. The most straightforward technique is often to measure the carotid or radial pulse (at the finger).

Scoring: Numbers were recorded to represent the amount of beats in one minute.

2. **Vital capacity**

Purpose: To measure lungs capacity

Equipment: Digital Dry Spirometer, score card.

Procedure: The subjects were requested to stand comfortably near to the digital spirometer; take deep breath in as possible. After a deep inhale, they asked to exhale deeply into the digital spirometer. Nose clips were used to prevent leaking of air from nostrils and 'filter mouth pieces' were used to prevent from spread of microorganisms

Scoring: Each test subject was given three chances, and the best was recorded

3. Blood Pressure

Purpose: To measure Blood pressure.

Equipment: Sphygmomanometer

Procedure: Blood pressure was measured by Automatic Digital Blood Meter in units of millimetres of mercury (mmHg). The readings are always given in pairs, with the upper (systolic) value first and followed by the lower (diastolic) value.

Scoring: The systolic and diastolic blood pressure recorded in the digital blood meter was recorded in the score sheet.

3.10 Collection of Data

The necessary data was collected by administering the test for the selected physical and physiological variables, before the eight-week experimental period. All test elements were explained to them before the tests were administered. Pretest data was collected today's prior to the start of the treatment period and posttest data was collected immediately after completion of the experimental treatment period of slow continuous and alternate pace endurance training and control group. The collected data was processed with appropriate statistical techniques.

3.11 Statistical Techniques for Analysis of Data

In order to find out the effect of slow continuous and alternate pace endurance training on selected physical and physiological variables of long-distance runners. The univariate analysis of covariance (ANCOVA) and the post hoc pair wise comparison using the LSD test analysis.

The data were compiled and analysed using the statistical package for the social science (SPSS) for window computer software.

For testing the hypothesis, the level of confidence was set at 0.05 levels.

CHAPTER–IV

ANALYSIS OF THE DATA AND RESULTS OF THE STUDY

4.1 Overview

The aim of the study was to investigate the effect of continuous and alternating pace endurance training on a selected physical and physiological variable. Ninety male long-distance runners were selected at random to participate in the study in order to fulfil this objective. Three groups of thirty subjects each; two experimental groups and a control group were created. The two experimental groups conducted slow continuous and alternate pace endurance training (three days per week) for eight weeks, while the third group served as the control and received no additional training. Before and after the training programme, tests on specific criteria variables were administered to all three groups' subjects.

To find out if there were any differences between the groups before and after the training period on selected physical and physiological variables, the analysis of covariance (ANCOVA) was performed. The LSD test was used as a post-hoc test to ascertain the paired mean differences whenever the adjusted post-test 'F' ratio was determined to be significant. To assess the analysis's 'F' ratio, the level of significance was set at 0.05 level of confidence. On a selected physical and physiological variable, the magnitude of improvements was calculated for each group separately.

Data Analysis

In order to determine the impact of independent factors on the selected criteria variables, the acquired data underwent an analysis of covariance.

Significant Level

The significance level of 0.05 was determined to be appropriate for the current study's assessment of the obtained results on the variables.

Analysis of Data

The following analysis and presentation show how the independent variables affected each selected variable.

4.2.1 Physical Variables

4.2.1.1 Speed Endurance:

The results of the analysis of covariance on speed endurance for the slow continuous and alternate pace endurance training and the control group are presented in Table 4.1.

Table – 4.1

Results of Analysis of Covariance on Speed Endurance among Experimental and Control Groups

Test		Slow Continuous Training	Alternate Pace Endurance Training	Control Group	Sources of Variance	Sum of Square	DF	Mean of Square	Obtain F ratio	Sig. (2-tailed)
Pre-Test	M	42.49	43.09	43.13	B	7.73	2	3.86	1.25	0.29
	SD	1.87	2.02	1.30	W	269.11	87	3.09		
Post Test	M	40.81	40.67	42.28	B	47.63	2	23.81	10.95*	0.00
	SD	1.80	1.32	1.24	W	189.17	87	2.17		
Adjusted Post Test	M	41.10	40.54	42.12	B	38.36	2	19.18	28.91*	0.00
					W	57.06	86	0.66		

***Significant at 0.05 level of significance if p-value is < 0.05**

The 300-meter run test findings from the speed endurance analysis has shown in Table 4.1. The slow continuous training group, alternate pace endurance training group, and control group all had pre-test speed endurance means of 42.49, 43.09, and 43.13, respectively. F ratio was computed as (1.25, $p>0.05$). Thus, the pre-test was not significant with a 0.05 level of confidence. This showed that there were no significant differences between the slow continuous training group, the alternating pace endurance training group and control group.

The slow continuous training group, alternate pace endurance training group, and control group all had post-test means were 40.81, 40.67, and 42.28, respectively. The calculated F ratio was (10.95, $p<0.05$). As a result, the post-test was significant with a confidence level of 0.05. This reveals that there was a significant difference between the subjects' post-test means.

The slow continuous training group, alternate pace endurance training group, and control group all had adjusted post-test means were 41.10, 40.54, and 42.12, respectively. The adjusted post-test F ratio was (28.91, $p<0.05$) with a confidence level of 0.05, therefore, the adjusted post-test mean f-ratio was considered significant. This proved that the experimental training was the reason for the significant difference in the adjusted post-test means for speed endurance.

A post hoc analysis employing the LSD test is performed on the adjusted post-test means, which demonstrate significant differences. In table - 4.2, post hoc results are presented.

Table - 4.2

LSD Post Hoc Test for Difference between Adjusted Post Test Paired Means on Speed Endurance

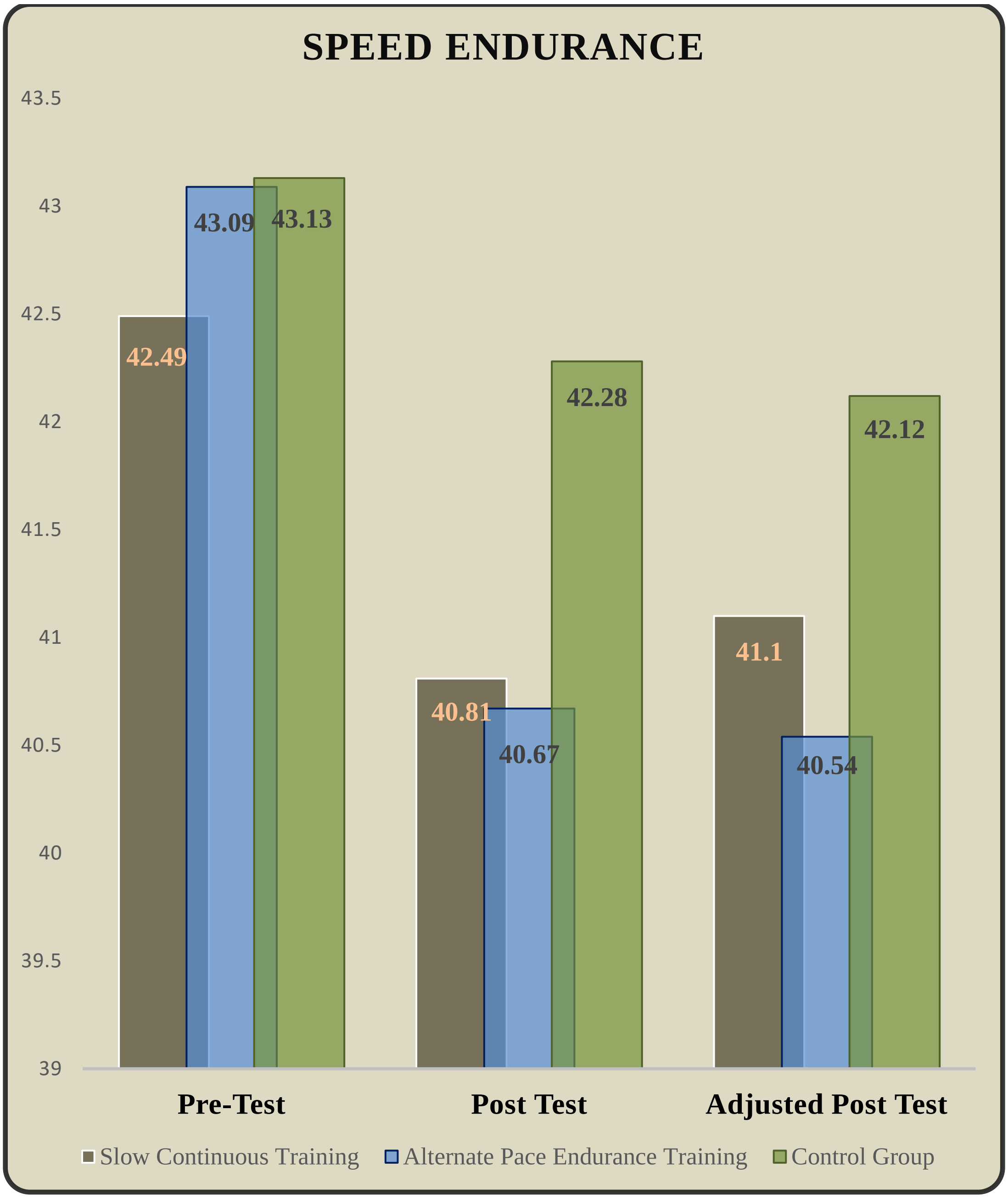
Slow Continuous Training	Alternate Pace Endurance Training	Control Group	Mean Difference	Sig.
41.10	40.54	-	0.56*	0.01
41.10	-	42.12	1.02*	0.00
-	40.54	42.12	1.58*	0.00

***Significant at 0.05 Level of Significance if p<0.05.**

Table 4.2's multiple comparisons demonstrate that there are significant differences between the slow continuous training with alternate pace endurance training groups (0.56, p<0.05), slow continuous training with control group (1.02, p<0.05), alternate pace endurance training with the control group (1.58, p<0.05).

Based on the study's findings, it can be said that both the slow continuous training and alternative pace endurance training groups had a noticeable increase in speed endurance after completing their respective training regimens. The study's findings also revealed a significant difference in the training groups' capacity for speed endurance, with the alternate pace endurance training having better speed endurance than the slow continuous training and control group.

Figure 4.1's bar chart serves as an illustration of the pre, post, and adjusted speed endurance means.



The Mean value of Speed Endurance are shown

Graphically in Fig .4.1

4.2.1.2 Cardio Respiratory Endurance:

The results of the analysis of covariance on cardio respiratory endurance for the slow continuous and alternate pace endurance training and the control group are presented in Table 4.3.

Table – 4.3

Results of Analysis of Covariance on Cardio Respiratory Endurance among Experimental and Control Groups

Test		Slow Continuous Training	Alternate Pace Endurance Training	Control Group	Sources of Variance	Sum of Square	DF	Mean of Square	Obtain F ratio	Sig. (2-tailed)
Pre-Test	**M**	2305.67	2326.33	2308.00	B	7686.67	2	3843.33	0.10	0.90
	SD	170.31	220.84	186.53	W	3264513.33	87	37523.14		
Post Test	**M**	2422.33	2497.00	2327.00	B	435635.56	2	217817.78	7.77*	0.00
	SD	161.94	162.59	177.40	W	2439796.67	87	28043.64		
Adjusted Post Test	**M**	2428.69	2486.23	2331.42	B	366942.73	2	183471.37	79.32*	0.00
					W	198921.76	86	2313.04		

***Significant at 0.05 level of significance if p-value is < 0.05.**

The coopers 12 minutes run test findings from the cardio respiratory endurance analysis has shown in Table 4.3. The slow continuous training group, alternate pace endurance training group, and control group all had pre-test cardio respiratory endurance means of 2305.67, 2326.33, and 2308.00, respectively. F ratio was computed as (0.10, $p>0.05$). Thus, the pre-test was not significant with a 0.05 level of confidence. This showed that there were no significant differences between the slow continuous training group, the alternating pace endurance training group and control group.

The slow continuous training group, alternate pace endurance training group, and control group all had post-test means were 2422.33, 2497.00, and 2327.00, respectively. The calculated F ratio was (7.77, $p<0.05$). As a result, the post-test was significant with a confidence level of 0.05. This reveals that there was a significant difference between the subjects' post-test means.

The slow continuous training group, alternate pace endurance training group, and control group all had adjusted post-test means were 2428.69, 2486.23, and 2331.42, respectively. The adjusted post-test F ratio was (79.32, $p<0.05$) with a confidence level of 0.05, therefore, the adjusted post-test mean f-ratio was considered significant. This proved that the experimental training was the reason for the significant difference in the adjusted post-test means for cardio respiratory endurance.

A post hoc analysis employing the LSD test is performed on the adjusted post-test means, which demonstrate significant differences. In table - 4.4, post hoc results are presented.

Table - 4.4

LSD Post Hoc Test for Difference between Adjusted Post Test Paired Means on Cardio Respiratory Endurance

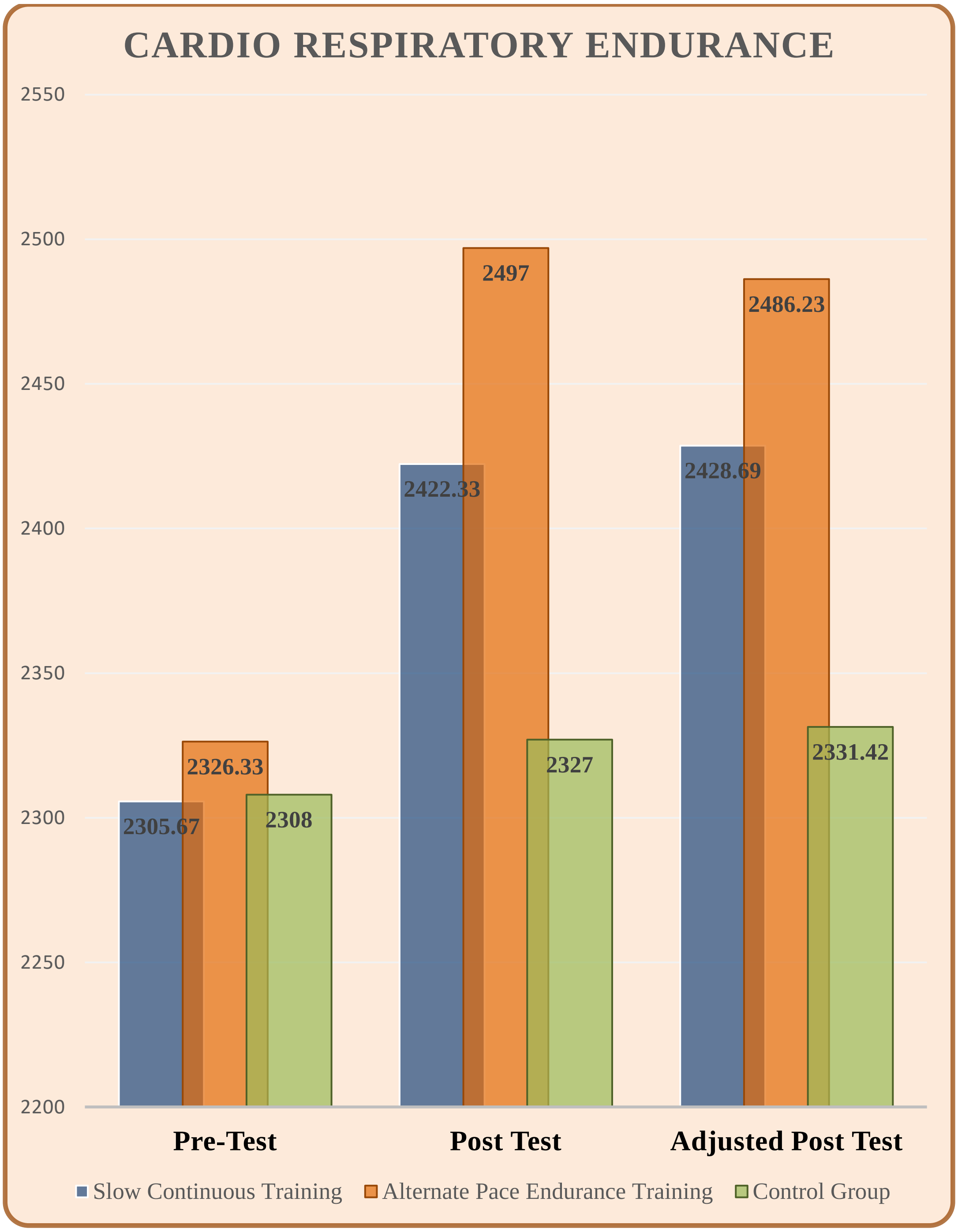
Slow Continuous Training	Alternate Pace Endurance Training	Control Group	Mean Difference	Sig.
2428.69	2486.23	-	57.54*	0.00
2428.69	-	2331.42	97.27*	0.00
-	2486.23	2331.42	154.81*	0.00

***Significant at 0.05 Level of Significance if p<0.05.**

Table 4.4's multiple comparisons demonstrate that there are significant differences between the slow continuous training with alternate pace endurance training groups (57.54, $p<0.05$), slow continuous training with control group (97.27, $p<0.05$), alternate pace endurance training with the control group (154.81, $p<0.05$).

Based on the study's findings, it can be said that both the slow continuous training and alternative pace endurance training groups had a noticeable increase in cardio respiratory endurance after completing their respective training regimens. The study's findings also revealed a significant difference in the training groups' capacity for cardio respiratory endurance, with the alternate pace endurance training having better cardio respiratory endurance than the slow continuous training and control group.

Figure 4.2's bar chart serves as an illustration of the pre, post, and adjusted cardio respiratory endurance means.



The Mean value of Cardio Respiratory Endurance are shown Graphically in Fig .4.2

4.2.1.3 Endurance:

The results of the analysis of covariance on endurance for the slow continuous and alternate pace endurance training and the control group are presented in Table 4.5.

Table – 4.5

Results of Analysis of Covariance on Endurance among Experimental and Control Groups

Test		Slow Continuous Training	Alternate Pace Endurance Training	Control Group	Sources of Variance	Sum of Square	DF	Mean of Square	Obtain F ratio	Sig. (2-tailed)
Pre-Test	**M**	4.75	4.67	4.68	B	0.11	2	0.06	0.73	0.49
	SD	0.35	0.26	0.20	W	6.78	87	0.08		
Post Test	**M**	4.43	4.31	4.57	B	1.02	2	0.51	19.72*	0.00
	SD	0.17	0.10	0.20	W	2.26	87	0.03		
Adjusted Post Test	**M**	4.41	4.33	4.58	B	1.03	2	0.51	65.91*	0.00
					W	0.67	86	0.01		

***Significant at 0.05 level of significance if p-value is < 0.05.**

The 1600 m run test findings from the endurance analysis has shown in table 4.5. The slow continuous training group, alternate pace endurance training group, and control group all had pre-test endurance means of 4.75, 4.67, and 4.68, respectively. F ratio was computed as (0.73, $p>0.05$). Thus, the pre-test was not significant with a 0.05 level of confidence. This showed that there were no significant differences between the slow continuous training group, the alternating pace endurance training group and control group.

The slow continuous training group, alternate pace endurance training group, and control group all had post-test means were 4.43, 4.31, and 4.57, respectively. The calculated F ratio was (19.72, $p<0.05$). As a result, the post-test was significant with a confidence level of 0.05. This reveals that there was a significant difference between the subjects' post-test means.

The slow continuous training group, alternate pace endurance training group, and control group all had adjusted post-test means were 4.41, 4.33, and 4.58, respectively. The adjusted post-test F ratio was (65.91, $p<0.05$) with a confidence level of 0.05, therefore, the adjusted post-test mean f-ratio was considered significant. This proved that the experimental training was the reason for the significant difference in the adjusted post-test means for endurance.

A post hoc analysis employing the LSD test is performed on the adjusted post-test means, which demonstrate significant differences. In table - 4.6, post hoc results are presented.

Table - 4.6

LSD Post Hoc Test for Difference between Adjusted Post Test Paired Means on Endurance

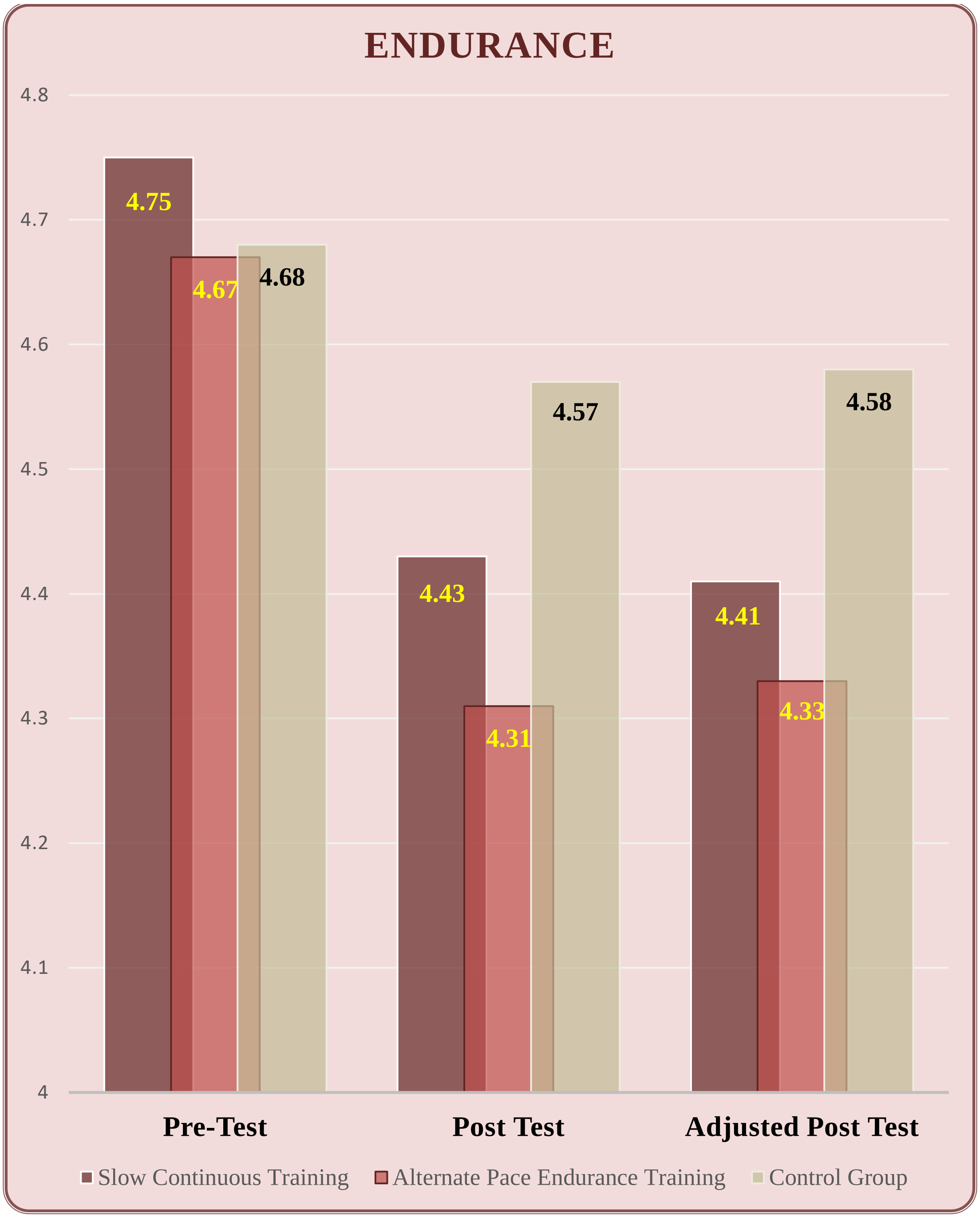
Slow Continuous Training	Alternate Pace Endurance Training	Control Group	Mean Difference	Sig.
4.41	4.33	-	0.08*	0.00
4.41	-	4.58	0.17*	0.00
-	4.33	4.58	0.25*	0.00

***Significant at 0.05 Level of Significance if p<0.05.**

Table 4.6's multiple comparisons demonstrate that there are significant differences between the slow continuous training with alternate pace endurance training groups (0.08, $p<0.05$), slow continuous training with control group (0.17, $p<0.05$), alternate pace endurance training with the control group (0.25, $p<0.05$).

Based on the study's findings, it can be said that both the slow continuous training and alternative pace endurance training groups had a noticeable increase in endurance after completing their respective training regimens. The study's findings also revealed a significant difference in the training groups' capacity for endurance, with the alternate pace endurance training having better endurance than the slow continuous training and control group.

Figure 4.3's bar chart serves as an illustration of the pre, post, and adjusted endurance means.



The Mean value of Endurance are shown

Graphically in Fig .4.3

4.2.1.4 Abdominal Strength Endurance:

The results of the analysis of covariance on abdominal strength endurance for the slow continuous and alternate pace endurance training and the control group are presented in Table 4.7.

Table – 4.7

Results of Analysis of Covariance on Abdominal Strength Endurance among Experimental and Control Groups

Test		Slow Continuous Training	Alternate Pace Endurance Training	Control Group	Sources of Variance	Sum of Square	DF	Mean of Square	Obtain F ratio	Sig. (2-tailed)
Pre-Test	**M**	34.03	34.93	33.37	B	37.09	2	18.54	1.02	0.37
	SD	4.37	5.04	3.19	W	1583.80	87	18.21		
Post Test	**M**	37.80	39.17	33.73	B	479.27	2	239.63	13.91*	0.00
	SD	4.01	5.19	2.93	W	1498.83	87	17.23		
Adjusted Post Test	**M**	37.87	38.40	34.43	B	274.99	2	137.49	88.51*	0.00
					W	133.59	86	1.55		

***Significant at 0.05 level of significance if p-value is < 0.05.**

The bent knee sit ups test findings from the abdominal strength endurance analysis has shown in table 4.7. The slow continuous training group, alternate pace endurance training group, and control group all had pre-test abdominal strength endurance means of 34.03, 34.93, and 33.37, respectively. F ratio was computed as (1.02, p>0.05). Thus, the pre-test was not significant with a 0.05 level of confidence. This showed that there were no significant differences between the slow continuous training group, the alternating pace endurance training group and control group.

The slow continuous training group, alternate pace endurance training group, and control group all had post-test means were 37.80, 39.17, and 33.73, respectively. The calculated F ratio was (13.91, p<0.05). As a result, the post-test was significant with a confidence level of 0.05. This reveals that there was a significant difference between the subjects' post-test means.

The slow continuous training group, alternate pace endurance training group, and control group all had adjusted post-test means were 37.87, 38.40, and 34.43, respectively. The adjusted post-test F ratio was (88.51, p<0.05) with a confidence level of 0.05, therefore, the adjusted post-test mean f-ratio was considered significant. This proved that the experimental training was the reason for the significant difference in the adjusted post-test means for abdominal strength endurance.

A post hoc analysis employing the LSD test is performed on the adjusted post-test means, which demonstrate significant differences. In table - 4.8, post hoc results are presented.

Table - 4.8

LSD Post Hoc Test for Difference between Adjusted Post Test Paired Means on Abdominal Strength Endurance

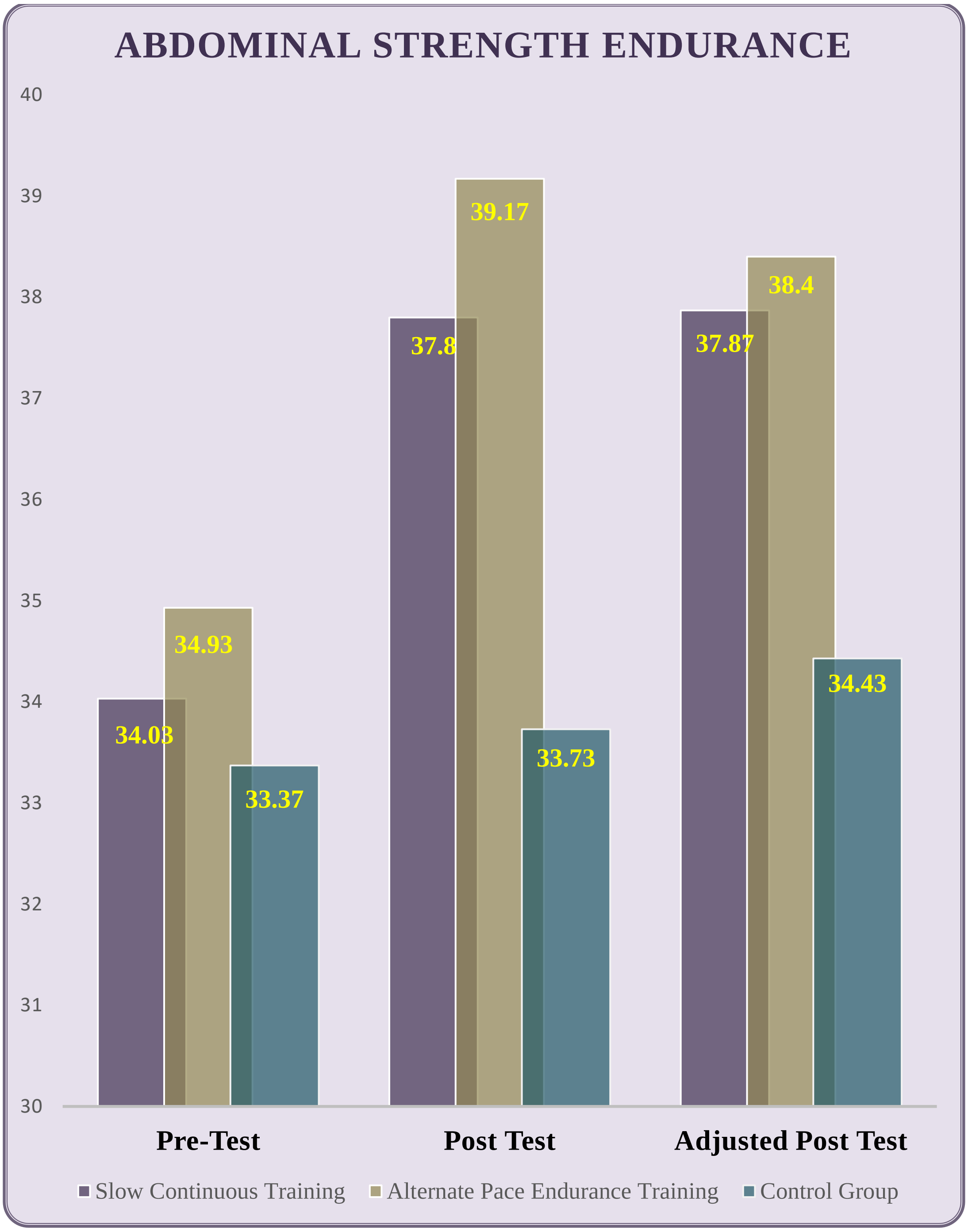
Slow Continuous Training	Alternate Pace Endurance Training	Control Group	Mean Difference	Sig.
37.87	38.40	-	0.53	0.10
37.87	-	34.43	3.44*	0.00
-	38.40	34.43	3.97*	0.00

***Significant at 0.05 Level of Significance if p<0.05.**

Table 4.8's multiple comparisons demonstrate that there are significant differences between the slow continuous training with control group (3.44, $p<0.05$), alternate pace endurance training with the control group (3.97, $p<0.05$). The table also reveals that there no significant difference between slow continuous training and alternate pace endurance training (0.53, $p>0.05$).

Based on the study's findings, it can be said that both the slow continuous training and alternative pace endurance training groups had a noticeable increase in abdominal strength endurance after completing their respective training regimens. The study's findings also revealed a significant difference in the training groups' capacity for abdominal strength endurance, with the alternate pace endurance training having better abdominal strength endurance than the slow continuous training and control group.

Figure 4.4's bar chart serves as an illustration of the pre, post, and adjusted abdominal strength endurance means.



The Mean value of Abdominal Strength Endurance are shown Graphically in Fig .4.4

4.2.1.5 Leg Strength:

The results of the analysis of covariance on leg strength for the slow continuous and alternate pace endurance training and the control group are presented in Table 4.9.

Table – 4.9

Results of Analysis of Covariance on leg strength among Experimental and Control Groups

Test		Slow Continuous Training	Alternate Pace Endurance Training	Control Group	Sources of Variance	Sum of Square	DF	Mean of Square	Obtain F ratio	Sig. (2-tailed)
Pre-Test	M	57.84	58.02	57.49	B	4.31	2	2.15	1.60	0.21
	SD	1.06	1.21	1.20	W	116.87	87	1.34		
Post Test	M	60.23	60.46	58.22	B	91.12	2	45.56	30.40*	0.00
	SD	1.44	0.95	1.23	W	130.40	87	1.50		
Adjusted Post Test	M	60.18	60.25	58.49	B	57.57	2	28.79	78.36*	0.00
					W	31.59	86	0.37		

***Significant at 0.05 level of significance if p-value is < 0.05.**

The leg dynamometer test findings from the leg strength analysis has shown in table 4.9. The slow continuous training group, alternate pace endurance training group, and control group all had pre-test leg strength means of 57.84, 58.02, and 57.49, respectively. F ratio was computed as (1.60, p>0.05). Thus, the pre-test was not significant with a 0.05 level of confidence. This showed that there were no significant differences between the slow continuous training group, the alternating pace endurance training group and control group.

The slow continuous training group, alternate pace endurance training group, and control group all had post-test means were 60.23, 60.46, and 58.22, respectively. The calculated F ratio was (30.40, p<0.05). As a result, the post-test was significant with a confidence level of 0.05. This reveals that there was a significant difference between the subjects' post-test means.

The slow continuous training group, alternate pace endurance training group, and control group all had adjusted post-test means were 60.18, 60.25, and 58.49, respectively. The adjusted post-test F ratio was (78.36, p<0.05) with a confidence level of 0.05, therefore, the adjusted post-test mean f-ratio was considered significant. This proved that the experimental training was the reason for the significant difference in the adjusted post-test means for leg strength.

A post hoc analysis employing the LSD test is performed on the adjusted post-test means, which demonstrate significant differences. In table - 4.10, post hoc results are presented.

Table - 4.10

LSD Post Hoc Test for Difference between Adjusted Post Test Paired Means on Leg Strength

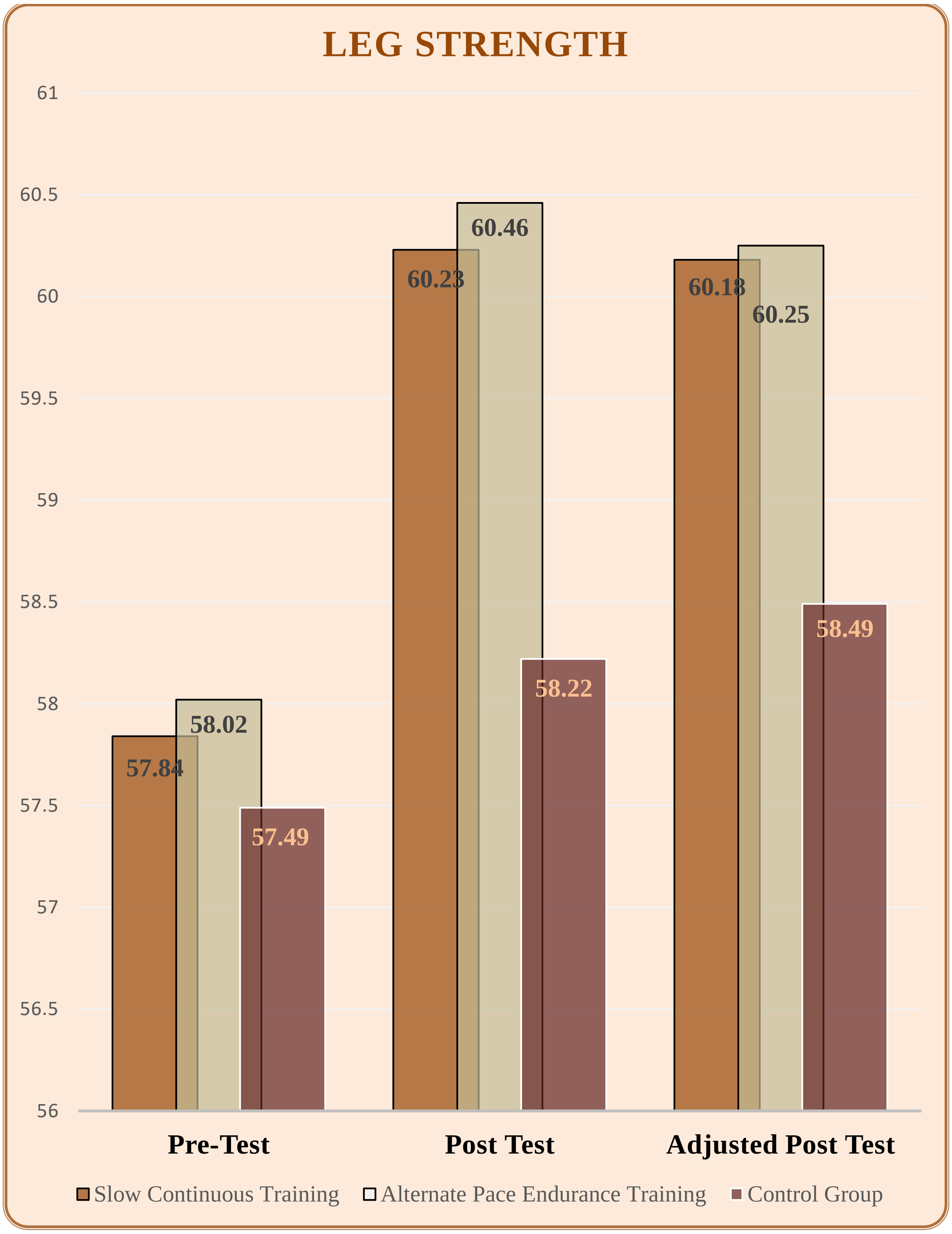
Slow Continuous Training	Alternate Pace Endurance Training	Control Group	Mean Difference	Sig.
60.18	60.25	-	0.07	0.67
60.18	-	58.49	1.69*	0.00
-	60.25	58.49	1.76*	0.00

***Significant at 0.05 Level of Significance if p<0.05.**

Table 4.10's multiple comparisons demonstrate that there are significant differences between the slow continuous training with control group (1.69, $p<0.05$), alternate pace endurance training with the control group (1.76, $p<0.05$). The table also reveals that there no significant difference between slow continuous training and alternate pace endurance training (0.07, $p>0.05$).

Based on the study's findings, it can be said that both the slow continuous training and alternative pace endurance training groups had a noticeable increase in leg strength after completing their respective training regimens. The study's findings also revealed a significant difference in the training groups' capacity for leg strength, with the alternate pace endurance training having better leg strength than the slow continuous training and control group.

Figure 4.5's bar chart serves as an illustration of the pre, post, and adjusted leg strength.



The Mean value of Leg Strength are shown

Graphically in Fig .4.5

4.2.2 Physiological Variables

4.2.2.1 Heart Rate:

The results of the analysis of covariance on heart rate for the slow continuous and alternate pace endurance training and the control group are presented in Table 4.11.

Table – 4.11

Results of Analysis of Covariance on Heart Rate among Experimental and Control Groups

Test		Slow Continuous Training	Alternate Pace Endurance Training	Control Group	Sources of Variance	Sum of Square	DF	Mean of Square	Obtain F ratio	Sig. (2-tailed)
Pre-Test	**M**	70.63	69.83	70.50	B	11.02	2	5.51	1.23	0.30
	SD	2.14	2.00	2.21	W	390.63	87	4.49		
Post Test	**M**	67.93	67.50	70.03	B	110.16	2	55.08	25.18*	0.00
	SD	1.20	1.50	1.69	W	190.33	87	2.19		
Adjusted Post Test	**M**	67.75	67.79	69.93	B	93.10	2	46.55	70.30*	0.00
					W	56.95	86	0.66		

***Significant at 0.05 level of significance if p-value is < 0.05.**

The findings from the heart rate analysis has shown in table 4.11. The slow continuous training group, alternate pace endurance training group, and control group all had pre-test heart rate means of 70.63, 69.83, and 70.50, respectively. F ratio was computed as (1.23, $p>0.05$). Thus, the pre-test was not significant with a 0.05 level of confidence. This showed that there were no significant differences between the slow continuous training group, the alternating pace endurance training group and control group.

The slow continuous training group, alternate pace endurance training group, and control group all had post-test means were 67.93, 67.50, and 70.03, respectively. The calculated F ratio was (25.18, $p<0.05$). As a result, the post-test was significant with a confidence level of 0.05. This reveals that there was a significant difference between the subjects' post-test means.

The slow continuous training group, alternate pace endurance training group, and control group all had adjusted post-test means were 67.75, 67.79, and 69.93, respectively. The adjusted post-test F ratio was (70.30, $p<0.05$) with a confidence level of 0.05, therefore, the adjusted post-test mean f-ratio was considered significant. This proved that the experimental training was the reason for the significant difference in the adjusted post-test means for heart rate.

A post hoc analysis employing the LSD test is performed on the adjusted post-test means, which demonstrate significant differences. In table - 4.12, post hoc results are presented.

Table - 4.12

LSD Post Hoc Test for Difference between Adjusted Post Test Paired Means on Heart Rate

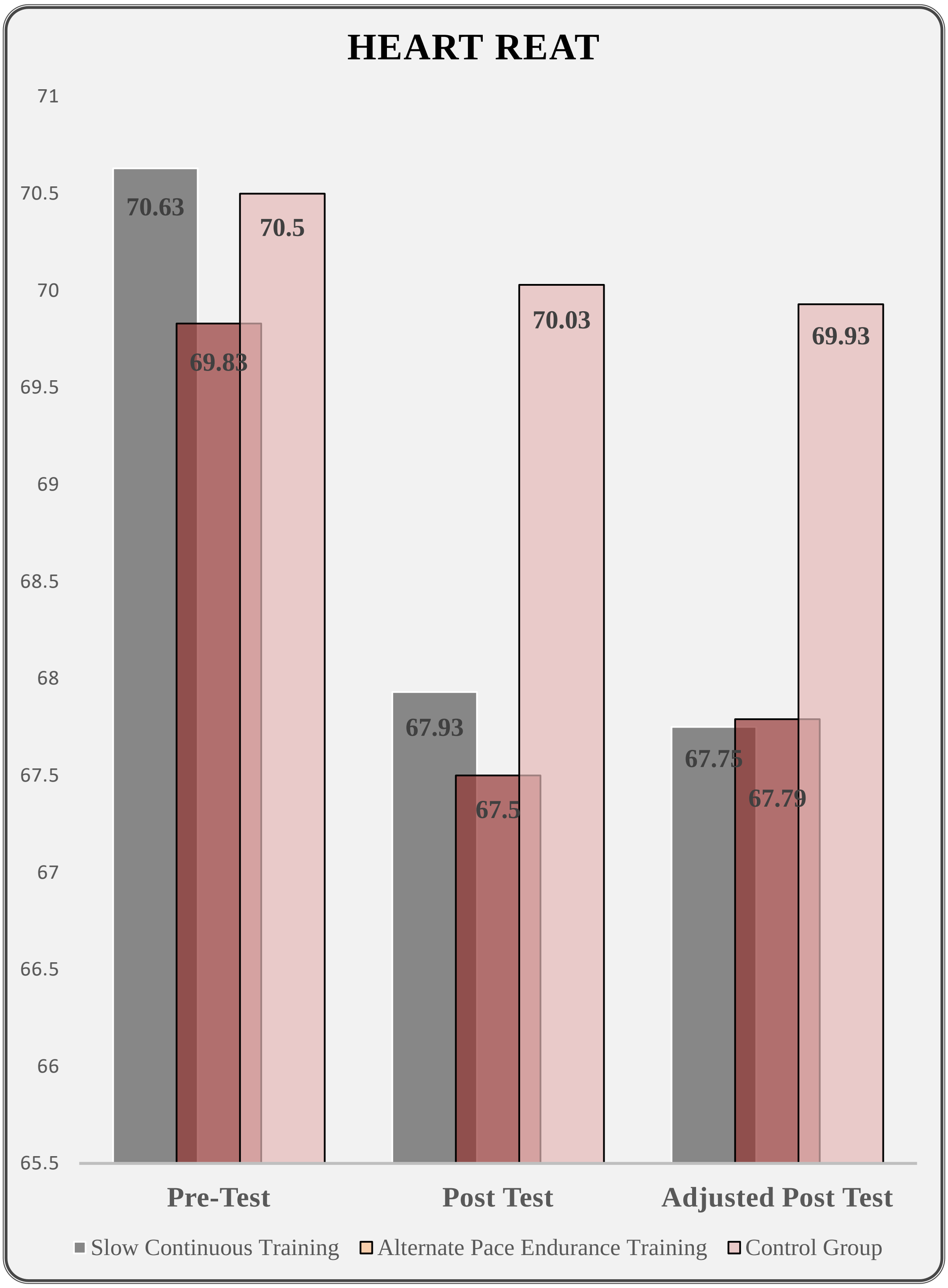
Slow Continuous Training	Alternate Pace Endurance Training	Control Group	Mean Difference	Sig.
67.75	67.79	-	0.04	0.87
67.75	-	69.93	2.18*	0.00
-	67.79	69.93	2.14*	0.00

***Significant at 0.05 Level of Significance if $p<0.05$.**

Table 4.12's multiple comparisons demonstrate that there are significant differences between the slow continuous training with control group (2.18, $p<0.05$), alternate pace endurance training with the control group (2.14, $p<0.05$). The table also reveals that there no significant difference between slow continuous training and alternate pace endurance training (0.04, $p>0.05$).

Based on the study's findings, it can be said that both the slow continuous training and alternative pace endurance training groups had a noticeable decrease in heart rate after completing their respective training regimens. The study's findings revealed a significant difference in the training groups' capacity for heart rate. Also, both experimental groups showed equal improvement in the performance of heart rate.

Figure 4.6's bar chart serves as an illustration of the pre, post, and adjusted heart rate.



The Mean value of Heart Rate are shown

Graphically in Fig .4.6

4.2.2.2 Vital Capacity:

The results of the analysis of covariance on vital capacity for the slow continuous and alternate pace endurance training and the control group are presented in Table 4.13.

Table – 4.13

Results of Analysis of Covariance on Vital Capacity among Experimental and Control Groups

Test		Slow Continuous Training	Alternate Pace Endurance Training	Control Group	Sources of Variance	Sum of Square	DF	Mean of Square	Obtain F ratio	Sig. (2-tailed)
Pre-Test	**M**	3.75	3.72	3.71	B	0.02	2	0.02	0.20	0.82
	SD	0.31	0.25	0.14	W	5.15	87	0.06		
Post Test	**M**	4.01	4.02	3.74	B	1.51	2	0.76	24.38*	0.00
	SD	0.21	0.16	0.16	W	2.70	87	0.03		
Adjusted Post Test	**M**	4.00	4.03	3.75	B	1.37	2	0.69	117.54*	0.00
					W	0.50	86	0.01		

***Significant at 0.05 level of significance if p-value is < 0.05.**

The findings from the vital capacity analysis has shown in table 4.13. The slow continuous training group, alternate pace endurance training group, and control group all had pre-test vital capacity means of 3.75, 3.72, and 3.71, respectively. F ratio was computed as (0.20, $p>0.05$). Thus, the pre-test was not significant with a 0.05 level of confidence. This showed that there were no significant differences between the slow continuous training group, the alternating pace endurance training group and control group.

The slow continuous training group, alternate pace endurance training group, and control group all had post-test means were 4.01, 4.02, and 3.74, respectively. The calculated F ratio was (24.38, $p<0.05$). As a result, the post-test was significant with a confidence level of 0.05. This reveals that there was a significant difference between the subjects' post-test means.

The slow continuous training group, alternate pace endurance training group, and control group all had adjusted post-test means were 4.00, 4.03, and 3.75, respectively. The adjusted post-test F ratio was (117.54, $p<0.05$) with a confidence level of 0.05, therefore, the adjusted post-test mean f-ratio was considered significant. This proved that the experimental training was the reason for the significant difference in the adjusted post-test means for vital capacity.

A post hoc analysis employing the LSD test is performed on the adjusted post-test means, which demonstrate significant differences. In table - 4.14, post hoc results are presented.

Table - 4.14

LSD Post Hoc Test for Difference between Adjusted Post Test Paired Means on Vital Capacity

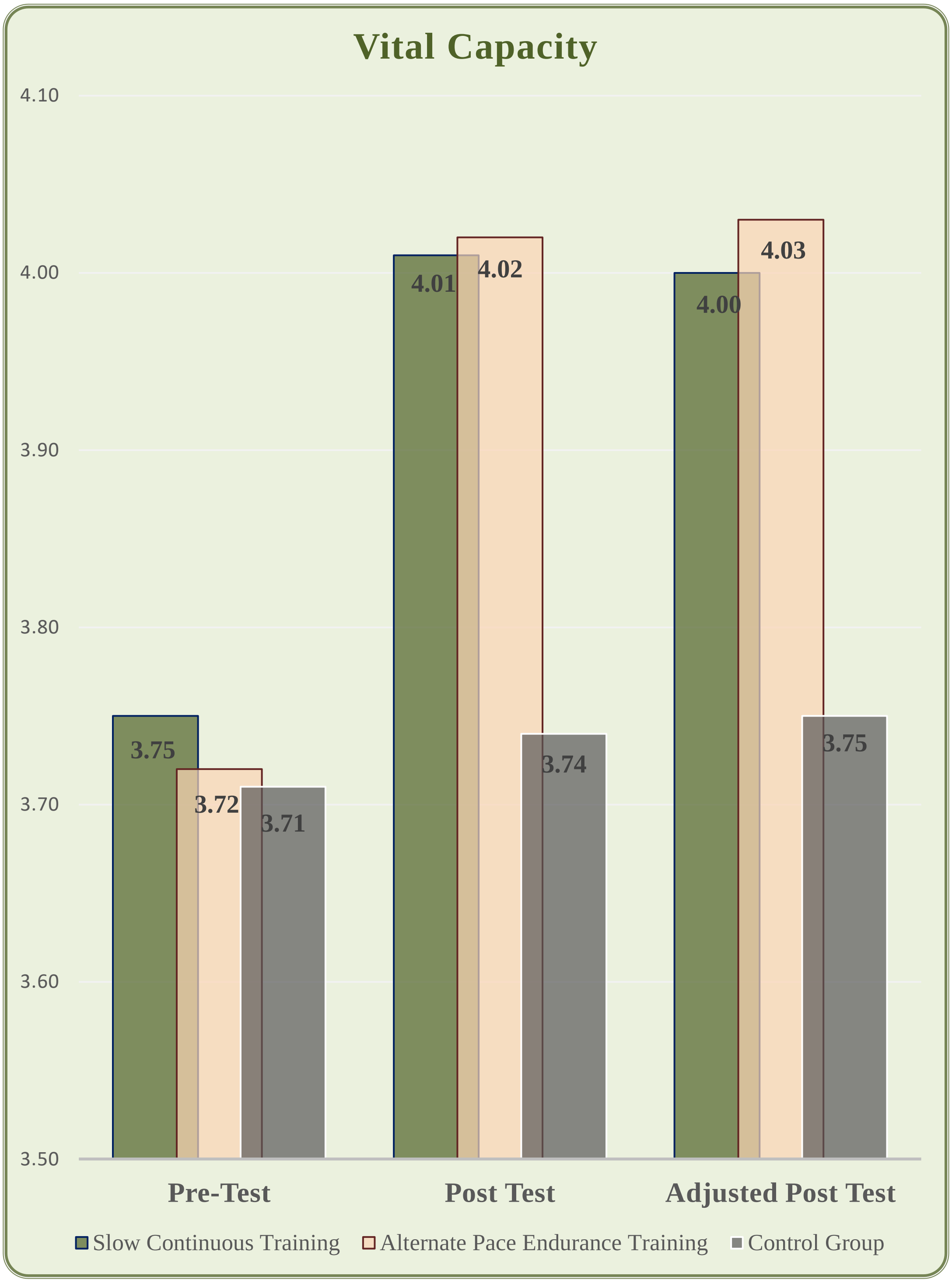
Slow Continuous Training	Alternate Pace Endurance Training	Control Group	Mean Difference	Sig.
4.00	4.03	-	0.03	0.12
4.00	-	3.75	0.25*	0.00
-	4.03	3.75	0.28*	0.00

***Significant at 0.05 Level of Significance if p<0.05.**

Table 4.14's multiple comparisons demonstrate that there are significant differences between the slow continuous training with control group (0.25, p<0.05), alternate pace endurance training with the control group (0.28, p<0.05). The table also reveals that there no significant difference between slow continuous training and alternate pace endurance training (0.03, p>0.05).

Based on the study's findings, it can be said that both the slow continuous training and alternative pace endurance training groups had a noticeable increase in vital capacity after completing their respective training regimens. The study's findings also revealed a significant difference in the training groups' capacity for vital capacity, with the alternate pace endurance training having better vital capacity than the slow continuous training and control group.

Figure 4.7's bar chart serves as an illustration of the pre, post, and adjusted vital capacity.



The Mean value of Vital Capacity are shown

Graphically in Fig .4.7

4.2.2.3 Systolic Blood Pressure:

The results of the analysis of covariance on systolic blood pressure for the slow continuous and alternate pace endurance training and the control group are presented in Table 4.15.

Table – 4.15

Results of Analysis of Covariance on Systolic Blood Pressure among Experimental and Control Groups

Test		Slow Continuous Training	Alternate Pace Endurance Training	Control Group	Sources of Variance	Sum of Square	DF	Mean of Square	Obtain F ratio	Sig. (2-tailed)
Pre-Test	**M**	116.43	115.23	116.20	B	24.29	2	12.14	0.36	0.70
	SD	5.44	6.18	5.72	W	2915.53	87	33.51		
Post Test	**M**	112.30	112.33	115.23	B	170.16	2	85.08	2.73	0.17
	SD	5.32	6.04	5.35	W	2710.33	87	31.13		
Adjusted Post Test	**M**	111.86	112.99	115.01	B	152.45	2	76.22	24.11*	0.00
					W	271.84	86	3.16		

***Significant at 0.05 level of significance if p-value is < 0.05.**

The findings from the systolic blood pressure analysis has shown in table 4.15. The slow continuous training group, alternate pace endurance training group, and control group all had pre-test systolic blood pressure means of 116.43, 115.23, and 116.20, respectively. F ratio was computed as (0.36, p>0.05). Thus, the pre-test was not significant with a 0.05 level of confidence. This showed that there were no significant differences between the slow continuous training group, the alternating pace endurance training group and control group.

The slow continuous training group, alternate pace endurance training group, and control group all had post-test means were 112.30, 112.33, and 115.23, respectively. The calculated F ratio was (2.73, p>0.05). As a result, the post-test was not significant with a confidence level of 0.05. This reveals that there was a no significant difference between the subjects' post-test means.

The slow continuous training group, alternate pace endurance training group, and control group all had adjusted post-test means were 111.86, 112.99, and 115.01, respectively. The adjusted post-test F ratio was (24.11, p<0.05) with a confidence level of 0.05, therefore, the adjusted post-test mean f-ratio was considered significant. This proved that the experimental training was the reason for the significant difference in the adjusted post-test means for systolic blood pressure.

A post hoc analysis employing the LSD test is performed on the adjusted post-test means, which demonstrate significant differences. In table - 4.16, post hoc results are presented.

Table - 4.16

LSD Post Hoc Test for Difference between Adjusted Post Test Paired Means on Systolic Blood Pressure

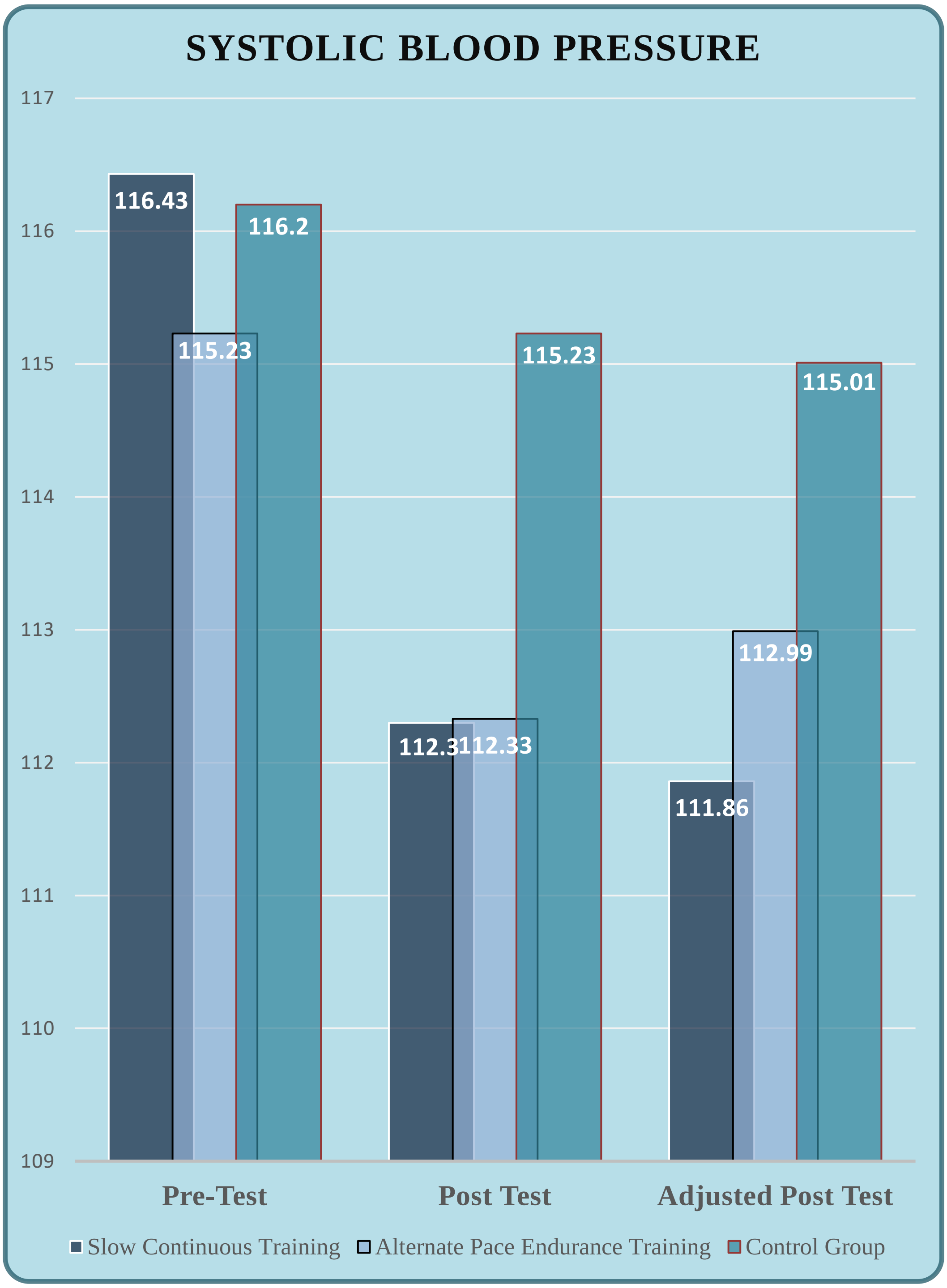
Slow Continuous Training	Alternate Pace Endurance Training	Control Group	Mean Difference	Sig.
111.86	112.99	-	1.13*	0.01
111.86	-	115.01	3.15*	0.00
-	112.99	115.01	2.02*	0.00

***Significant at 0.05 Level of Significance if p<0.05.**

Table 4.16's multiple comparisons demonstrate that there are significant differences between the slow continuous training with alternate pace endurance training groups (1.13, $p<0.05$), slow continuous training with control group (3.15, $p<0.05$), alternate pace endurance training with the control group (2.02, $p<0.05$).

Based on the study's findings, it can be said that both the slow continuous training and alternative pace endurance training groups had a noticeable decrease in systolic blood pressure after completing their respective training regimens. The study's findings also revealed a significant difference in the training groups' capacity for systolic blood pressure, with the slow continuous training having better systolic blood pressure than the alternate pace endurance training and control group.

Figure 4.8's bar chart serves as an illustration of the pre, post, and adjusted systolic blood pressure.



The Mean value of Systolic Blood Pressure are shown

Graphically in Fig .4.8

4.2.2.4 Diastolic Blood Pressure:

The results of the analysis of covariance on diastolic blood pressure for the slow continuous and alternate pace endurance training and the control group are presented in Table 4.17.

Table – 4.17

Results of Analysis of Covariance on Diastolic Blood Pressure among Experimental and Control Groups

Test		Slow Continuous Training	Alternate Pace Endurance Training	Control Group	Sources of Variance	Sum of Square	DF	Mean of Square	Obtain F ratio	Sig. (2-tailed)
Pre-Test	M	78.33	78.93	79.43	B	18.20	2	9.10	1.01	0.37
	SD	3.79	2.90	2.04	W	781.90	87	8.99		
Post Test	M	75.20	76.20	78.20	B	140.00	2	70.00	10.99*	0.00
	SD	2.86	2.38	2.30	W	554.40	87	6.37		
Adjusted Post Test	M	75.62	76.18	77.81	B	76.30	2	38.15	24.61*	0.00
					W	133.32	86	1.55		

***Significant at 0.05 level of significance if p-value is < 0.05.**

The findings from the diastolic blood pressure analysis has shown in table 4.17. The slow continuous training group, alternate pace endurance training group, and control group all had pre-test heart rate means of 78.33, 78.93, and 79.43, respectively. F ratio was computed as (1.01, $p>0.05$). Thus, the pre-test was not significant with a 0.05 level of confidence. This showed that there were no significant differences between the slow continuous training group, the alternating pace endurance training group and control group.

The slow continuous training group, alternate pace endurance training group, and control group all had post-test means were 75.20, 76.20, and 78.20, respectively. The calculated F ratio was (10.99, $p<0.05$). As a result, the post-test was significant with a confidence level of 0.05. This reveals that there was a significant difference between the subjects' post-test means.

The slow continuous training group, alternate pace endurance training group, and control group all had adjusted post-test means were 75.62, 76.18, and 77.81, respectively. The adjusted post-test F ratio was (24.61, $p<0.05$) with a confidence level of 0.05, therefore, the adjusted post-test mean f-ratio was considered significant. This proved that the experimental training was the reason for the significant difference in the adjusted post-test means for diastolic blood pressure.

A post hoc analysis employing the LSD test is performed on the adjusted post-test means, which demonstrate significant differences. In table - 4.18, post hoc results are presented.

Table - 4.18

LSD Post Hoc Test for Difference between Adjusted Post Test Paired Means on Diastolic Blood Pressure

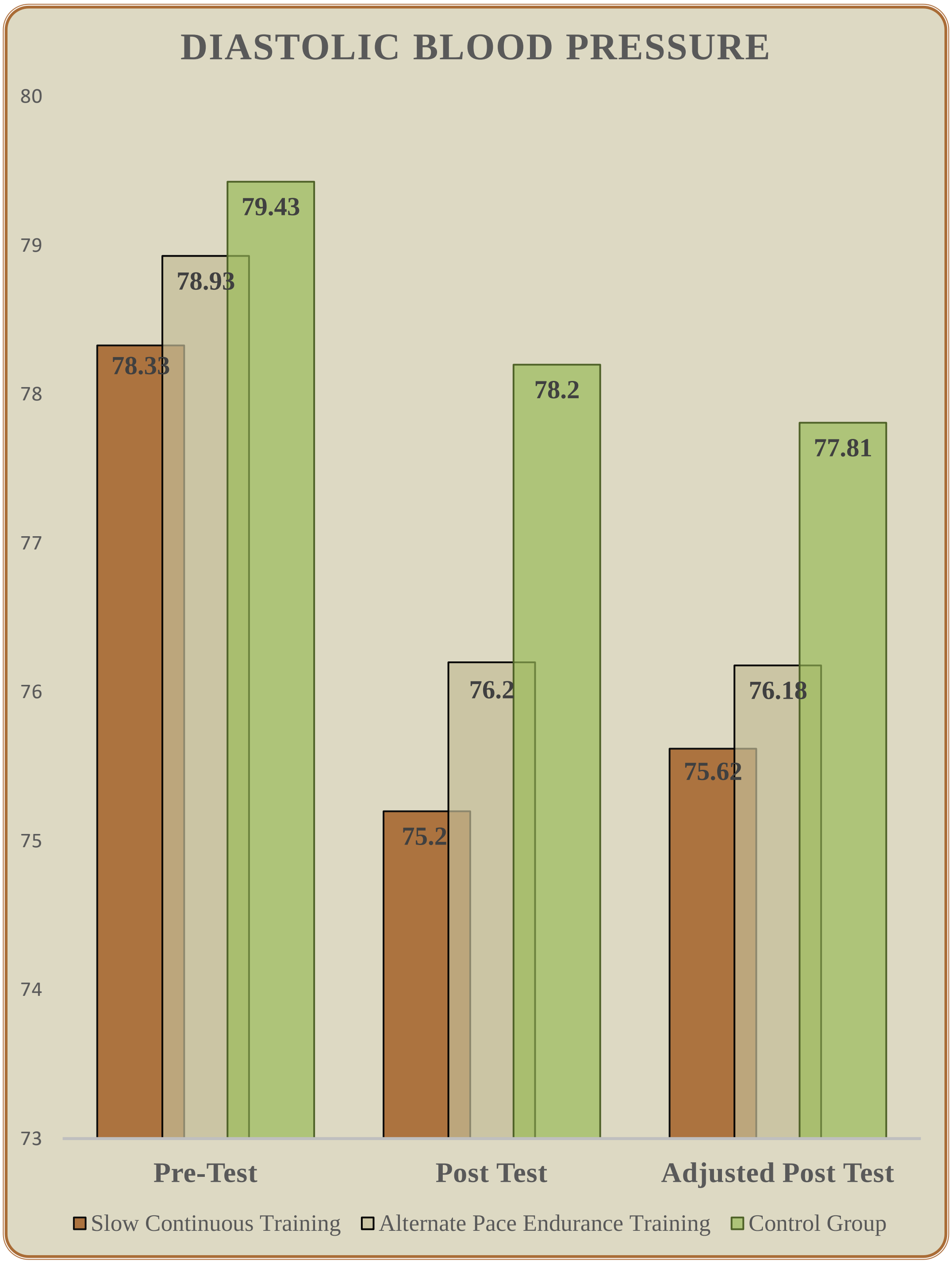
Slow Continuous Training	Alternate Pace Endurance Training	Control Group	Mean Difference	Sig.
75.62	76.18	-	0.56	0.08
75.62	-	77.81	2.19*	0.00
-	76.18	77.81	1.63*	0.00

***Significant at 0.05 Level of Significance if p<0.05.**

Table 4.18's multiple comparisons demonstrate that there are significant differences between the slow continuous training with control group (2.19, $p<0.05$), alternate pace endurance training with the control group (1.63, $p<0.05$). The table also reveals that there no significant difference between slow continuous training and alternate pace endurance training (0.56, $p>0.05$).

Based on the study's findings, it can be said that both the slow continuous training and alternative pace endurance training groups had a noticeable decrease in diastolic blood pressure after completing their respective training regimens. The study's findings also revealed a significant difference in the training groups' capacity for diastolic blood pressure, with the slow continuous training having better diastolic blood pressure than the alternate pace endurance training and control group.

Figure 4.9's bar chart serves as an illustration of the pre, post, and adjusted diastolic blood pressure.



The Mean value of Diastolic Blood Pressure are shown

Graphically in Fig .4.9

4.3 Discussion of Findings

The findings of the investigational study indicate that alternative pace endurance training improves improvisation on a subset of dependent variables. Each dependent variable in the two experimental groups has improved since the original data. Below, we'll review the findings of earlier studies in relation to the study's current findings.

4.3.1 Physical Variables:

Due to the training effects of slow continuous and alternate pace endurance training programmes, the results of speed endurance, endurance, cardio respiratory endurance, abdominal strength endurance, and leg strength had all significantly improved. On speed endurance, endurance, cardio respiratory endurance, abdominal strength endurance, and leg strength among the long distance runners, alternating pace endurance training had a significantly stronger impact than slow continuous training. The outcome also shows that none of the specified physical factors in the control group had significantly improved, according to the results.

The following past research investigations that used one and other dependent and independent variables also lend support to the findings of this studies.

The impact of 12-week endurance training packages with different repetition lengths on middle distance runners' physiological, psychological, and physical fitness is examined by **Kumar (2022).** The study's findings demonstrated that a combined repetition endurance training programme considerably enhanced the selected dependent variables, such as speed endurance, aerobic endurance, and abdominal strength endurance.

In 2020, **Vigneshwaran and Sundar;** The benefits of interval and strength endurance training for long distance athletes include increased speed, cardiopulmonary endurance, and muscular strength.

A study by **Paavolainen et al. (2020)** to examine the effects of concurrent explosive-strength and endurance training on physical performance traits. The study's findings show that well-trained endurance athletes' 5K times improved while receiving the current simultaneous explosive-strength and endurance training, with no alterations to their VO2 max.

Kumar and Kumar's study (2020) to determine the impact of uphill training on specific physical and physiological factors in long-distance runners. The experimental groups differed significantly in terms of their ability to maintain speed and cardio respiratory endurance. **Assefa (2020)** found that 8 weeks of intermittent training enhanced athletes' aerobic fitness more than continuous training did. Hill running and fartlek running benefit middle- and long-distance runners by increasing their lower body strength and resilience to exhaustion, claims **Kumar (2018).** The development of aerobic fitness is encouraged.

Arunprasanna et al. (2019) investigated the effects of continuous running, running at a different pace, and mixed training on abdominal strength endurance in male athletes. Rendering to the study, the combined group that received both endurance trainings outperformed the other groups in the selected variables.

The 2018; **Engel et al.** Even said, HIIT may be advantageous for young athletes because it takes less time per training session, which means more time for developing sport-specific abilities.

Sharma et al. 2017. At 2100 m natural altitude, elite middle-distance runners experience negative effects on their running speed, with the severity of the impairment depending on the amount of training. A greater sense of exertion may be felt if RS is maintained at particular intensities when training at altitude. **Gleason and others (2014)** To improve running performance on the 1.5 and 2-mile run tests required by the military, a combination of conventional strength training, high intensity interval training, and distance training should be performed. According to **Chtara et al. (2005),** endurance training improved the 4 km time trial and aerobic capacity more than the other training regimens or each one done independently.

4.3.2 Physiological Variables:

The current study clearly demonstrates that, when compared to the other groups, the alternative pace endurance training group's enhanced vital capacity and the slow continuous training group's considerable improvement in systolic and diastolic blood pressure. And the performance of heart rate in both experimental groups improved equally.

Krishnan et al. (2020) investigate the impact of continuous and interval training on a number of physiological indicators in male college students. The study's findings demonstrated a considerably greater improvement in resting pulse rate, vital capacity, and VO2 Max in the experimental group when compared to the control group.

The impact of continuous running, alternate-pace running, and fartlek training on resting pulse rate and breath holding capacity is examined by **Arunprasanna, Prasanna, and Vaithianathan (2019)**. The results of the study showed that the combined group with the three endurance trainings outperformed the other groups in the physiological variable that was chosen.

According to **G. Molina et al. (2017),** rookie runners' spatiotemporal characteristics and physiological variables are examined after 8 weeks of concurrent plyometric and running training. In conclusion, concurrent plyometric and running training involves a decrease in heart rate as well as increases in peak speed and VO2max.

The results of the **Silva et al. (2017)** study indicate that 4 weeks of HIIT can enhance some conventional physiological indicators connected to endurance performance.

Etxebarria et al. (2014) investigated the benefits of two cycle HIT (high-intensity interval training) variations on cycling and running specifically for triathlons. Long high-intensity intervals increase cycling physiology and performance while short high-intensity interval training reduces heart rate, blood lactate, and perceived exertion in both groups. Performance over a 5 km run is more likely to be improved by longer 5-min cycling intervals.

Brandon (1995), This distinguishes middle distance runners from long distance runners because middle distance runners can succeed with physiological profiles that encompass a variety of aerobic and anaerobic capabilities.

The material mentioned above makes it abundantly evident that slow continuous and alternative pace endurance training must be performed frequently and with adequate supervision. As a result, it is concluded that long distance runners may benefit from a carefully planned programme of slow continuous and alternate pace endurance training. This will help them develop their physical and physiological performance parameters as well as prevent them from getting injured too soon.

4.4 Discussion of Hypotheses

1. In the first hypothesis, it was mentioned that 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. Similar findings were obtained in the present study. As a result, the investigator's initial research hypothesis was accepted.
2. In the second hypothesis, it was mentioned that there would be significant improvement on selected physiological variables due to the effect of slow continuous and alternate pace endurance training of long-distance runner. Similar findings were obtained in the present study. As a result, the investigator's second research hypothesis was accepted.
3. In the third hypothesis, it was mentioned that there would be significant differences on selected physical and physiological variable among the slow continuous and alternate pace endurance training programmes and control groups. Similar findings were obtained in the present study. As a result, the investigator's third research hypothesis was accepted.

CHAPTER-V

SUMMARY
CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The purpose of the current investigation, in brief, was to determine an effect of continuous and alternate pace endurance training on selected physical and physiological variables of long-distance runners. To achieve this purpose, ninety (n=90) male long-distance runners from the Surat district who have competed at least once in distance running competitions longer than 3000 meters were selected at random and they were in 17 to 22 years of age. The selected subjects were divided randomly into three equal groups of thirty (n=30), including experimental and control groups. Group - I (n = 30) participated in slow continuous training, Group - II (n = 30) participated in alternate pace endurance training, and Group - III (n = 30) served as the control group.

The variables were selected as criterion variables from the Physical and Physiological variables name as; speed endurance, cardio respiratory endurance, endurance, abdominal strength endurance, leg strength, heart rate, vital capacity and blood pressure. The two experimental groups were participating in the training given 3 days a week for 8 weeks. The regular curriculum was offered to the control group. All groups were retested on all selected variables after the conclusion of the eight-week training programme, and the results were kept as a post-test score. The collected data was then analysed using the appropriate statistical techniques.

In order to find out the effect of slow continuous and alternate pace endurance training on selected physical and physiological variables of long-distance runners. The univariate analysis of covariance (ANCOVA) and the post hoc pair wise comparison using the LSD test analysis. For testing the hypothesis, the level of confidence was set at 0.05 levels.

5.2. Conclusions

The following conclusions were drawn based on the results provided and the discussions conducted, under the limitation and delimitations of this study.

1. The Experimental groups namely, slow continuous training group and alternate pace endurance training group had significantly improved in speed endurance, cardio

respiratory endurance, endurance, muscular endurance, leg strength, heart rate, vital capacity and systolic and diastolic blood pressure.

2. Significant differences in achievements were found between slow continuous training and alternate pace endurance training in all the selected criterion variables such as speed endurance, cardio respiratory endurance, endurance, muscular endurance, leg strength, heart rate, vital capacity and systolic and diastolic blood pressure.
3. The alternating pace endurance training had a significantly stronger impact on the group concerned than the slow continuous training in enhancing the performance of speed endurance, endurance, cardio respiratory endurance, muscular endurance, leg strength and vital capacity.
4. The slow continuous training group's considerable improvement in systolic and diastolic blood pressure than the alternating pace endurance training.
5. The experimental groups' namely slow continuous training group and alternate pace endurance training group showed equal improvement while improving the performance of heart rate.
6. The control group did not show any significant improvement on any of the selected physical and physiological variables among long distance runners.

5.3. Recommendations

The results of this study show that participants selected physical and physiological variables were considerably changed by eight weeks of slow continuous training and alternative pace endurance training programmes. The following recommendations are given in light of the research's findings, discussions, and results.

1. According to the findings of the current study, slow continuous training and alternative pace endurance training increased the physical and physiological responses of long-distance runners. It is recommended that coaches, trainers, and physical educators use these data to help their players' chosen physical and physiological characteristics.
2. According to the study's findings, slow continuous training and alternate pace endurance training can be employed by exports to enhance their players' overall physical fitness and performance in a variety of games.

3. The study's findings demonstrated that alternative pace endurance training and slow continuous training were more successful at enhancing performance. As a result, it can be used for a variety of sports and games for both men and women.

5.4 Suggestions for Further Research

1. There are more opportunities to carry out research of this nature on different sporting events, including middle and short distance races.
2. Other bio-chemical, physiological and physical fitness factors may be included to a study using a similar research design.
3. The sample size may be increased, allowing the researchers to obtain more exact results from their research.
4. The subjects of a similar study could be athletes or players competing at the state or national levels.
5. On female participants, a similar study might be carried out.
6. Similar studies could be conducted over longer time periods or with training intensities other than those described in the current study.
7. For students in colleges and higher secondary schools, a similar study may also be conducted.

APPENDIX

APPENDIX – I

Score of Physical Fitness Variables of Slow Continuous Training Group

Sr. No	Speed Endurance		CRE		Endurance		Abdo. Strength Endurance		leg Strength	
	(300 M Dash)		Cooper Test		1600 m Run		Sit-ups		Leg Dynamometer	
	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test
1	41.20	40.16	2290	2370	4.56	4.34	34	38	59.64	61.54
2	40.60	38.65	2350	2460	4.60	4.40	37	41	58.06	60.48
3	41.65	39.06	2490	2570	4.51	4.32	31	35	57.64	60.34
4	43.56	41.26	2260	2410	5.10	4.61	25	30	56.97	58.46
5	41.23	40.16	2540	2630	4.66	4.37	42	44	57.69	59.46
6	40.58	38.15	2460	2540	4.37	4.26	36	38	58.79	61.48
7	45.45	42.87	2010	2210	5.43	4.78	34	39	56.84	59.31
8	43.44	40.69	2330	2390	5.10	4.67	33	38	57.69	59.64
9	41.22	40.89	2360	2470	4.78	4.46	32	35	56.49	57.23
10	40.58	39.48	2470	2570	4.30	4.21	41	42	58.34	60.78
11	44.16	42.98	2040	2130	4.66	4.47	33	38	56.43	59.34
12	40.56	39.48	2490	2560	4.53	4.31	32	36	59.76	62.34
13	47.65	43.65	1940	2110	5.48	4.87	29	32	55.64	57.63
14	45.21	44.89	2080	2190	5.43	4.69	32	36	58.61	60.43
15	43.12	41.69	2340	2470	4.76	4.37	24	28	57.69	61.64
16	42.54	40.78	2360	2520	4.65	4.22	34	37	57.98	60.43
17	43.26	41.69	2140	2240	4.71	4.42	40	44	58.96	62.71
18	40.25	39.54	2390	2530	4.58	4.28	36	42	58.36	61.13
19	43.92	41.19	2240	2410	4.62	4.33	34	39	57.64	59.46
20	40.83	39.29	2310	2560	4.53	4.33	42	44	59.89	62.24
21	40.56	38.14	2440	2550	4.35	4.24	35	37	58.93	62.46
22	40.58	39.46	2480	2580	4.63	4.46	40	43	58.31	60.85
23	41.81	40.14	2530	2590	4.66	4.44	39	43	57.67	59.46
24	43.39	41.31	2240	2370	4.62	4.33	34	39	56.64	59.46
25	44.16	42.98	2040	2120	4.66	4.47	33	38	56.43	59.34
26	41.65	39.06	2490	2570	4.51	4.32	31	35	57.64	60.34
27	43.41	41.12	2230	2380	4.65	4.33	34	38	57.62	60.46
28	41.63	39.82	2380	2560	4.49	4.31	31	34	57.61	60.78
29	45.23	44.89	2080	2160	5.73	4.68	31	35	58.69	60.41
30	41.29	40.89	2370	2450	4.86	4.62	32	36	56.47	57.23

APPENDIX – II

Score of Physical Fitness Variables of Alternate Pace Endurance Training Group

Sr. No	Speed Endurance		CRE		Endurance		Abdo. Strength Endurance		leg Strength	
	(300 M Dash)		Cooper Test		1600 m Run		Sit-ups		Leg Dynamometer	
	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test
1	40.65	38.56	2560	2640	4.34	4.21	34	38	61.23	62.34
2	44.59	41.26	2530	2710	4.79	4.38	32	34	56.41	58.47
3	43.36	40.16	2430	2590	4.66	4.32	31	35	57.48	59.67
4	41.58	39.45	2510	2670	4.56	4.26	34	36	58.43	61.78
5	44.68	40.36	2130	2340	4.64	4.39	31	36	56.78	59.78
6	46.56	42.56	1940	2320	5.12	4.48	32	35	55.97	59.64
7	43.56	41.26	2310	2570	4.69	4.28	34	39	57.34	60.23
8	44.16	40.16	2060	2290	4.77	4.37	37	40	57.84	60.78
9	40.85	40.12	2610	2730	4.39	4.26	42	44	59.46	61.74
10	40.19	39.46	2570	2680	4.44	4.23	40	43	58.32	60.69
11	44.56	42.16	2130	2310	4.89	4.41	40	46	58.97	61.48
12	43.57	41.69	2340	2460	4.86	4.39	32	36	58.46	60.72
13	44.56	41.68	2170	2340	4.68	4.21	36	41	57.48	59.34
14	45.45	41.59	2040	2270	5.08	4.37	32	37	57.90	59.78
15	41.36	39.47	2410	2610	4.53	4.21	24	29	58.66	60.49
16	46.91	43.71	2070	2320	5.09	4.50	31	36	56.73	59.83
17	41.06	39.46	2580	2660	4.43	4.11	42	47	58.78	60.45
18	40.56	38.46	2510	2590	4.31	4.13	36	44	59.34	61.76
19	44.45	41.69	2030	2290	4.61	4.33	38	43	56.39	59.74
20	41.57	40.14	2470	2510	4.49	4.29	43	47	58.44	60.43
21	44.56	41.68	2170	2340	4.68	4.21	36	41	57.49	59.24
22	42.35	40.87	2410	2590	4.64	4.32	31	36	57.46	59.64
23	46.05	42.56	1940	2310	5.46	4.48	32	34	55.96	59.61
24	40.86	40.82	2540	2670	4.38	4.26	41	45	59.52	61.74
25	43.54	41.69	2320	2460	4.85	4.39	33	37	58.44	60.72
26	41.83	39.47	2540	2660	4.53	4.21	22	26	58.63	60.41
27	40.52	38.46	2490	2590	4.42	4.32	36	42	59.33	61.76
28	41.55	40.14	2460	2520	4.49	4.33	42	46	58.46	60.31
29	41.54	39.45	2510	2650	4.55	4.26	35	39	58.42	61.58
30	45.67	41.67	2010	2220	4.75	4.39	39	43	56.48	59.74

APPENDIX – III

Score of Physical Fitness Variables of Control Group

Sr. No	Speed Endurance		CRE		Endurance		Abdo. Strength Endurance		leg Strength	
	(300 M Dash)		Cooper Test		1600 m Run		Sit-ups		Leg Dynamometer	
	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test
1	42.65	41.67	2460	2480	4.56	4.48	34	35	58.46	59.13
2	43.67	43.18	2310	2360	4.63	4.52	31	29	56.49	57.16
3	43.16	41.34	2470	2410	4.68	4.67	36	35	56.47	56.74
4	44.56	41.37	2210	2240	4.89	4.83	30	32	57.43	58.13
5	42.67	42.57	2540	2540	4.56	4.43	34	34	57.84	58.09
6	43.26	42.64	2340	2430	4.69	4.52	35	34	57.63	58.17
7	42.15	40.17	2480	2510	4.67	4.48	37	38	58.51	59.48
8	41.37	41.31	2570	2560	4.39	4.32	39	38	58.34	59.41
9	41.67	41.67	2490	2510	4.46	4.39	34	35	59.78	59.89
10	40.67	40.31	2610	2620	4.48	4.41	37	36	59.74	60.43
11	43.16	41.87	2210	2240	4.48	4.38	32	34	57.34	58.74
12	44.31	44.67	2430	2370	4.87	4.76	29	31	55.69	56.22
13	45.26	43.46	2170	2210	5.13	4.98	31	32	56.78	57.09
14	45.18	44.47	2100	2130	4.97	4.86	32	32	56.79	57.36
15	43.26	42.06	2170	2150	4.62	4.57	36	37	57.49	58.76
16	44.28	43.16	2030	2060	4.93	4.81	28	29	57.63	58.71
17	43.25	42.29	2130	2080	4.53	4.41	33	34	54.67	55.94
18	43.15	42.18	2040	2090	4.62	4.57	34	35	56.71	57.17
19	42.15	41.27	2210	2220	4.68	4.57	30	31	58.79	59.47
20	42.07	43.18	2270	2330	4.57	4.49	37	38	57.42	58.43
21	43.65	42.16	2300	2360	4.61	4.52	32	29	56.47	57.19
22	43.23	42.07	2380	2450	4.69	4.34	35	35	57.61	58.23
23	41.34	41.13	2560	2560	4.38	4.29	39	38	58.97	59.44
24	40.31	40.31	2620	2630	4.48	4.29	35	36	59.72	60.43
25	44.39	41.37	2210	2230	4.89	4.82	30	33	57.48	58.93
26	44.29	44.67	2430	2370	4.85	4.76	30	30	55.77	56.14
27	44.28	43.15	2030	2070	4.97	4.81	27	29	57.61	58.79
28	42.26	42.18	2310	2330	4.57	4.50	37	37	57.47	58.44
29	43.14	42.18	2040	2090	4.60	4.50	35	35	56.89	57.16
30	45.18	44.38	2120	2180	4.97	4.85	32	31	56.78	57.36

APPENDIX – IV

Score of Physiological Variables of Slow Continuous Training Group

Sr. No	Heart Rate (Stethoscopes)		Vital Capacity (DDS)		Blood Pressure (Systolic)		Blood Pressure (Diastolic)	
	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test
1	66	65	4.02	4.08	113	109	79	75
2	71	68	4.11	4.21	109	108	74	71
3	73	69	3.68	3.89	118	114	81	76
4	72	70	3.63	3.87	126	122	86	82
5	69	67	4.21	4.34	117	113	77	75
6	68	67	3.87	4.07	113	109	73	72
7	71	69	3.46	3.74	121	117	84	79
8	70	67	4.19	4.31	128	122	81	79
9	70	68	3.85	4.06	115	110	75	73
10	73	69	4.06	4.32	107	101	76	70
11	73	69	3.48	3.85	127	121	82	77
12	71	68	4.08	4.19	112	109	78	75
13	70	68	3.51	3.74	120	116	84	78
14	73	69	3.61	3.92	118	117	81	79
15	71	67	3.48	3.88	114	110	76	74
16	73	69	3.29	3.97	117	113	75	73
17	73	68	3.31	3.61	113	107	78	75
18	70	68	4.11	4.19	106	104	79	76
19	69	67	3.26	3.76	119	115	76	74
20	68	67	4.34	4.48	111	104	75	72
21	66	65	3.86	4.08	113	110	77	75
22	69	67	4.02	4.18	115	112	75	73
23	73	69	3.51	3.93	124	119	81	78
24	69	67	3.41	3.87	117	112	76	74
25	73	69	3.73	3.97	117	112	81	75
26	69	67	3.87	4.08	113	107	71	72
27	71	68	3.69	3.87	121	117	84	77
28	73	69	3.62	4.09	116	117	74	73
29	69	69	3.41	3.74	120	113	83	80
30	73	69	3.86	4.02	113	109	78	74

APPENDIX – V

Score of Physiological Variables of Alternate Pace Endurance Training Group

Sr. No	Heart Rate Stethoscopes		Vital Capacity (DDS)		Blood Pressure (Systolic)		Blood Pressure (Diastolic)	
	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test
1	68	66	4.08	4.23	107	103	76	74
2	71	67	3.59	3.97	123	120	84	81
3	73	68	3.71	4.07	117	115	76	75
4	69	67	3.98	4.18	111	109	79	77
5	73	70	3.49	3.89	119	117	83	79
6	68	67	3.29	3.61	123	119	81	78
7	70	68	3.57	3.89	114	111	78	76
8	68	67	3.60	3.96	108	106	82	80
9	73	69	4.12	4.28	110	108	75	73
10	71	68	4.18	4.30	107	103	76	73
11	68	66	3.48	3.86	122	119	83	79
12	67	66	3.61	4.03	118	113	77	75
13	69	67	3.56	3.91	123	120	79	76
14	73	69	3.57	3.96	120	113	74	74
15	71	69	3.94	4.07	108	105	78	75
16	68	66	3.43	3.94	121	117	83	78
17	69	67	3.87	4.03	117	114	80	77
18	72	69	4.09	4.18	106	104	77	72
19	73	70	3.49	3.85	114	112	80	76
20	67	66	3.76	4.21	109	106	81	76
21	69	67	3.85	4.03	108	112	78	77
22	69	68	3.56	3.93	123	120	78	76
23	71	69	4.14	4.26	110	107	75	73
24	69	66	3.64	3.96	124	118	83	79
25	69	66	4.07	4.23	106	102	76	73
26	72	70	3.78	4.07	114	109	76	74
27	67	66	3.43	3.94	121	120	82	79
28	69	70	3.55	3.87	117	111	79	77
29	68	65	3.48	3.88	122	121	82	79
30	71	66	3.71	4.06	115	116	77	75

APPENDIX – VI

Score of Physiological Variables of Control Group

Sr. No	Heart Rate (Stethoscopes)		Vital Capacity (DDS)		Blood Pressure (Systolic)		Blood Pressure (Diastolic)	
	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test	Pre Test	Post Test
1	68	67	3.74	3.81	121	120	81	79
2	71	70	3.62	3.61	111	109	79	77
3	72	72	3.73	3.76	119	118	81	80
4	73	71	3.43	3.40	126	125	83	81
5	72	71	3.85	3.87	119	117	79	80
6	71	72	3.74	3.83	112	113	78	76
7	69	68	3.72	3.76	119	118	82	81
8	69	68	4.07	4.11	106	107	78	79
9	73	72	3.89	3.78	109	108	79	76
10	73	71	3.91	3.92	109	110	82	81
11	70	69	3.76	3.84	123	121	81	80
12	71	71	3.58	3.66	121	122	79	76
13	70	71	3.49	3.41	117	114	82	80
14	68	68	3.56	3.59	123	121	80	79
15	72	71	3.79	3.81	122	120	75	73
16	70	70	3.53	3.58	121	119	79	77
17	73	72	3.64	3.67	113	112	79	77
18	71	71	3.86	3.92	113	111	77	76
19	67	68	3.73	3.79	108	111	78	79
20	68	68	3.64	3.71	112	108	79	77
21	66	67	3.74	3.83	121	119	81	79
22	73	71	3.83	3.87	118	116	79	81
23	68	68	3.72	3.74	118	118	81	81
24	73	72	3.87	3.78	109	107	79	76
25	68	68	3.77	3.84	120	119	82	80
26	71	71	3.49	3.41	116	114	82	80
27	72	71	3.78	3.81	121	120	75	73
28	73	72	3.66	3.67	110	108	78	77
29	67	69	3.71	3.79	107	110	77	79
30	73	71	3.57	3.66	122	122	78	76

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