THE EFFECT OF RESISTANCE CIRCUIT TRAINING AND INTENSIVE INTERVAL TRAINING ON SELECTED PHYSICAL AND PHYSIOLOGICAL VARIABLES OF VEER NARMAD SOUTH GUJARAT UNIVERSITY KHO-KHO PLAYERS

वीर नर्मद दक्षिण गुजरात विश्वविद्यालय के खो–खो खिलाड़ीयो के चयनित भौतिक एवं शारीरिक चर पर प्रतिरोध सर्किट प्रशिक्षण और गहन अंतराल प्रशिक्षण का प्रभाव

A

Thesis

Submitted for the Award of the Ph.D. degree of

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By

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DATE: - **PATEL PRAFULKUMAR RAMESHBHAI**

DEDICATED TO
MY FAMILY, FRIENDS
AND WELL-WISHERS

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PREFACE

The purpose of the study was to find out the effect of resistance circuit training and intensive interval training on selected physical and physiological variables of Veer Narmad South Gujarat University Kho-Kho players. To achieve the purpose of the study 90 male Kho-Kho players from different colleges of Veer Narmad South Gujarat University, Surat. Subjects were between the ages of 18 and 25 years. To assess the level of physical variables speed, endurance, agility, flexibility and explosive power and physiological variables resting pulse rate, vital capacity and blood pressure in Kho-Kho players. To identify the outcome of resistance circuit training and intensive interval training on selected physical variables of Kho - Kho players. To determine the effects of resistance circuit training and intensive interval training on physical and physiological variables, a pre-test-post-test random group design with two experimental groups and one active control group was used. Selected ninety subjects were divided at random into three groups of thirty each (n=30). Group - I underwent resistance circuit Training, Group - II underwent Intensive Interval Training, and Group - III acted as the Control group. The experimental groups were trained for a period of eight weeks. The training is sessions were conducted three alternate days a week. Measurement of all the variables were taken for all the groups before and after the experimental period of eight week. The data collected from the three groups before and immediately after the training program were statistically analyzed on the selected criteria variables with Analysis of Covariance (ANCOVA). as long as he "F" ratio for adjusted post-test means was significant, Scheffe's post hoc test was followed to determine which of the paired mean differences was significant. In all cases, a confidence level of ($p<0.05$) was set to test the hypothesis. The LSD post hoc test was used to determine the significance of the difference between the paired post-test means when the adjusted post-test means were significant. Resistance circuit training and intense interval training were found to have a significant impact on all criteria variables in the current investigation. Therefore, in order to enhance the overall performance of male kho-kho players, it is advised that coaches, trainers, and physical educators implement this training. The same training may be used to increase performance in different games and sports since the selected trainings demonstrated a higher degree of improvement on the selected variables.

Key words: Speed, Endurance, Agility, Flexibility, Explosive Power

CHAPTER – I

INTRODUCTION

1.1 Introduction

As a result of many forms of scientific advancements and their application in the sphere of sports in particular, the world of games and sports has achieved numerous milestones. Athletes are subjected to workouts and training methods that have been helpful for obtaining greater standards in the present scientific era as they are trained using extremely complex ways for better performance in their particular sports.

Every person has the right to the privilege of receiving physical education and participation in sports, both of which are necessary for the entire development of the individual. Both within the academic framework and in other facets of social life, the freedom to develop one's physical, intellectual, and ethical fortitude through physical education and recreation must be guaranteed. Everyone should have the opportunity to succeed in sport at a level that is commensurate with their abilities, regardless of the level of national trust they have in physical education, sport, or both.

Good health is essential for success in school or in life in general, and it cannot be attained in youth if growth and development do not take place in an appropriate manner. Unless the child is able to grow his physical and physical condition to attain the aforementioned goals, a healthy body is required for him to fulfill his full potential.

More than any previous time in human history, sports have become very popular and prominent in the twenty-first century. Finding the right abilities for the right jobs has now become an important necessity.

A sport is an essential component of schooling. According to research, children who participate in regular sports will benefit from improved learning and memory, increased concentration, and improved problem-solving abilities. A healthy learning environment is vital for fostering a positive attitude toward oneself and others, which is fostered through regular physical activity. Students get the ability to incorporate physical activity into their daily lives through physical education when they comprehend how leading an active lifestyle encourages personal development and equips them to take on the problems of society.

In today's society, sport is significant. It is crucial for every person, every organization, every nation, and for the entire globe. Sport is an institutionalized

competitive activity that requires intense physical effort or the application of relatively complex physical skills by participants who are motivated to participate both by the intrinsic rewards of the activity itself and by the external rewards attained through participation. The dedication to achieving a set objective through competition is the fundamental element of sport. Standardized rules and circumstances must apply to this competition **(Howell et al. 1994).**

Sport is a lifestyle choice where the pursuit of improving neuromuscular coordination is performed through a variety of actions. Every single person in the modern day is directly or indirectly involved in sports. Nowadays, physical education is frequently associated with the sports that publicly create the physical, biological, and social sciences as a desire for discipline.

Sport has existed since the beginning of human society and today has a widespread following. It has more appeal than any other type of social interaction right now. It is now an essential component of the learning process. Numerous sporting events are followed by millions of people worldwide with fervor bordering on devotion. Many people play sports for enjoyment or to improve their strength, fitness, and health. For individuals with high skill levels, it is taking the shape of a profession with significant financial rewards associated with widespread popularity **(Remirez, 1976).**

A context for frequent and structured physical activity involvement is provided through physical education. Due to its positive effects on children's health and fitness, physical education is frequently justified as having a place in the school curriculum **(Physical Education Association of the United Kingdom, 2004).**

Physical education is defined as a teaching strategy that makes use of physical activity to help students develop the information, attitudes, and abilities necessary for their most effective physical and mental growth. "The time period training" refers to the constant learning process that occurs throughout our lifetime. Physical education is no longer limited to a specific age range and can take place anywhere in a number of settings. Some of the more prestigious settings for education and physical education programs include homeschooling, distance learning, workplace fitness advertising programs, and preschools.

Physical education is that type of education that starts with physical improvement and progresses to optimal development of the individual, with the ultimate goals of achieving an active and solid physique, mental alertness, achieving sound wellbeing, and maintaining social and emotional balance **(Kales, 1988).**

Gandhi and Tagore both believed that a child's holistic growth must be based on the genuine education that is given to us. The child's overall growth, including their mental, moral, social, and physical health, must come before their education. A person's personality changes as a result of their education. Sports are essential to building a robust and healthy physique that will enable people to withstand all physical, physiological, psychological, and sociological issues. A person's mind is refreshed after playing for a time. The player feels more energised and enthusiastic as a result. In general, education is incomplete without physical activity.

Performances in physical education are fundamental components of lifetime training in the general educational system. As an essential component of education and civilization, physical education and sport should develop each person's ability, willpower, and self-discipline as a fully integrated member of society. Through the ability of a worldwide lifespan and democratized education, the everlasting nature of physical activity and the rise of sports must be ensured over life.

Every person has the right to the privilege of receiving physical education and participation in sports, both of which are necessary for the entire development of the individual. Both within the academic framework and in other facets of social life, the freedom to develop one's physical, intellectual, and ethical fortitude through physical education and recreation must be guaranteed. Everyone should have the opportunity to succeed in sport at a level that is commensurate with their abilities, regardless of the level of national trust they have in physical education, sport, or both. Performances in physical education are fundamental components of lifetime training in the general educational system. As an essential component of education and civilization, physical education and sport should develop each person's ability, willpower, and self-discipline as a fully integrated member of society. Through the ability of a worldwide lifespan and democratized education, the everlasting nature of physical activity and the rise of sports must be ensured over life.

It is well accepted that regular physical activity enables a person to maintain physical fitness and to continue with his daily exercises. In any case, everyone who aspires to be a hero or to reach the highest level in sports or entertainment should go beyond the fundamental requirements of regular exercise. He should engage in extreme physical activity and go through rigging to develop the physical traits that are most important for success, especially in game endeavor.

Everyone agrees that regular exercise keeps one physically fit and helps the ordinary person function normally during the course of a day. The simple guideline of regular exercise, however, is not enough for everyone who wants to compete successfully in games and sports, desires to be a champion, or wants to reach the highest level. He has to put in a lot of effort and practice becoming physically fit, working on the physical attributes that are most important for success in a certain activity **(Ghosh, 1980).**

Throughout the world, nations compete in international sporting events to display their accomplishments. Every nation creates its own unique innovations, methods, and plans for displaying elite performance in order to win and become the sports champion.

Sports and games in the modern era are becoming harder and faster every day. The game is now mesmerized by agility, endurance, enormous strength, flexibility, and action-packed encounters in addition to the complexity of the tools, surroundings, and attire. There is constant incentive to get better through fresh setups and even generally shifting method approaches. Due in great part to a scientific training regimen, the fundamental level of fitness at the international and even the national levels is improving.

Currently, the intricacy of hardware, offices, and fabrics, together with speed, endurance, outstanding quality, suppleness, and control-filled experiences, are what make the game exciting. There is overall comfort in the ability to improve with new setups, despite general changes in styles or systems. Due in large part to a logical preparation strategy, both the fundamental well-being on a global and even a national scale is significantly improving.

The Mahabharata and the Ramayana, two of the world's greatest epics, were written on the Indian subcontinent. The Ramayana serves as the foundation for the idea of Ram Rajya, which is meant to benefit all of humanity. Like many other kinds of international entertainment, popular sports have their roots in India's cultural history. There are numerous games and sports mentioned in the ancient Indian treatises that we have access to. Kho-Kho is essentially a card game from India. Both metropolitan streets and suburban neighborhoods like playing Kho Kho. And it's not just in California; word of this game's success has traveled across the entire nation.

Apart from kabaddi, the most popular game in rural India is Kho-Kho, a simple game with a lengthy history. Currently, it is the most well-liked Indian native team game. Competitions are held at all levels, including national.

Indian Kho-Kho is a sport that is frequently practised in schools and institutions across the nation. Every Indian is aware of the game's long history and the fact that it has been played ever from the beginning of time. Two teams of twelve players each compete on a rectangular court; nine players take the field while the remaining three serve as reserves. Kho-Kho is a fantastic way to gauge a player's stamina, speed, strength, and dodging skills. Although many historians claim that Kho-Kho is essentially a modified version of "Run Chase," no one is certain of the game's origins or when it was originally played.

Although just nine players take the field for a match, each of the competing sides is required to have twelve members by the Kho-Kho game's rules. One team sits in a row in the middle of the court after winning the coin toss, with alternate players facing in different directions. The chasers are them. A member of the opposing team enters the court as a dodger.

There are 2 main types of skills in Kho-Kho they are offensive skills (chase) and Defensive skills (Dodge).

Kho-Kho is a game that is based on the laws of physical development. It is ferocious and cultivates healthy competitiveness in young people. In addition to moving quickly, CHASE is a natural instinct to overtake and follow an opponent in order to get a kill. Speed is the heart, without a doubt, and it takes strength and stamina to maintain a relentless pursuit for several minutes at a time (turn). A young person who

is physically active appreciates it, and those watching enjoy a thrilling sport to their satisfaction. There are two innings in the game. A team has fifteen players. However, only one participant actually enters the game at first out of the 12 individuals who are nominated for the match. In a game that consists of two innings, each team must chase and defend for a minute each twice. A "Turn" of the specific act is when a player pursues or defends once during an inning.

Between two innings, there is a minute of rest, and between two turns, there are five minutes. Controlled sprinting, dodging, and dividing are a few of the abilities displayed throughout the contest, which is won by the team scoring the most points (one point is given for each away defender who is ejected). Any surface that is appropriate for open field sports can be used to play the game. As of right now, it is played on fields made of turf or even dirt. It goes without saying that playing indoors and on artificial turf are unacceptable.

The physical parameters of Kho-Kho are based on nature. It is engaging and cultivates a healthy competitive spirit in children, encouraging not only fast walking but also a natural instinct to overtake, pursue, and score a kill. Speed is without a doubt the focus of this game, and it takes strength and endurance to endure a relentless pursuit for nine minutes at a time. Some of the competencies displayed during the course of the game include controlled sprinting, dogging, and diving. The public enjoyed it and watched exciting sports to their satisfaction, especially the physically fit children **(Sharma 2004).**

The Kho-Kho players should be able to ramp up speed as quickly as possible and execute the action quickly. The necessities of the sport dictate it. Speed, according to **Neilson (1970),** is the quickness with which a person can transfer his bodily structure from one place to another.

Kho-Kho players because the game's nature necessitates rapid running to get away from opponents and change opponents. To shrug off the competition as well as to flee, a change of course is required. A participant in Kho-Kho needs a lot of patience because they must run at different speeds for extended periods of time **(Robert 1973).**

Kho-Kho seeks out physical attributes including quickness, stamina, strength, agility, and coordination. Sports like Kho-Kho adhere to the rules of physical fitness. Kho-

Kho sport encourages young athletes to be healthy and active. Its goal is to develop a skill, not just speed, but also to obey natural rules of overtaking to develop a particular competence. There is no denying that speed is crucial to Kho-Kho and provides us the endurance to chase and catch the opponent during a battle. The amount of stamina required for this process is substantial. Although a physically fit player likes the game, a good and exciting match also appeals to the viewers.

Speed is essential for both the active chaser and the dodger in order to meet the demands of the sporting position. Occasionally, when the runner is in the middle of the field, the active chaser must spin quickly around the summit in order to attack the dodger. It is well known that Kho-Kho is a form of fast recreation. Speed is essential for both the active chaser and the dodger in order to meet the demands of the sporting position. Speed is necessary to club the runner, shock attack to take pole dive, provide judgment kho, etc. The defender must run quickly, play ring to take, provide pulpit, and execute each and every fundamental skill of speed in one way or another in order to escape the speedy energetic pursuer.

A crucial aspect of bio-motor ability is flexibility, which is the capacity of a joint or muscle to move through its full range of motion. It is an essential component of both Kho-Kho and many other sports. The Kho-Kho, pole dive, heel tap, and other crucial skills can be seen. For instance, a chaser must be able to quickly stretch his hand and leg forward to make touch with and offer aid to his team members; this needs a great level of flexibility, which would otherwise hinder him from doing so. Additionally, flexibility reduces the risk of sports-related injuries.

A player who has considerable strength and explosive leg power may not necessarily be an effective Kho-Kho player; instead, he needs to have a reasonable amount of muscular and cardiovascular stamina. Every step, the runner throws his entire body weight into the air, fighting against inertia and perhaps having to sprint in "restricted" fashion, exhausting himself too rapidly. The next requirement for the game is therefore endurance.

All of the skills and characteristics of runners stated above should be had by a chaser. In addition to these, they require unique qualities that enable their squad to score more goals quickly and effectively. To dismiss a runner in the smallest amount of time

possible, all chasers should cooperate with one another. To accomplish this goal, every chaser should contribute to the game's increased speed and refrain from giving a runner a break that can wear him out or put him in an awkward situation.

Kho-Kho needs a high degree of physical fitness since it involves sprinting, twisting, and turning. Playing this sport regularly can assist in enhancing cardiovascular health, agility, and general fitness. It is one of the best benefits of playing the Kho-Kho game.

Physical, physiological and mental fitness are crucial components of a game like Kho-Kho. A player can only play the game effectively if they are both physically and physiologically. Sports training plays an important role in improving both these factors. By performing repetitive exercises, training is a methodical procedure for enhancing your gaming skills. Training is the sum of regular exercise under the supervision of professionals. Players claim that training gives them greater tolerance for similar types of stress. The training program, which aids in the improvement of each player's specific sporting abilities, involves straining the players and teaching them how to respond to stress.

Exercise, healthy eating, and adequate rest are typically required to achieve physical fitness. It is a crucial aspect of existence. Physical fitness is now viewed as a gauge of the body's capacity to do tasks quickly and effectively, to stay healthy, to fend off hypokinetic disorders, and to respond to emergencies. It has only been about 30 years since the science of sports training emerged as a distinct field of sports science. Before this, there were various sports-related ideas and training methods. The primary sources from which the science of sports training evolved as a scientific discipline are physical education and the philosophy and methods of various prominent sports like track and field, soccer, boxing, swimming, etc.

The goal of a training program should be to increase players' athletic ability and stamina in preparation for a certain event. Different things in different professions are meant by training. In general, physical education training entails prescribed physical activity. Training aims to increase one's physical fitness. Different types of games are designed for various forms of exercise. To get the intended outcome in a training regimen, physical activity must be performed under the guidance of a professional. Initially, winning a game depended mostly on one's competence in the game, but

nowadays, both skill and physical fitness are necessary. Players are currently attending training camps to increase their physical fitness.

“Training is a complex process. Through which the player is prepared for high performance."**(Sharma, 2000).**

The ratio of each of these items will change as the construction plan moves forward. Compression conditioning for endurance will gradually change as a training season progresses, shifting from an emphasis on volume to one on power and substituting intensity for volume when calculating the total load **(Singh, 1991).**

Sports training's instructional component is brought into stark relief. When we take into account that practically all sports in performance sports require organized training to begin in childhood. Therefore, it becomes even more crucial to teach children and young people while also enhancing their athletic performance. Periodic evaluations of the athlete's performance are part of training. The difficulty of the task performance during training typically increases gradually. Training implies some kind of sustained, incremental improvement in some of the initial motions' performance output. Any training will inevitably require work. Health should be connected to training. Training is an activity plan created to help athletes develop their abilities and boost their energy levels in preparation for a certain competition **(Edward, 1984).**

Circuit Training

R. E. Morgan and G. T. Anderson created the circuit training exercise program in 1953 at the University of Leeds in England. It has been around ever since. Circuit training was created to enable individuals to exercise with others while simultaneously working out at their own intensity. A circuit would have 9 to 12 stations in the original format. Moving quickly from one station to the next while executing an exercise for a predetermined amount of time or repetitions. All of the energy systems interact during the circuit training session to allow for the performance of activities of varying intensities. As a result, during some exercises, the aerobic energy system will be more prominent, and during other exercises, the anaerobic energy system will be more prominent.

We refer to exercising in a circle as "circuit training." It is a unique form of training in which exercises are performed with or without equipment. The well-organized type of

physical exercise training is called circuit training. The number of repetitions, learner effort, time interval, etc. are all planned in advance. Circuit training's primary goal is to concurrently build muscle strength, tolerance, and proficiency. The necessary exercises are provided in a circle in accordance with the need for thorough preparation. These workouts include sprints, hops, and rolls, carrying loads over hurdles, pulling, pushing, and more. In it, the player must finish this circle in a set amount of time. These circles must be done in a higher number, either by getting more activity or by lengthening their duration.

In order to allow for appropriate recuperation, circuit training stations are typically organized so that they alternate between different muscle groups. Between stations, there should be a 30-90 second rest period, and between circuits, one to three minutes. A typical gym features a variety of workstations and strength training equipment, allowing for the formation of numerous circuits. This advantage of diversity keeps participants engaged from session to session by testing their skills.

For sports that aim to improve as many facets of physical fitness as possible, especially endurance, circuit training is a crucial form of exercise. There are typically six to twelve stations. The circuit's selection and variety of activities take into account the entire operation's continuous character. At each station, the player spends two minutes **(Matthews, 1971).**

Circuit training includes numerous stations. With the time allotted for each station, the player advances from one station to the next, typically in the set order, finishing the fitness objective at each one. Excellent for improving physical fitness (strength, power, endurance, agility, and flexibility) is the training provided by Morgan and Anderson.

In circuit training, various exercises are carried out in succession on various body regions with little break in between. The horizontal and vertical forms of circuit training are the two most fundamental. Prior to performing the subsequent exercise in a horizontal training session, one must complete all sets of the previous exercise. Prior to performing an activity a second time in vertical training, each type of exercise receives one set.

Resistance Circuit Training

The development of strength, self-efficacy, lean body mass, and the potential reduction of coronary artery syndrome risk factors have all been linked to circuit resistance training. For patients with cardio respiratory damage, circuit resistance training appears to provide a large benefit and minimal danger. These exercises may help players carry out daily tasks with stamina, efficiency, and confidence. One can greatly improve fitness level by participating in circuit resistance training activities, which depended on the balance and structure of the session.

With a little creativity, circuit training may be applied in a number of various ways. It is a method of interval training that cuts down on rest periods in between sets and workouts. It may consist solely of weight training or may alternate between short bursts of intense cardio exercise. Each exercise in a circuit-style weight-training program is performed after the other with little to no break in between. An exercise can be performed repeatedly before switching back to the initial exercise to start over, as opposed to resting in between sets. This enables optimizing workout time while decreasing rest time. In an interval circuit, a quick cardio interval is performed following each set of a weight-training activity.

Circuit weight training has been suggested and has been shown to improve strength, lean body mass, self-efficacy, and may decrease risk factors for coronary artery disease, according to **Verill et al. (1992).** By working out in brief spurts of about 60 seconds apiece, one can considerably raise their level of cardiovascular fitness. One will maintain a raised heart rate and achieve the best results if they combine an aerobic work-station with a high repetition and strength station. It saves time and improves physical attributes like strength and endurance by working both the upper and lower bodies. The advantages of circuit training can be summarized up in the phrase "maximum results in the least amount of time"*. It offers exceptional overall fitness, tone, and strength, making it arguably one of the best exercise strategies.

For patients with cardiovascular dysfunction, resistive exercise training appears to have a significant benefit and low risk. Patients may be able to execute daily strengthrelated tasks more effectively, confidently, and safely thanks to this type of training. According to studies, participating in circuit training activities can

significantly increase fitness level, depending on the structure and balance of the session.

A high-attainable result can be obtained by using an aerobic workstation with a strength station, high repetition, and individual motivation. The advantages of taking part in resistance training circuits may be summed up in a few phrases: best outcomes in the shortest amount of time. As a result, one of the best circuit resistance training exercise routines since it offers exceptional all-around strength and **fitness (Verill et al. 1992).**

A variation of the circuit known as a super circuit uses aerobic stations that may include exercises like stationary cycling, jogging in place, rope skipping, stair climbing, bench stepping, and rowing. Circuit resistance training typically consists of several circuits of resistance training with little rest in between the exercise stations.

During a circuit training session, the amount of weight that a person lifts can change between sets. A person can either begin with modest weights or progress to heavier ones (increasing pyramid) or they can begin with big weights and go back to lighter ones (decreasing pyramid). The key to circuit training is to alternate sets of the same or different exercises with short rest periods in between.

Adults can build their muscle mass and reduce their overall body fat by using resistance circuit training. Adults who engage in resistance circuit-based training simultaneously enhance their cardiorespiratory fitness and strength performance. A stronger impact on changes in body composition and strength is feasible if training load is effectively handled.

Resistance circuit training is made to produce strength training's advantages but in a much shorter amount of time. Reduced rest intervals are used in this time-saving technique to boost the metabolic, hormonal, and cardiovascular effects of resistance training. Resistance circuit training involves lifting large weights in a circuit arrangement, as the name would imply. Each session consists of three "mini-circuits" that each target a different body component.

According to a few studies, circuit-based resistance training is effective for increasing the highest levels of oxygen consumption, greatest lung ventilation, functional ability, and strength while also enhancing body composition. Circuit training is a time-

effective training method that can lead to significant improvements in physical and mental well-being. Similar recommendations have been made for high-resistance circuit training to increase strength, muscular mass, and bone mineral density in healthy, more youthful, more established individuals. The purpose of the current study is to determine the impact of circuit-based resistance training on adolescent boys' mental and physical health.

Benefits of Circuit Resistance Training

Circuit training sessions include a ton of benefits, including the ability to design a whole program using only body weight exercises, improving body composition, increasing muscular endurance, and much more. We could go on and on. However, based on our observations, the advantages of a circuit training program are those we've stated below. Resistance exercises that target several different muscle groups are included in circuit training, which also serves to increase overall strength and muscular endurance. Circuit training can assist to test your muscles and encourage growth by requiring you to execute a range of activities with short respite.

Your body continues to burn calories after strength training as it returns to its more rested condition (in terms of energy expended) with both aerobic activity and strength training. The American Council on Exercise (ACE) refers to it as "excess postexercise oxygen consumption." For adding muscle mass, resistance exercise is a fantastic alternative. Studies show that concentrating on mechanical tension and metabolic stress is the greatest method to build muscle. To see results from this kind of training program, persistence is crucial.

Your muscles can stay strong and functional with resistance training. Your muscles can assist you with simple tasks like lifting objects, opening containers, or even staying active for longer periods of time. One study found that your level of resistance training directly correlates with your level of muscle strength and endurance. Increase the amount of resistance training you undertake, either by lengthening the time you spend doing it or by doing it more frequently, if you want to develop your strength or endurance.

Hypertrophy is the term used to describe the growth in muscle size. Transient hypertrophy is the term used to describe the 'pump' one experiences after a single

exercise session. The fluid buildup from blood plasma in the intracellular and interstitial regions of the muscle is responsible for this momentary impact. Chronic hypertrophy, on the other hand, describes the growth in muscle size resulting from continuous resistance training. In the majority of training trials, increases in the cross-sectional area of muscle fibers vary from 20% to 45% **(Staron, et al., 1991).**

According to a 2017 review, performing at least one resistance training session per week, whether alone or as part of a program with a variety of workouts, can increase muscle strength by up to 37 percent, muscle mass by up to 7.5 percent, and functional capacity by up to 58 percent in frail, elderly adults. Functional capacity is linked to fall risk.

Interval Training

Interval training is a very hard form of exercise that is comparable to Sisyphus' incredibly arduous labor. Greek mythology describes Sisyphus as the king of Corinth and a cunning character. When the death god Hades came to collect him, Sisyphus fooled him and bound him. After eventually making his way out, Hades punished Sisyphus for his deception. The punishment was to push a heavy stone up a hill for all of eternity as Sisyphus. The stone would roll back down every time Sisyphus reached the top, making him have to resume his labor all over again. Anyone interested in interval training would do well to keep in mind Sisyphus' labors.

Activities that are more intermittent are a part of interval training. Alternating intervals of rather arduous work and active recovery make up this process. As opposed to working continuously, it enables the completion of more work with a heavy workload over an extended period of time **(Douga, 1987).**

"In interval training, the work should be done with sufficient speed and duration so that heart rate increases to 180 beats per minute," according to **Singh (1991).** After speaking, there should be a recovery interval, and work should resume when the heart rate drops to 120–130 beats per minute."

Exercises in interval training are performed at a high level of intensity with periods of incomplete recovery. Interval training is dependent on a number of principles, including the rate of work, the length of work and recuperation, the number of repetitions, and the type of recovery. Work should be done at a pace and for a length

of time that causes the heart rate to rise to 180 beats per minute. After this, there should be a recovery period, and work should resume when the heart rate drops to 120 beats per minute. The training load in the interval approach can be managed by repeatedly monitoring the heart rate. The key to success in interval training, according to Fox and Mathews, is using the right intensity of exercise, followed by a rest period **(Fox, et. al. 1974).**

The foundation of interval training is the idea that by breaking up intensive effort with rest breaks, more may be accomplished. A prescribed amount of work is done in a predetermined length of time for a predetermined number of repetitions during an interval training program. The athlete gets physiologically stressed and becomes fatigued numerous times during a single training session because the challenging periods of exercise are interspersed with recuperation periods. As a result, by placing an increasing amount of stress on their cardio-respiratory system, exercisers gradually build their endurance **(Novich and Taylor, 1993).**

In the continuous approach, an exercise is performed continuously over an extended period of time. In the continuous running approach, volume is high and intensity is low to medium. **Dick (2006)** states that the "continuous method" refers to a steady speed or intensity with a heart rate between 130 and 160 beats per minute and a running time of more than 30 minutes for young athletes. When using the interval training approach, the work is done comparatively quickly and with intermittent incomplete rest.

Intensive Interval Training

Intensive Interval training is a type of interval training exercise. It consists of a number of rounds that alternate between long stretches of high-intensity exercise to markedly raise heart rate to at least 80% of one's maximal heart rate and short bursts of lower-intensity exercise. Intensity Interval Training (HIIT) is a style of exercise that alternates between short bursts of high and low intensity activity. The physical components can be improved very effectively and efficiently with this kind of training.

Elite athletes have employed high-intensity interval training (HIIT) for decades. Nevertheless, it is still a training approach that has not received much attention.

Training during brief periods of time at an intensity that is close to the maximal or supramaximal is known as high intensity interval training. When an athlete reaches their VO2max, their intensity is measured as a percentage of their maximal speed.

The intensive interval method involves three to six sets of each exercise and somewhat higher resistance (50 to 60 percent) for shorter intervals (on average 30 seconds). The authors don't specify a goal heart rate for this technique but do say that the set performance needs to be explosive for each repetition. With this approach, we put less emphasis on reps and instead use time as a measuring stick **(Hartmann & Tunnemann 1995).**

High-intensity intermittent training is a type of interval training that consists of quick bursts of all-out effort followed by rest intervals that last anywhere from 20 seconds to five minutes. It is a low-volume approach for achieving improvements in aerobic power and endurance that are often linked to longer training sessions. In the lead-up to tournaments, endurance athletes should gradually introduce periods of highintensity intermittent training. Maximum oxygen uptake (Vo2max) of at least 70 ml.kg1.min-1 is a minimum criterion for an athlete to compete successfully in an endurance event **(Hawley et al., 1997).**

A form of cardiac training called high intensity interval training (HIIT) involves alternating short, highly intense intervals with longer, slower intervals to recover. Athletes have employed this kind of training to enhance performance, but research has also shown that it offers advantages for regular exercisers. HIIT training enhances the muscles' capacity to burn fat while also enhancing performance. A normal HIIT workout contains a 2:1 ratio, which means your recovery intervals are twice as long as the work intervals, and lasts 20 to 30 minutes on average. A set of five to ten highintensity sprints lasting 30 to 60 seconds and working at Level 8 to 9 on this scale of perceived exertion might serve as an example **(Waehner, 2010).**

Elite athletes have employed high-intensity interval training (HIIT) for decades. Nevertheless, it is still a training approach that has not received much attention. Training during brief periods of time at an intensity that is close to the maximal or supramaximal is known as high intensity interval training. As a proportion of the

speed at which the athlete reaches maximum aerobic power (vVO2max), intensity is calculated.

When compared to conventional endurance-based training methods, the available evidence demonstrates that HIIT is an effective and time-efficient training paradigm for the development of aerobic power. As a result of the numerous physical, tactical, and technical issues that need to be addressed in a short amount of time during open-loop team sports, training time is frequently constrained. This is especially true in a youth development program where learning and progress for the future are prioritized over a strong focus on results. Any training methodology used at the performance development level must be effective, time-efficient, and have a favorable influence on performance. Elite adult athletes who frequently participate in endurance sports are frequently favored in research in these areas. Therefore, additional research into the application of HIIT training with developing athletes to increase workload and aerobic power in team sports matches is necessary **(Morgan & Williams, 2009).**

Benefits of Intensive Interval Training

Although HIIT can aid in reducing body fat, boosting strength and endurance, and improving health outcomes, it is not always superior to other workout types. Its key value is that it incorporates rest periods and can produce comparable fitness and health benefits in a shorter amount of time.

Neranoch, et al. (2023) draw the conclusion that high-intensity interval training had some favorable effects on cardiopulmonary function and propose using short-term high-intensity interval training to enhance football players' forced vital capacity performance. This discovery can be used in the future to strengthen the respiratory muscles. The High Intensity Interval Training (HIIT) workout developed by **Fajrin et al. (2018)** is meticulously planned and executed. Increased explosive power, speed, and agility as a result of high-intensity interval training (HIIT). **Stankovic and others (2022)** conclusion that the athletes who participate in team sports benefit from HIIT programs, independent of the kind, in terms of VO2max, RSA, change of direction speed, speed, explosive strength of the lower limbs, and body composition. HIIT has benefits in both the preparation period, when physical performance is elevated to a higher level, and in the competing period, where it may be maintained, regardless of

the level of training or competitive experience. Additionally, it is crucial that coaches use HIIT techniques to prepare their teams and modify the type of HIIT performed based on the season. **Ruo-chin Lin (2020),** investigated "the cardio-respiratory fitness and agility in badminton players after two weeks of high-intensity foot work interval training." This study came to the conclusion that a 2-week HFIT program had similar advantages for VO2 Max. Researchers recently conducted the first direct comparison of intervals based on heart rate (HR) versus intervals based on power **(Swart et al., 2009)**. In that study, Swart et al. discovered that both kinds of interval training were effective in raising physiological fitness levels and performance in experienced cyclists. They did not, however, demonstrate the superiority of any approach. The relative efficacy of HR versus power-based interval training in recreational cyclists has not yet been studied.

Need of the Study

All Kho-Kho players today are faced with multiple challenges to develop the necessary speed, stamina and technical skills of the game. Techniques and skills of every player depend entirely on speed, aerobic and anaerobic endurance, abdominal strength and stride length. Although there are a variety of training techniques that might help Kho-Kho players increase their speed and endurance levels.

The skills in the game, such as sitting, chasing, turning, and diving, require more strength, endurance, and speed. Numerous studies' findings indicate that circuit training and interval training significantly enhance Kho-Kho players' physical and physiological characteristics. More studies have been done on Kho-Kho players to determine the effects of interval training, weight training, speed training, and endurance training; however, no studies have been done employing circuit-based resistance training and intense interval training. As a result, the researcher decided to focus on that research.

1.2 Statement of the Problem

The purpose of the study was to find out the effect of resistance circuit training and intensive interval training on selected physical and physiological variables of Veer Narmad South Gujarat University Kho-Kho players.

1.3 Objectives of the proposed study:

Following objective for the proposed study:

1. To assess the level of physical variables (speed, endurance, agility, flexibility and explosive power) and physiological variables (resting pulse rate, vital capacity and blood pressure) in Kho-Kho players.
2. To identify the outcome of resistance circuit training and intensive interval training on selected physical variables of Kho-Kho players.
3. To determine the comparative effect of resistance circuit training and intensive interval training on selected physiological variables of Kho-Kho players.
4. To find out which experimental training were more effective in improving the selected physical and physiological variables of Kho-Kho players.

1.4 Delimitation

1. Ninety (N=90) male Kho-Kho players from different colleges of Veer Narmad South Gujarat University, Surat were selected at random for this study.
2. Subjects were between the ages of 18 and 25 years.
3. The subjects were divided at random into three groups of thearty each (n=30). Group I underwent resistance circuit training, Group II underwent Intensive Interval training and Group III acted as Control.
4. The following dependent variables were delimited in the study.
   - **Physical Variables:**
     - Speed
     - Endurance
     - Agility
     - Flexibility
     - Explosive Power
   - **Physiological Variables:**
     - Resting Pulse Rate
     - Vital Capacity
     - Blood Pressor
5. The training period was delimited to ten weeks.

1.5 Limitation

1. The student had diverse socioeconomic backgrounds, nutrient preferences, behaviors, and disparities in how they interacted with their hearing peers. Which the researcher was unable to control and which might have had an impact on the performance was regarded as one of the limitations.
2. No special motivation technique was used while collection of pre and post test data which might affect the performance of the basketball players is another limitation of this study

1.6 Hypothesis

- There would be significant improvement on selected physical variables due to the effect of resistance circuit training and intensive interval training on KhoKho players.
- There would be significant improvement on selected physiological variables due to the effect of resistance circuit training and intensive interval training on Kho-Kho players.
- There would be significant differences on selected physical and psychological variables due to the effect of resistance circuit training and intensive interval training.

1.7 Definition and Explanation of the Terms Training

Training is a unique method of preparing athletes based on scientific principles with the goal of enhancing and sustaining higher performance capacity in a variety of sports.

Circuit Training

It is a series of exercises that are performed a progressive manner, doing a prescribed allocation of work at each station.

Resistance Circuit Training

It's a combination of six or more exercises performed with short rest periods between them for either a set number of repetitions or a prescribed amount of time with resistance.

Interval Training

A form of exercise known as interval training involves a sequence of high intensity sessions separated by rest or relaxation periods.

Intensity Interval Training

Intensity interval training involves alternating short bursts of intense or explosive anaerobic exercise with quick rest periods until tiredness sets in.

Speed

It is the competence to carry out motor functions under predetermined conditions in the shortest amount of time.

Endurance

Endurance is the capacity to carry out tasks in a sport quickly and satisfactorily under conditions of fatigue.

Agility

The ability to change directions swiftly and successfully while travelling at almost full speed is known as agility.

Flexibility

Flexibility is the capacity to move one's body and its components over a wide range of motion without causing damage to the joints and muscle attachments.

Explosive Power

Explosive Power can be characterized as a person's ability to engage maximum muscle contraction at the swiftest rate of speed.

Resting Pulse Rate

Resting pulse rate is the phrase for the measurement of heart rate when an organism is in complete physical and mental rest.

Vital Capacity

The amount of air expelled from the lungs after a deep inspiration.

Systolic Blood Pressure

The greatest arterial pressure that may be felt at the blood vessel walls during a cardiac cycle is called the systolic blood pressure.

Diastolic Blood Pressure

The lowest arterial blood pressure, known as diastolic blood pressure, is experienced at the blood vessel walls during the cardiac cycle.

1.8 Significance of the Study

- The findings of this study could be used to determine the impact of resistance circuit training and intense interval training on particular physical and physiological characteristics of kho-kho players.
- The results of this study may generally help physical education teacher, coaches, and experts evaluate the athletes' performance level.
- The study's findings would useful in identifying talent and choosing students for advanced Kho-Kho training.
- This study provides a blueprint for game coaches to create a group training program that could improve players' technical and physical skills.
- This study might aid future researchers in selecting a relevant problem.

CHAPTER – II

REVIEW OF LITERATURE

2.1 Review of related literature:

The research researcher endeavored to provide an overview of the pertinent literature, potentially aiding in comprehending the fundamental patterns and highlighting the significant findings of the proposed investigation. The studies that the investigator has used are the only ones included in the current review because it is based on the body of literature that is currently available for the topic. In order to give the background information required to assess the study's significance in this chapter, every relevant literature that the researcher has been in possession of has been supplied.

2.2 Resistance Circuit Training

S. Mohan et. al. (2023) study was to determine how high school level kho kho players' physical and physiological variables were affected by sophisticated training with game-specific training. Sixty student-athletes from Tirupur district schools in Tamil Nadu, who range in age from 15 to 17, were chosen as subjects in order to accomplish this goal. Four equal groups of fifteen participants each were formed from the chosen subjects: the resistance training group, the plyometric training group, the complex training group, and the control group. All groups had 8-week training durations. Speed, agility, lower extremity physiological variables, and upper extremity physiological variables, respectively, were used to test the chosen fitness characteristics. To determine if there were any significant differences between the groups, ANCOVA was performed. The study's findings demonstrated a substantial difference between the sophisticated training group and the control group in terms of strength endurance and agility. The "t" ratio, which assessed for significance, was used to achieve this. This study could be done on people of different ages and sexes. A thorough analysis of different sports and games can be done.

Belli et al. (2022), study is to look into how competitive amateur soccer players' physical performance is affected by circuit training combined with a basic workout regimen. For eight weeks during the off-season, there was training twice a week. The following tests were used for pre- and post-testing: 19 adults in all were split into the experimental group and the control group. While the CG reported no significant differences between the pre-test and post-test comparison, the EG shown substantial gains in lower and upper body strength, core strength, and balance. Despite the study's limitations, our encouraging findings indicate that circuit training combined with core

workouts appears to be a successful method for enhancing performance in adult soccer players.

Princy and Mahaboobjan (2022) determine the impact of circuit training on particular physiological elements. among female players of kho-kho. Thirty female KhoKho players from various departments at Bharathidasan University in Tiruchirappalli were chosen to carry out the study's objectives. The subjects' ages range from 21 to 23. The chosen participants were split into two equal groups at random. groups: group II, the control group, and group I, the experimental group. Each group has 15 participants. Attempting Group Six days a week for six weeks, I participated in circuit training in the only morning secessions. Group II control group receives only the same instruction as the ordinary daily activities. Pre- and post-test data have been collected to analyze the physiological characteristics, such as resting pulse rate, breath holding time, and Vo2 max. Analysis of covariance (ANCOVA) was used to statistically examine the acquired data. For each case, the level of significance was set at 0.05 of confidence. When compared to the control group, all of the selected physiological components significantly improved in the experimental groups.

Mane (2021) study was to examine the effects of the training regimen on a few key physiological factors in players of the Kho Kho sport. To accomplish the goal, players were chosen from D.B.ACS College in the Bhokar Dist.As test subjects, they were split into two groups: the experimental group and the control group. The Control Group received no particular training exercises. Circuit training was given to the experimental group for six weeks. Blood pressure (both systolic and diastolic), respiration rate, and pulse rate were the criteria variables. All of the dependent variables were evaluated both before and after the six-week training period. Discovering the posttest mean difference between the groups was made easier with the help of covariance analysis. Systolic blood pressure in the experimental group significantly decreased (CD=0.49, P0.01), whereas diastolic blood pressure did not significantly alter (CD=0.09, P>0.05). respiration rate significantly decreased (C.D. = 0.48, P 0.01), as well as pulse rate significantly decreased (C.D. = 0.52, P 0.01). In all factors, the Control Group did not exhibit any noteworthy differences.

Jadhav's (2020) research was to determine how athletes' physical fitness levels were affected by circuit training. 40 male varsity athletes from Rajarshishahu College Pathri, whose ages varied from 18 to 25, were chosen at random as subjects for the current study (n = 40). The randomly chosen subjects (n = 20) were divided into two equal groups with twenty each: the circuit training group (CTG) and the control group (CG). For six weeks, one session each day, the experimental group (circuit training) adhered to their individual experimental training. Beyond routine activities, the control group received no special instruction. Prior to and following the six-week training period, data were gathered. The differences between the two groups were computed using the independent t-test. The 0.05 level of significance was chosen. Based on the findings, it was determined that circuit training significantly improved the athletes' speed, explosive leg strength, endurance, flexibility, and agility between the pretest and posttest for the experimental group.

Muniraj (2020) examined the effects of a circuit training program using only one's own body weight on a number of schoolboys' physiological and physical characteristics. During the academic year 2014–2015, thirty (30) physically active boys were chosen at random from G. S. Hindu Higher Secondary School in Srivilliputtur, Virudhunagar Dist, Tennessee, to participate in the study. They were between the ages of 15 and 17. The chosen subjects were split into two equally sized groups, training (TG) and control (CG), totaling fifteen (15). The training group underwent three days per week for 12 weeks of own body weight circuit training, whereas the Control group received no treatment. The t test was used to examine and compute the collected data. According to the study's findings, the training group's physical and physiological characteristics (such as resting heart rate and breath holding time) were significantly altered by own body weight circuit training.

Vyas (2020) The purpose of the current study was to ascertain the motor skills of male school kabaddi and kho-kho players in the Jaipur district. In total, 50 male players from the Jaipur district who played kabaddi and kho kho between the ages of 14 and 18 were selected for the study. To compare muscular endurance, measure muscular strength, examine strength differences between kabaddi & kho-kho, assess agility in kabaddi & kho-kho, and determine speed motor ability variable in kabaddi and kho-kho players, only motor skills were employed. Using a random selection

technique, the district of Jaipur's male kho kho and kabaddi players. Subjects, variables, criterion measures, data collection, experimental design, test administrations, and statistical methods for data analysis have all been chosen. the investigation was to see that there was significant difference between the (muscular endurance, muscular strength, explosive strength, agility speed, cardiovascular endurance among school male players of jaipur district). There will be significant impact of training programme on the motor abilities among kabaddi and kho- kho school male players.

Kumar's (2019) research was to determine how a 4-week circuit training program affected the motor skills of hockey players. The study's participants were 30 black male hockey players between the ages of 14 and 17, who participated in at least one competition at the zonal level in the Distt. Kurukshetra, Haryana. To gather information, the AAPHER Youth Physical Fitness Test was used. The data were analyzed using 't' tests and descriptive statistics. For the standing long jump, the 600-meter shuttle run, the sit-up test, and the 50-meter dash of hockey players, there were significant variations between the pretest and the post-test.

Velmurugan's (2019) study was to determine how resistance training affected the physiological parameters of adolescent males who played kabaddi. 30 teenage boys who play kabaddi and vary in age from 14 to 17 will be chosen from Vidya Mandir Higher Secondary School in Ariyalur to carry out the study's objectives. The subjects (n=15) were divided into two equal groups at random. With 15 subjects in each experimental and control group, all the subjects were split into two groups. Twelve weeks of resistance training were conducted by Group I, whereas Group II served as the control group and just engaged in ordinary exercise. The physiological factors, including vital capacity, resting heart rate, and breath holding. had been chosen as the dependent variables. For the pre- and post-test random group design, this study was conducted. The difference between the mean soft two groups was ascertained using the dependent "t" test. to determine whether the experimental and control groups differed significantly from one another. Due to the effects of twelve weeks of resistance training, it was also determined that there was a substantial difference in vital capacity, resting heart rate, and breathe holding time between the experimental

and control groups. The chosen criterion variables were not improved by the control group.

Vyas (2019) examine the physiological characteristics of the male school kabaddi and kho-kho players in the district of Jaipur. In total, 50 male school athletes from the Jaipur district who play kabaddi and kho kho between the ages of 14 and 18 were selected for the study. Male players of kabaddi and kho-kho were evaluated physiologically for blood pressure, heart rate, and vital capacity. Different criteria were employed for various physiological tests, including blood pressure, pulse rate, and vital capacity. The 't' test was utilized as a stratification tool, and the level of significance was established at 0.05. The findings indicate that schoolboy male athletes' blood pressure, pulse rates, and vitality of activity were much higher. The study demonstrates that players' physiological parameters, such as systolic and diastolic blood pressure, resting heart rate, and vital capacity, all improved. Male players of kabaddi and kho-kho had lower resting heart rates.

Balasing and Night's (2018) study was to determine the impact of circuit and interval training on kabaddi players' VO2 max. 45 male kabaddi players from Tamil Nadu's Anna University Zone V universities were chosen. They were split into three groups: group I received interval training, group II received circuit training, and group III received control. For a period of 12 weeks, the two groups tested out circuit training and interval training, respectively. By using the analysis of covariance (ANCOVA), the data obtained from the three groups before and after the test were statistically evaluated to identify any significant differences. Scheffe's test was used as a post hoc test to identify any paired mean difference because there were three groups involved. The threshold for statistical significance was established at 0.05 in each example. The VO2 max of kabaddi players increased significantly after twelve weeks of circuit and interval training.

Kodgire (2018) study was to compare the effects of the SAQ and CIRCUIT training programs on specific physical fitness metrics in male school-level kho-kho players. (14 to 16 years old) Three groups of 90 players from the Nanded city were chosen at random. SAQ training in Group A. Circuit training in Group B. Control group. Exp. Group A received a circuit training program of chosen exercises whereas Group B

received a SAQ training program of chosen exercises. These training courses were delivered over the course of eight weeks in total. For testing the hypothesis, the following criteria measures were used. The unit of measurement for the speed was 1/100 second over a distance of 50 yards. Standing broad jumps were used to gauge the leg's explosive power, and meters served as the measurement's measurement unit. Bent knee setups were used to assess the muscular strength endurance, and counts served as the measuring unit.

Muneer et al. (2018) 45 University-level Women with a Purpose The Department of Physical Education and Sports at Pondicherry University, Bharathidasan Women's College in Pondicherry, and Mary Matha Arts and Science College in Manantthavady selected players for the Kho-Kho competition who had completed three years of training. They were divided into three groups: Experiment Group 1 (N=15) Playometric Training Group (Ptg), Experiment Group 2 (N=15) Circuit Training Group (Ctg), and Control Group (N=15) (Cg). Their age group ranged from 17 to 22 years. The experimental group received a resistance training program created by the researcher for six weeks (three times per week). Plyometric training was given to the Experiment Group 1, circuit training was given to the Experiment Group 2, and no specific training was given to the Control Group. Speed, endurance, agility, leg endurance, and explosive power were the performance-related variables chosen for the study. Additionally, they evaluated players' Kho-Kho skills both before and after the six-week training period. The three groups of the dependent variables were compared using the analysis of covariance to determine whether any significant differences existed. The study showed that plyometric training significantly improved the performance-related variables of university-level female khokho players.

Thiumalaisamy (2018) University men's basketball players were chosen as the subjects, and the effects of specific yoga asanas and circuit resistance training on specific physical, physiological, and psychological variables were chosen. Additionally, 45 male students from Alagappa University were chosen as the subjects. They were chosen by random sampling techniques and ranged in age from 18 to 25 years. 45 male students were chosen for this investigation. Three groups—experimental group I, experimental group II, and control group—were formed from the chosen participants. Yoga techniques were purposefully programmed to affect

experimental group I and circuit resistance. The control group and experimental group II did not receive any experimental treatment during training. After the twelve-week study period, post-test results for all three groups were collected. The discrepancy between the preliminary and final results for the circuit resistance and yogic group In this study, training group, physical, physiological, and psychological variables were used. In this study, "co-variance" analysis was used. The confidence level for the level of significance was set at 0.05. The significant difference between the matched means was determined using the Scheffe's post hoc test. Circuit resistance training is a more effective on specific physical, physiological, and psychological variables.

S. Sumathi (2017) among kho-kho players, the impact of circuit training on specific strength metrics. Thirty kho-kho players from Sri Sarada College of Physical Education for Women in Salem, Tamil Nadu, were chosen at random as subjects for the current study; their ages ranged from 18 to 25. The participants were split into two equally sized groups. The study was created using a pre- and post-test and a true random group design. The 30 participants were divided into two equal groups of 15 kho-kho players each at random. In a similar way, the groups were given the labels "control group" and "experimental group." The post-tests were administered after the training group had completed its six weeks of instruction. Shoulder strength, upper body strength, explosive power, and anaerobic power tests were conducted on the participants both before and after the trial. All subjects provided the variable that would be used in the current investigation before they were given the appropriate treatments. The pre-test assumption was made. They were retested on all the variables utilized in the current study after the course of treatment, just as they were in the pre-test. We considered this test to be a post-test. The data were processed using the following statistical techniques in order to address the defined hypothesis and study goals. The treatment effect of the training programs on all the study's variables was examined using analysis of covariance (ANCOVA). It was found that the selected strength metrics of kho-kho players had greatly improved after six weeks of circuit training.

Singh (2017) effect of a 4-week circuit training program on kho-kho players' motor skills. The study's participants were 30 male kho-kho players between the ages of 14 and 17 who have competed at least in zonal level tournaments for schools in Rohtak.

The AAPHER youth physical fitness test was used to get the information. To analyze the data, descriptive statistics and the 't' test were used. Pre-test and post-test results for the standing broad jump 600 meters, shuttle run, sit-ups, and 50-meter dash of Kho-Kho players all showed significant differences.

Kumar (2016) sought to determine how circuit training affected a few specific motor skills in male university students. At Guru Nanak Dev University in Amritsar, Punjab (India), the Department of Physical Education (T) chose 60 boys ranging in age from 18 to 25 as study participants. The participants were purposefully split into two groups: experimental Group-A (N1=30) and control Group-B (N2=30). The study's goal and procedures were explained to each volunteer. The participants in Group-A underwent an 8-week Circuit Training Program. Group B served as the control group, participating in only the standard schoolwork and no additional training. The statistical significance of the pre- and post-mean differences for each age group was determined using the T-test. At a level of confidence of 0.05, the significance level was chosen. According to the study's findings, circuit training greatly increased the subjects' speed, leg power, arm power, and agility.

Raju and Babu (2016) to determine how circuit training affects football players' ability to build endurance. Twenty male football players from Andhra University made up the sample for this study, of which 10 were in the experimental group and 10 were in the control group. The experimental group received the circuit training on alternate days, or three sessions per week, while the control group received the general training for six weeks. The circuit training consists of six to ten strength exercises that are performed one after another. Examples include squat jumps, medicine ball throws, sit-ups, steps-ups, hopping shuttles, skipping, and sit-ups. Cooper tests lasting 12 minutes were used as pre- and post-tests to gauge the endurance of the experimental group and the control group.

This study demonstrates that the experimental group's endurance performance improves as a result of circuit training, while the controlled group's endurance performance declines. It has been determined that football players' endurance will increase as a result of circuit training.

Ali and Cherappurath (2015) comparative Effect of Two Resistance Training Menu on Selected Performance Related Variables of University Level Women Kho-Kho Players. The Department of Physical Education and Sports at Pondicherry University, Bharathidasan Women's College in Pondicherry, and Mary Matha Arts and Science College in Manantthavady picked 45 university-level women Kho-Kho players who had completed three years of training for this purpose. They were separated into three groups based on age: Experiment group 1 (n=15) Plyometric training group (PTG), Experiment group 2 (n=15) Circuit training group (CTG), and Control group (n=15) (CG). Their age ranged from 17 to 22 years. Three times each week for six weeks, the researcher's resistance training program was administered to the experimental group. Plyometric training was provided to experiment group 1, circuit training to experiment group 2, and no training at all to the control group. Speed, endurance, agility, leg endurance, and explosive power were the performance-related variables that were selected for the study. Additionally, they evaluated players' Kho-Kho skills both before and after the six-week training session. Analyzing ANACOVA revealed significant differences between the three sets of dependent variables. The study found that plyometric training significantly enhanced the performance-related factors of female university-level Kho-Kho players.

In order to compare the effects of resistance training and endurance training on resting heart rate and explosive power, **Reddy (2015)** studied the effects of both strategies. Thirty (N=30) female degree college students from K.V.R.College in Nandigama, Krishna Dist, Andhra Pradesh, India, were chosen at random as subjects for this study. They were split into two equal groups, each with fifteen people (n=15). Resistance and endurance exercises were performed in series and parallel in Group I, while Group II served as the control group. Heart rate at rest and explosive power were both measured for both groups utilizing bio monitors, with explosive power expressed as a horizontal jump. The training group conducted strength and endurance training in series and parallel over a 12-week period (six weeks for series training and six weeks for parallel training), while the control group received no particular training. Researchers have found that healthy untrained women have considerably enhanced resting heart rate and explosive power both before and after training.

2.3 Intensive Interval Training

Bhomik (2023) study was to ascertain how certain training affected particular physical and physiological variables in college-level male athletes. Thirty male athletes were chosen at random from Ramakrishna Mission Vivekananda University and Maruthi College of Physical Education in Periyanaickenpalayam, Coimbatore, to fulfill the goal. The subject was between the ages of 18 and 24. The chosen participants were split into two groups, each with 15 participants: group A was the experimental group, and group B was the control group. The experimental group received specialized instruction. The following criterion factors were chosen for the physiological variables, such as breath holding duration and resting heart rate, as well as for the physical variables, such as speed, agility, and leg explosive power. Each subject's data was gathered both before and after the eight weeks of specialized training. The 't' ratio was used to statistically assess the collected data. The use of particular training has been demonstrated to significantly improve speed, agility, and leg explosive power. Additionally, it was shown that the use of particular training significantly reduces the amount of time spent holding your breath and increases your resting heart rate.

Kumar et. al. (2022) study is to assess how the National Kho-Kho players' functional mobility, balance, and agility are affected by intensive short-term functional strength training. Thirty-five male and twenty-five female National Kho-Kho players were enlisted for the study's Kho-Kho camp. The players received two weeks of strength- and balance-based training, and then data on functional mobility, balance, and agility were collected before and after the training, respectively. Both male and female Kho-Kho players showed a substantial improvement in FMS composite scores after the intervention was in place for two weeks ($p=0.001$). Balance showed a substantial improvement after two weeks of the intervention, with close eye, and dynamic for both feet, for single foot comparison. Significant changes were seen in agility as well. Illinois exam, 40-meter run.

According to Taufik et al. **(2021)**, research, circuit training and interval training both have the potential to increase VO2max capacity. We employed a quasi-experimental in this investigation. Pre-, post-, and control group designs are the method. 156 athletes from the Futsal Academy in the Indonesian city of Cianjur were included in

the sample. Thirty athletes took part in this study, and the sample was chosen using the random sampling method. The interval training group (n=15) and the circuit training group (n=15) were each given a group of the samples. 18 sessions, held three times a week for two months, comprised the study. The study's instrument was a multi-stage beep test. Analysis of variance statistics (ANOVA) were used to analyze the data using SPSS 21. According to the study's findings, they were collected from the interval training and circuit training groups, with the circuit training group's VO2max increasing by 0.63 with a value of 0.00.

Rai and Yoga's (2020) to determine how speed among male Kho-Kho players is affected by SAQ (speed, agility, and quickness) training. Thirty Kho-Kho players from the Alagappa University College of Physical Education in Karaikudi, Tamil Nadu, India, were chosen to conclude the study's reasoning. The person is between the ages of 18 and 25. The chosen subject was then divided into two identical groups, the experimental group and the control group, each consisting of 15 male students. In this study, speed was used as a criteria variable. The shortlisted candidates underwent a (50-meter dash) test to assess their speed. Prior to the training period, a pre-test was conducted, and immediately after the seven weeks of training, a post-test was conducted. The means of the pre-test and post-test data for the experimental and control groups were analyzed using the statistical approach 't' ratio. The findings showed that the criteria variable had a substantial variance. When compared to the control group, the experimental group received SAQ (speed, agility, and quickness) training on speed, which is what led to the observed result.

Bhavani et al. (2016) with an isokinetic analyzer, compare pre- and post-values for peak torque in the ankle dorsi- and plantar-flexor muscles. To compare the athletes' pre- and post-test agility scores using the Illinois T test. A quasi-experimental study method was used, and 30 female kho-kho players (n=30) were chosen at random.Players ranged in age from 18 to 25.All athletes participated in warm-up and cool-down drills.

One session each day, three days per week, for six weeks, of plyometric exercise. Agility and muscle mass at the ankle joint. The analysis's findings showed a

substantial improvement in agility and ankle muscle strength (p 0.00). According to the study, khokho players' ankle strength and agility have significantly improved.

Das and Chatterjee (2019) Pre-Post Purposive Sampling was employed for the investigation. Men competing at the state level at Kho Kho totaled fifteen (N=15), and they were evenly divided into three groups: HIITG, MIITG, and CG. Ages varied between 17 and 20. High and Moderate Intensities were recorded during the varied anaerobic capacity test and the 50-meter drill. For six weeks, three days per week, each experimental group received a distinct sort of training, while the control group received no training at all. Through the use of the Running Based Anaerobic Sprint Test (RAST), data was gathered both before and after the administration of training. Power in watts has been used to measure anaerobic capability. Levene's Test of Equality, descriptive statistics, ANCOVA, and the Bonferroni Post-hoc Test were also used for the statistical study. For each examined measure, the effect magnitude was provided with a 95% confidence level. The significance level was chosen at p-0.05. SPSS (Trial Version) was used for all of the statistical analysis. The anaerobic capacity of Kho-Kho players was significantly impacted by six weeks of high and moderate intensity interval training.

Kulothungan et. al. (2019) the study was to determine how kho-kho players' maximal oxygen consumption (Vo2 max) was affected by intense and extensive interval training. Thirty male Kho-Kho players from Annamalai University in Chidambaram, Tamil Nadu, India, were randomly chosen for the study and split into three groups of 10 players each. The subjects were between the ages of 18 and 25. Two experimental variables—intense interval training and extended interval training—were used in this investigation. Maximum oxygen uptake (Vo2 max), the chosen dependent variable, was evaluated using techniques and tools that adhered to scientific norms. For twelve weeks, three days a week, the experimental groups experienced their separate training regimens. 'ANCOVA' and the Scheffé S test were employed to statistically analyze the variations on the criteria variables. The data analysis showed that experimental treatments significantly improved some criteria variables. maximum oxygen uptake (Vo2 max) during intense interval exercise. These findings imply that interval training with varying intensities may be used depending on the player's requirements.

Murugavel and Nirendan (2019) look at how the intercollegiate men's kho-kho players' selected skill-related physical fitness factors are affected by the speed training program. Thirty male kho-kho players from the Department of Physical Education at Bharathiar University in Coimbatore were chosen to carry out the study's objectives. They were between the ages of 18 and 25. The individuals were divided into two equal groups at random (n=15). Group II served as the control group (N=15), whereas Group I underwent speed training (experimental group). For eight weeks, the experimental group received speed training three days a week (Monday, Wednesday, and Friday). Except for their usual duties, the control group received no training. Standardized tests were used to assess the subjects' cardiorespiratory endurance (12-minute Cooper's run and walk test), agility (shuttle run rest), and speed (50-meter dash). The individuals' data were statistically examined using the t ratio to determine if there had been any appreciable improvement at the 0.05 level of confidence. With the restrictions of nutrition, climate, lifestyle, and prior training, the results of speed, agility, and cardiorespiratory endurance considerably improved. The conclusions of the inquiry conducted by several specialists in the field of sports sciences and those of the current study are in agreement.

Zala (2019) to determine the impact of interval training on kho-kho players' skillrelated physical characteristics. Thirty intercollegiate kho-kho players from Gujarat's Anand and Nadiad cities were chosen at random as subjects for the current study; their ages ranged from 17 to 21. The participants were split into two equally sized groups. The 30 participants were divided into two equal groups of 15 kho-kho players each at random. The post-tests were carried out after the interval training group had trained for six weeks. Prior to and during the trial, the volunteers underwent testing for speed, speed endurance, and agility. The treatment effect of the training programs on all the study's variables was examined using analysis of covariance (ANCOVA). It was found that the selected skillrelated physical characteristics of kho-kho players had dramatically improved after six weeks of interval training.

Meeravali et. al. (2015) In this study, male high school kho-kho players' physical fitness, physiological, psychological, and skill factors were chosen in order to determine the impact of specialized training on each. Using the random sampling

approach, 30 kids from the Sri Ramakrishna Mission Vidyalaya Swami Shivananda Higher Secondary School, SRKV post, Periyanaickenpalayam, Coimbatore, Tamil Nadu, were chosen as subjects for this project. The subjects were between the ages of 11 and 14. Two groups of fifteen each were formed from the chosen subjects (N=30). The control group did not participate in any specific training; instead, they continued with their normal activities while the experimental group completed the specified training for three days per week from 4.30 to 5.30 pm for a total of six weeks. 't' ratio was calculated to findout the significance difference between the mean of pre and post test of the group. The study's findings indicate that the experimental group had received specialized instruction and had improved in terms of speed, agility, and endurance. physiological parameter, namely vital capacity, Stress is a psychological variable, and pole diving and covering are skill variables. This can be as a result of the impact of certain training.

T. Nagaraju et al. (2015) determine the impact of separate and combined strength and endurance training on the strength endurance of Kho Kho players, Sixty male kho kho players were chosen as the study's participants for the academic year 2014– 2015 from among those enrolled in various colleges associated with Acharya Nagarjuna University in Nagarjuna Nagar, Guntur, Andhra Pradesh, India. The subjects, who ranged in age from 18 to 22, were chosen at random and divided into four equal groups of fifteen each. To determine if there were any statistically significant differences between the pre- and post-test, the data obtained from the experimental and control groups on the chosen dependent variable was statistically examined using the paired 't' test. Additionally, percentage changes were calculated to determine the likelihood that particular dependent variables would change as a result of the experimental treatment. Data obtained from the four groups before and after the experiment on a few dependent variables were statistically evaluated to determine whether there was any significant difference, if any, by using the analysis of covariance (ANCOVA), in order to cancel out the original mean differences. Since there were four groups involved, the Scheffe's test was used as a post hoc test to identify any paired mean differences since the derived 'F' ratio value in the adjusted post test mean was frequently found to be significant. The study's findings indicate that the subjects' strength and endurance have increased significantly as a result of

both separate and combined strength and endurance training. The study's findings also showed improvements of 11.91% due to strength training, 20.76% due to endurance training, and 25.79% owing to combination training.

CHAPTER – III

RESEARCH METHODOLOGY

In this chapter the procedures adapted for the selection of subjects, selection of variables, criterion measures, reliability of data, design of the study, orientation of subjects, administration of tests, training programme, collection of data and statistical techniques for the analysis of the data have been explained.

3.1 Selection of Subjects

For this study Ninety (N=90) College men Kho-kho players studying in various Colleges affiliated to Veer Narmad South Gujarat University, Surat, Gujarat were randomly selected as subjects. Their age ranged from 18 to 25 years.

The subjects were divided at random into three groups of thirty each (n=30). Group - I underwent resistance circuit Training, Group - II underwent Intensive Interval Training, and Group - III acted as the Control group. All of the subjects gave permission to participate in this study after receiving complete information about the experimental methodology.

Sufficient information was provided concerning the procedures and the role of the subjects regarding the collection of data during the experiment and testing period. During the period of the experiment and testing, subjects had the option of withdrawing their consent if they encountered any problems. However, there were no research dropouts, and all of the willing participants cooperated well during the whole investigation.

3.2 Selection of Variables

The following dependent and independent variables were selected in accordance with the opinions of qualified experts in physical education and in accordance with the relevant research review:

I. Depended Variables:

- **Physical Variables**
- Speed
- Endurance
- Agility
- Flexibility
- **Physiological Variables s**
- Resting Pulse Rate

- Vital Capacity
- Blood Pressure (Systolic and Diastolic)

II. Independent Variables:

- Resistance Circuit Training
- Intensive Interval Training

3.3 Criterion Measures

Following a review of the literature and consultation with the expert, the following parameters were selected as the study's criterion measures.

Table 3.1 : Criterion Measure

No	Variables	Test	Units of Measurement
Physical Variables			
1.	Speed	50 M Dash Test	$1/100^{th}$ of a second
2.	Endurance	Coopers 12 Minutes Run / Walk	Distance Covered / Meters
3.	Agility	Illinois Agility Test	$1/100^{th}$ second
4.	Flexibility	Sit and Reach Test	In Centimetre
5.	Explosive Power	Standing Broad Jump	In meter
Physiological Variables			
1.	Resting Pulse Rate	Digital Heart Rate Monitor	In beats per minute
2.	Vital Capacity	Digital Dry Spirometer	In litter
3.	Blood pressure (Systolic and Diastolic)	Automatic Digital Blood Meter	Millimetres of mercury (mm Hg)

3.4 Reliability of Data

The reliability of data was ensured by establish the instrument reliability, tester's reliability and subject reliability.

3.4.1 Instrument Reliability

The researcher tested the equipment's reliability using a variety of devices, including a stopwatch, measuring tape, clapper, cone, sit-and-reach box, digital heart rate monitor, and digital dry spirometer. Each variable is recorded, and the equipment

have also been calibrated with Standard units. All the instruments were in good functioning order inside. Its calibration has been examined and confirmed to be accurate enough to fulfill the study's aims.

3.4.2 Tester Competency

The researcher went through several practice sessions on the correct examination method to make sure he was familiar with the operating technique of the test. In this study, the investigator took measurements of physical variables with aid from the Director of Physical Education, working in various colleges in the south Gujarat region and physiological variables were assessed by Dr. P.R. Ramawat (M.D. Medicine).

3.4.3 Reliability of the Data

Reliability was established through a test and retest method by using ten (n=10) subjects at random. All the dependent variables selected in the present study were tested twice for the subjects by the same personnel under similar conditions. The Pearson correlation coefficient was used to find out the reliability of the data and the results are presented in Table - 3.2.

Table 3.2 : Correlation of Test-Retest Score

Sr. No	Variables	Reliability Co-efficient
1.	Speed	0.80*
2.	Endurance	0.79*
3.	Agility	0.82*
4.	Flexibility	0.81*
5.	Explosive Power	0.83*
6.	Resting Pulse Rate	0.80*
7.	Vital Capacity	0.83*
8.	Systolic Blood Presser	0.78*
9.	Diastolic Blood Presser	0.80*

***Significant (p < 0.01) N-10 r – 0.01 (08) = 0.765**

3.4.4 Subject Reliability

All subjects received a thorough explanation of the exercises and test procedures prior to the test's administration to ensure that they understood them and that they worked well together to produce accurate test results. Prior to the gathering of actual data, subjects are pre-tested. a training course set up under the researcher's direct supervision.

3.5 Design of the Study

To determine the effects of resistance circuit training and intensive interval training on physical and physiological variables, a pre-test-post-test randomized group design with two experimental groups and one active control group was used. Selected ninety subjects were divided at random into three groups of thirty each (n=30). Group - I underwent resistance circuit Training, Group - II underwent Intensive Interval Training, and Group - III acted as the Control group. The experimental groups were trained for a period of eight weeks. The training sessions were conducted three alternate days a week. Measurement of all the variables were taken for all the groups before and after the experimental period of eight week.

3.6 Orientation to the Subjects

To ensure their sincere effort, the researcher met with subjects, experts, and other technical staff members in physical education. He explained the significance and goal of his research. To dispel any scepticism or uncertainty regarding the effort and physical exertion that went into making this research successful, the test technique was also thoroughly explained to the participants. The investigator gave the subjects complete assurances of their true and enthusiastic support. In the sake of this scientific investigation, subject-matter experts and other certified authorities have voluntarily consented to offer their full support and assistance.

3.7 Training Programme

To achieve the purpose of the present study, training programs namely resistance circuit training and intensive interval training were designed by the researcher with the help and guidance of research supervisors, sports training experts and coaches. Resistance circuit training and intensive interval training have separate training plans with corresponding levels of difficulty. When developing training plans, both

individual characteristics and the fundamentals of sports training, such as load progression and specificity, were taken into consideration.

Experimental group during the training period; they followed their respective training program. Group - I underwent resistance circuit training and group - II was given intensive interval training, for three alternate days in a week for eight weeks under the careful supervision of the investigator. The control group - III did not participate in any specific training except your regular schedule.

The resistance circuit training and intensive interval training, which included 10 minutes prior warming up and 5 minutes relaxation procedure after training programme for three days per week for 08 weeks. The training sessions were held between 6.30 to 8.00 in the morning. The length of the training intervention for this study was based on the fact that eight weeks has been shown to be sufficient to provide significant changes in college male students. The detailed procedures of these three training programs were dealt with in detail.

3.7.1 Resistance Circuit Training

Resistance circuit training programs consist of series, usually 08-10, of resistance exercises for different body parts. The external resistance can be dumbbells, barbells, resistance tub, medicine ball or any other object that causes the muscles to contract. Resistance circuit training Group – I was gone for resistance circuit training exercises for three days in a week (Monday, Wednesday and Friday) for total eight (08) weeks.

Week	Duration of time	Workload (1RM)	Set	Rest between exercise	Rest between set
1	30 sec	50%	1	15 sec	-
2	30 sec	50%	2	15 sec	2 min
3-4	35 sec	60%	2	20 sec	2 min
5-6	40 sec	65%	2	25 sec	3 min
7-8	45 sec	70%	2	25 sec	3 min

- This workout was including exercises with free weights, weight machines, resistance bands, own body weight, medicine balls and weighted bags.

- Step up, Squat, push up, sit ups, lunges, leg press, Leg extension, hip extension, heel raise, bench press, shoulder press, barbell biceps curl, crunches, planks, medicine ball twisting etc.

3.7.2 Intensive Interval Training

In intensive interval training; the exercise was done at relatively higher intensity with intervals of incomplete recovery. With these the intensive interval training program was composed for 40-60 minutes per session which includes ten minutes prior warm-up and five minutes of warm down. Further the training program was implemented to the subjects on three alternate days (Tuesday, Thursday, Saturday) of a week. The training schedule with the 70% of intensity of their maximum heart rate for first two weeks. After every two weeks of training periods the intensity was increased by 5%.

Week	Days	Schedule	Intensity	Set	RR	RS
1-2	Tuesday	4x40 m 5x30 m 5x20 m	70 %	1	Active Reset	2 min
	Thursday	2x100 m 2x150 m 1x200 m		1	Active Reset	2 min
	Saturday	4x50 m 4x40 m 4x30 m		1	Active Reset	2 min
3-4	Tuesday	4x40 m 5x30 m 5x20 m	75 %	2	Active Reset	2.30 min
	Thursday	2x100 m 2x150 m 1x200 m		2	Active Reset	2.30 min
	Saturday	4x50 m 4x40 m 4x30 m		2	Active Reset	2.30 min

Week	Days	Schedule	Intensity	Set	RR	RS
5-6	Tuesday	4x50 m 5x60 m 5x70 m	80 %	2	Active Reset	3 min
	Thursday	2x150 m 2x200 m 1x300 m		2	Active Reset	3 min
	Saturday	3x70 m 4x75 m 4x80 m		2	Active Reset	3 min
7-8	Tuesday	4x60 m 5x70 m 5x80 m	85 %	2	Active Reset	3 min
	Thursday	3x150 m 2x200 m 1x400 m		2	Active Reset	3 min
	Saturday	5x70 m 4x75 m 3x80 m		2	Active Reset	3 min

***Active Reset** – (Ex. 30 m run/30 m waking)

***RR** – Rest between Repetitions

***RS** – Rest between Set

3.8 Administration of the Tests

The investigator clearly stated the purpose of the investigation to the subjects and provided directions on how to do each test one at a time in order to analyze the physical and physiological factors.

Every experiment was demonstrated by the researcher, who also answered any questions the subjects had. To get relevant findings, the test results were tallied and statistically processed. Throughout the instruction and test administration periods, the individuals were very engaged and cooperative.

Each test was demonstrated by the investigator and doubts of the subjects were clarified. The scores obtained in each test were tabulated and statistically calculated to arrive at meaningful conclusions. Subjects were highly cooperative throughout the training period and the test period.

3.8.1 Physical Variables

3.8.1.1 Speed

Purpose: In order to measure the individuals' speed.

Equipment: Measuring tape, starting clapper and stopwatch

Procedure: At a distance of 50 meters, two lines (the start and finish lines) were drawn. With a standing start, subjects were lined up behind the starting line. At the "Ready" and "Clap" signals, the players begin a 50-meter run. One trial is all that is permitted.

Scoring: Using a stopwatch, the time it took the runner to cross the finish line after the run's start signal was measured to the nearest hundredth of a second.

3.8.1.2 Endurance

Purpose: To measure cardio respiratory endurance.

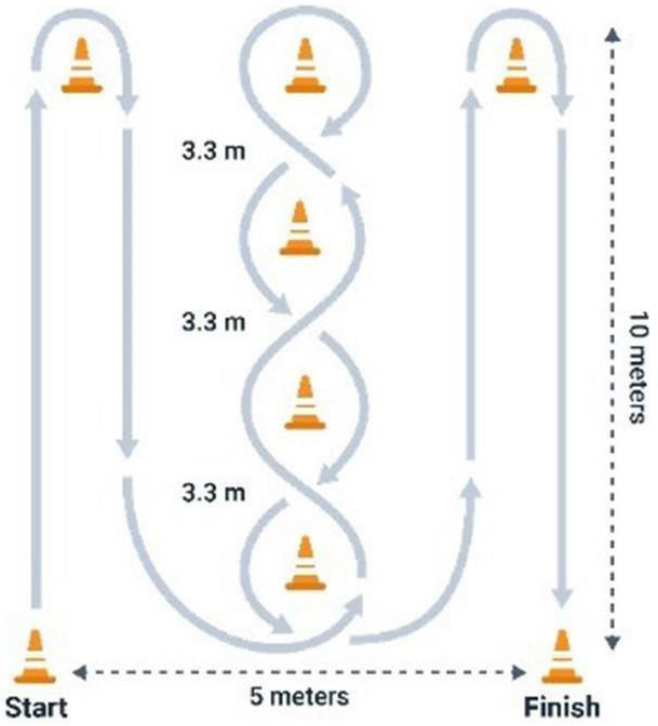
Equipment: 200 m running track, stop watch, marking cones and score sheet.

Procedure: On a 200 m track, Cooper completed a 12-minute run/walk test. At regular 10-meter intervals, the track's inner lane was marked. The subjects were instructed to line up behind the starting line, and when the word "ready, go" was given, they either started to run or walk. Subjects were instructed to cover the greatest distance possible by running or walking in 12 minutes. The eleventh minute of the test came to an end, and the subjects were notified that only one minute remained. The individuals halted when the whistle blew to signify the end of the twelve minutes so the investigator or his assistant could measure the distance covered. **Scoring:** Total distance covered was measured in meters.

3.8.1.3 Agility

Purpose: The length of the course was 10 meters and the width (distance between the start and finish points) was 5 meters. Four cones were used to mark the start, finish and the two turning points. Another four cones were placed down the centre an equal distance apart. Each cone in the centre was spaced 3.3 meters apart. Subjects should

lie on their front (head to the start line) and hands by their shoulders. On the 'Go' command the stopwatch was started, and the athlete got up as quickly as possible and ran around the course in the direction indicated, without knocking the cones over, to the finish line, at which the timing was stopped.



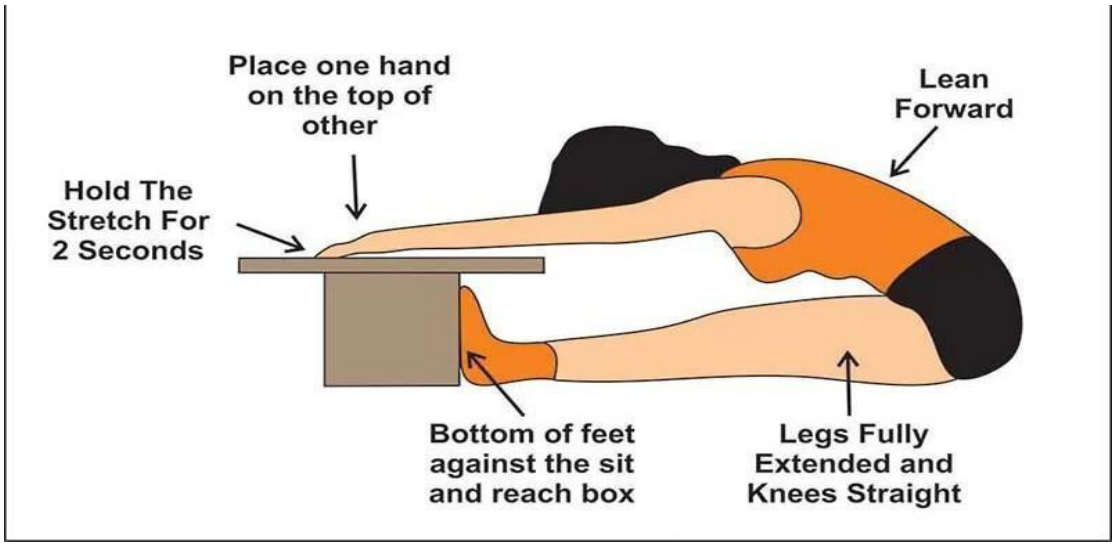
3.8.1.4 Flexibility

Purpose: The test was to measure the Flexibility of the subjects.

Equipment: Sit and Reach Box

Procedure: Sit on the ground with your legs straight ahead for this test. Take off your shoes. The box is pressed flat against the bottoms of the feet. The tester can help by holding one leg down while the other is locked and forced flat to the floor. The individual extends as far forward as they can along the measuring line with their palms facing down and their hands stacked or placed side by side. Make sure that both hands are at the same level and are not extending further than the other. The patient reaches out after a few practices reaches and maintains that position for at least one to two seconds while the distance is measured. Verify that there are no jerking motions.

Scoring: The measurement was recorded in Centimetre.



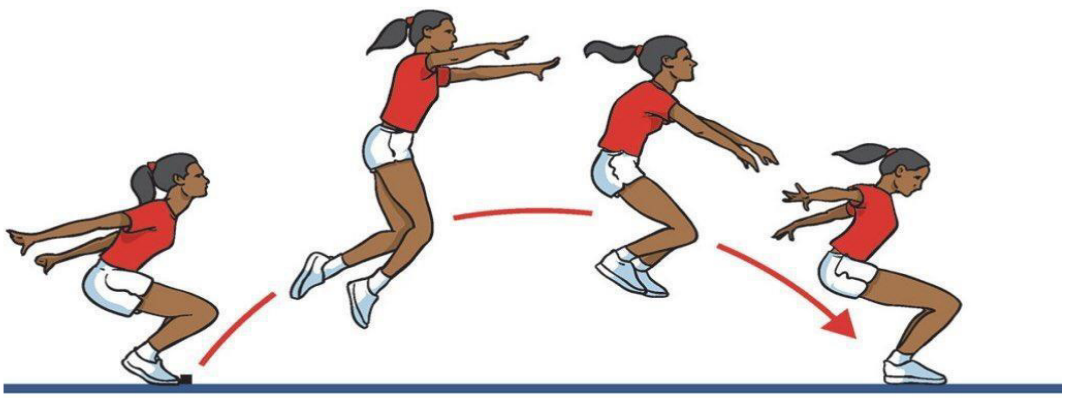
3.8.1.5 Explosive Power

Purpose: The test was to measure the Explosive power.

Equipment: Jump peat, Measuring Tape, Lime Powder, Thread, Score Sheet.

Procedure: The subject was asked to stand with his feet apart, parallel to each other and toes just behind the take off line, prior to jumping, the subject was asked to take a preliminary movement by flexing his knee and swinging his arms possible. The subject attempted to jump as far as possible, landing on both foot without failing backwards. All subjects were allowed three attempts on the Standing Broad Jump test

Scoring: The Measurements of the Jump was taken from the outer line of the take-off line and the nearest point of contact his body on the landing. Record the longest distance jumped from the best of three attempts was recorded as the score. Measurement was taken to the meter.



3.8.2 Physiological Variables

3.8.2.1 Resting Pulse Rate

Purpose: To measure resting pulse rate per minute.

Equipment: Stopwatch and chair.

Purpose: The pulse rate of all the subject were recorded in a sitting position in the morning session between 6.00 am before taking the pulse rate, the subjects were asked to sit in a chair and relax for 15 min. To record the pulse rate, the three finger tips were placed or the left radial artery at the wrist in such a manner that pulse was clear.

Scoring: The number of pulse was conducted for 15 seconds and then multiplies by four to record for full minute.

3.8.2.2 Vital Capacity

Purpose: To measure lungs capacity

Equipment: Digital Dry Spirometer

Procedure: By using a digital dry spirometer and small computer program, vital capacity was determined. Before the test, subjects were instructed to take a deep breath. Then, after inhaling as fully as possible, the subject slowly and steadily let out air with the aid of a clip, taking care to prevent air from escaping through the nose or around the edges of the mouse piece. The examiner carefully considered the results and chose the best of the three.

Scoring: Three chances were given to each test subject, and the best of those was recorded.

3.8.2.3 Blood Pressure

Purpose: To measure Blood pressure.

Equipment: Blood pressure cuff, Digital sphygmomanometer.

Procedure: Blood pressure was measured by a digital blood monitor. A blood pressure cuff is placed on the upper arm and just above the elbow. And with just a push of a button, the monitor is activated and automatically displays systolic and diastolic blood pressure based on changes in blood volume in the arteries.

3.9 Collection of the Data

The data was collected on the selected physical and physiological variables as per the methods described above. The pre-test data were collected prior before the training programme and post test data were collected immediately after the eight weeks of resistance circuit training, intensive interval training from two experimental groups and a control group.

3.10 Statistical Techniques

The data collected from the three groups before and immediately after the training program were statistically analysed on the selected criteria variables with Analysis of Covariance (ANCOVA). as long as he "F" ratio for adjusted post-test means was significant, Scheffe's post hoc test was followed to determine which of the paired mean differences was significant. In all cases, a confidence level of ($p<0.05$) was set to test the hypothesis.

CHAPTER – IV

ANALYSIS OF DATA AND RESULTS OF THE STUDY

4.1 Overview

The analysis of the data gathered from the study's sample populations is the subject of this chapter. This study looked at how certain physical and physiological factors in Kho-Kho players were affected by resistance circuit training and intense interval training.

The participants in this study were selected at random, but the groups were equalized in light of the factors that had already been looked at. Therefore, when analyzing the post-test difference between the means, it was necessary to take into consideration the difference between the means of the three groups in the pre-test. This was accomplished by using analysis of covariance (ANCOVA), where the adjusted mean and the find means adjusted for difference in the initial means were assessed for significance. The LSD post hoc test was used to determine the significance of the difference between the paired post-test means when the adjusted post-test means were significant.

4.2 Test of Significance

The test was usually called the test of significance since we test whether the differences between three groups or within many group's scores were significant or not. In this study, if they obtained F-value were $p<0.05$, the research hypothesis was accepted, if they obtained F value w ere $p>0.05$ the research hypothesis was rejected.

4.3 Level of Significance

The ($p<0.05$) level was chosen to test the level of significance and considered sufficient for this investigation.

4.4 Analysis of Data

The influence of the independent variables on each criterion variables were analysed and presented below.

4.4.1 Physical Variables

4.4.1.1 Speed

Table 4.1 : Analysis of Covariance on Speed among Resistance Circuit Training Group, Intensive Interval Training Group and Control Group

Test	Resistance Circuit Training Group	Intensive Interval Training Group	Control Group	Sources of Variance	Sum of Square	DF	Mean of Square	Obtain F ratio	Sig.
Pre Test Mean	7.59	7.64	7.57	B	0.10	2	0.05	0.24	0.79
	0.55	0.40	0.44	W	19.02	87	0.22		
Post Test Mean	7.29	7.18	7.50	B	1.60	2	0.80	3.79*	0.02
	0.52	0.41	0.44	W	18.37	87	0.21		
Adjusted Post Test Mean	7.30	7.13	7.53	B	2.41	2	1.20	72.23*	0.00
				W	1.43	86	0.02		

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

In accordance with table 4.1, the speed pre-test means for the resistance circuit training, intensive interval training, and control groups were 7.59, 7.64, and 7.57 respectively. The obtained F ratio was 0.24 and had a significant value of 0.79 > 0.05. Therefore, at a 0.05 level of confidence and with 2 and 87 degrees of freedom, the pretest was determined to be insignificant. This demonstrated that there were no significant differences between the resistance circuit training, intensive interval training and control group on speed.

Resistance circuit training, intensive interval training, and the control group all had post-test means on speed that were 7.29, 7.18, and 7.50, respectively. The obtained F ratio was 3.79 and significant value (0.02 < 0.05) was obtained, meaning that the post-test was significant at the 0.05 level of confidence for 2 and 87 degrees of freedom. This demonstrates that there was a significant difference in the post-test means on speed of the subjects.

The adjusted post-test means for speed in the resistance circuit training, intensive interval training, and control groups were 7.30, 7.13, and 7.53, respectively. The

obtained F ratio was 72.23, and the significant value (0.00 < 0.05) was at a level of 0.05 confidence with 2 and 86 degrees of freedom. According to the findings, resistance circuit training, intense interval training, and the control group all had significantly different post-test means.

To determine which of the paired means had a significant difference, the LSD lest was used as post-hoe test and the results are presented in the table 4.2.

Table 4.2 : LSD Post Hoc Test for the Differences between the Paired Adjusted Post-Test Means of Speed

Resistance Circuit Training Group	Intensive Interval Training Group	Control Group	Mean Difference	Sig.
7.30	7.13	-	0.17*	0.00
7.30	-	7.53	0.23*	0.00
-	7.13	7.53	0.40*	0.00

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

The paired adjusted post-test means for each group are shown in Table 4.2. The mean difference between resistance circuit training and intensive interval training (0.17, $p<0.05$), resistance circuit training and control group (0.23, $p<0.05$) and intensive interval training and control group (0.40, $p<0.05$) which were significant at the 0.05 confidence level.

The study's findings indicated that after completing their respective training regimens, the resistance circuit training and intensive interval training groups' speeds significantly increased. The study's findings also indicated that there was a significant difference in the training groups' ability to increase speed, with the intensive interval training group outperforming the resistance circuit training and control groups in this regard.

The pre, post and adjusted means on speed are illustrated through bar chart in figure - 4.2.

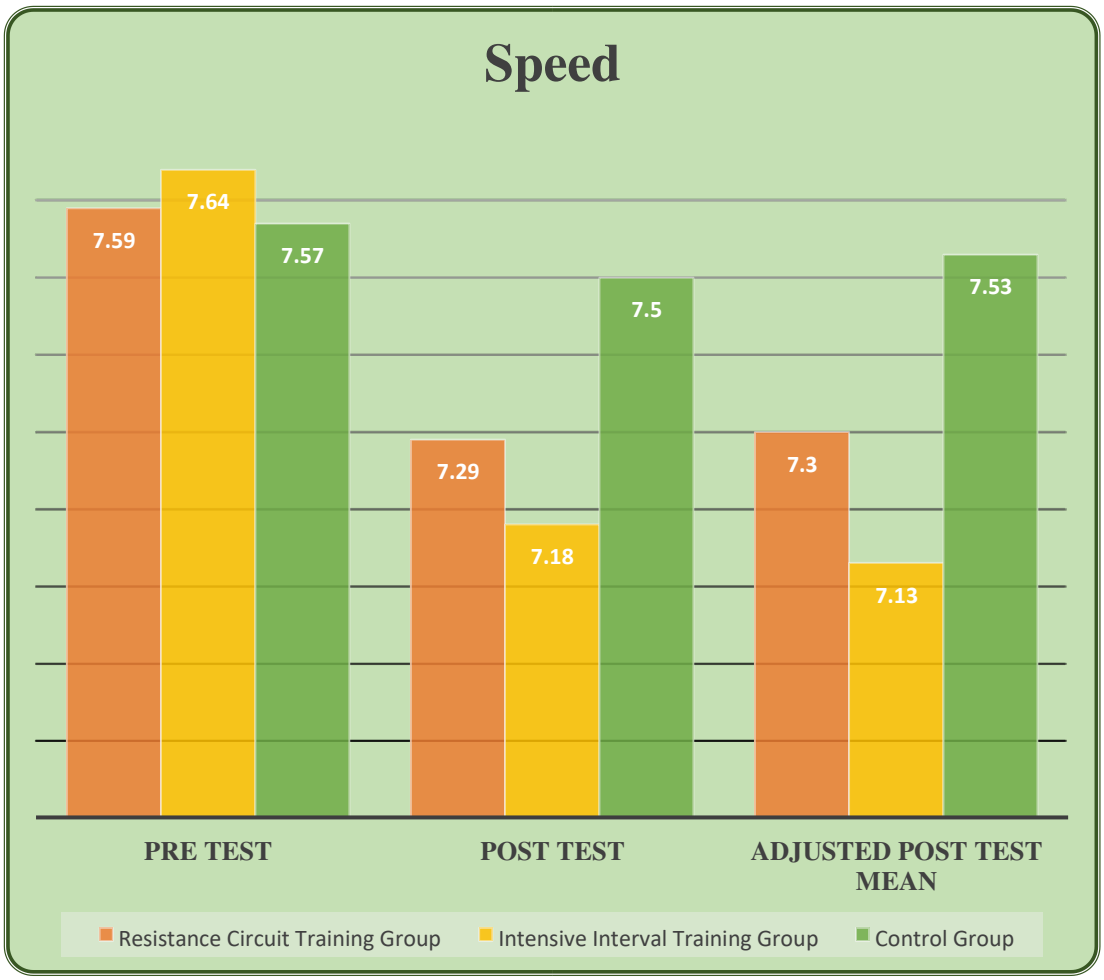


Fig. 4.1 : The Mean value of Speed are shown graphically

4.4.1.2 Endurance

Table 4.3 : Analysis of Covariance on Endurance among Resistance Circuit Training Group, Intensive Interval Training Group and Control Group

Test	Resistance Circuit Training Group	Intensive Interval Training Group	Control Group	Sources of Variance	Sum of Square	DF	Mean of Square	Obtain F ratio	Sig.
Pre Test Mean	1902.67	1964.67	1913.00	B	66202.22	2	33101.11	2.31	0.11
	118.90	121.90	118.44	W	1247763.33	87	14342.11		
Post Test Mean	2099.67	2209.00	1919.33	B	1283806.67	2	641903.33	52.76*	0.00
	125.05	77.87	121.65	W	1058553.33	87	12167.28		
Adjusted Post Test Mean	2114.91	2185.05	1928.04	B	1040162.95	2	520081.47	79.87*	0.00
				W	559989.43	86	6511.51		

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

In accordance with table 4.3, the endurance pre-test means for the resistance circuit training, intensive interval training, and control groups were 1902.67, 1964.67, and 1913.00 respectively. The obtained F ratio was 2.31 and had a significant value of 0.11 > 0.05. Therefore, at a 0.05 level of confidence and with 2 and 87 degrees of freedom, the pre-test was determined to be insignificant. This demonstrated that there were no significant differences between the resistance circuit training, intensive interval training and control group on endurance.

Resistance circuit training, intensive interval training, and the control group all had post-test means on endurance that were 2099.67, 2209.00, and 1919.33, respectively. The obtained F ratio was 52.76 and significant value (0.00 < 0.05) was obtained, meaning that the post-test was significant at the 0.05 level of confidence for 2 and 87 degrees of freedom. This demonstrates that there was a significant difference in the post-test means on endurance of the subjects.

The adjusted post-test means for endurance in the resistance circuit training, intensive interval training, and control groups were 2114.91, 2185.05, and 1928.04, respectively. The obtained F ratio was 79.87, and the significant value (0.00 < 0.05) was at a level of 0.05 confidence with 2 and 86 degrees of freedom. According to the findings, resistance circuit training, intense interval training, and the control group all had significantly different post-test means.

To determine which of the paired means had a significant difference, the LSD lest was used as post-hoe test and the results are presented in the table 4.4.

Table 4.4 : LSD Post Hoc Test for the Differences between the Paired Adjusted Post-Test Means of Endurance

Resistance Circuit Training Group	Intensive Interval Training Group	Control Group	Mean Difference	Sig.
2114.91	2185.05	-	70.14*	0.00
2114.91	-	1928.04	186.87*	0.00
-	2185.05	1928.04	257.01*	0.00

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

The paired adjusted post-test means for each group are shown in table 4.4. The mean difference between resistance circuit training and intensive interval training (70.14, $p<0.05$), resistance circuit training and control group (186.87, $p<0.05$) and intensive interval training and control group (257.01, $p<0.05$) which were significant at the 0.05 confidence level.

The study's findings indicated that after completing their respective training regimens, the resistance circuit training and intensive interval training groups' endurance significantly increased. The study's findings also indicated that there was a significant difference in the training groups' ability to increase endurance, with the intensive interval training group outperforming the resistance circuit training and control groups in this regard.

The pre, post and adjusted means on endurance are illustrated through bar chart in figure - 4.2.

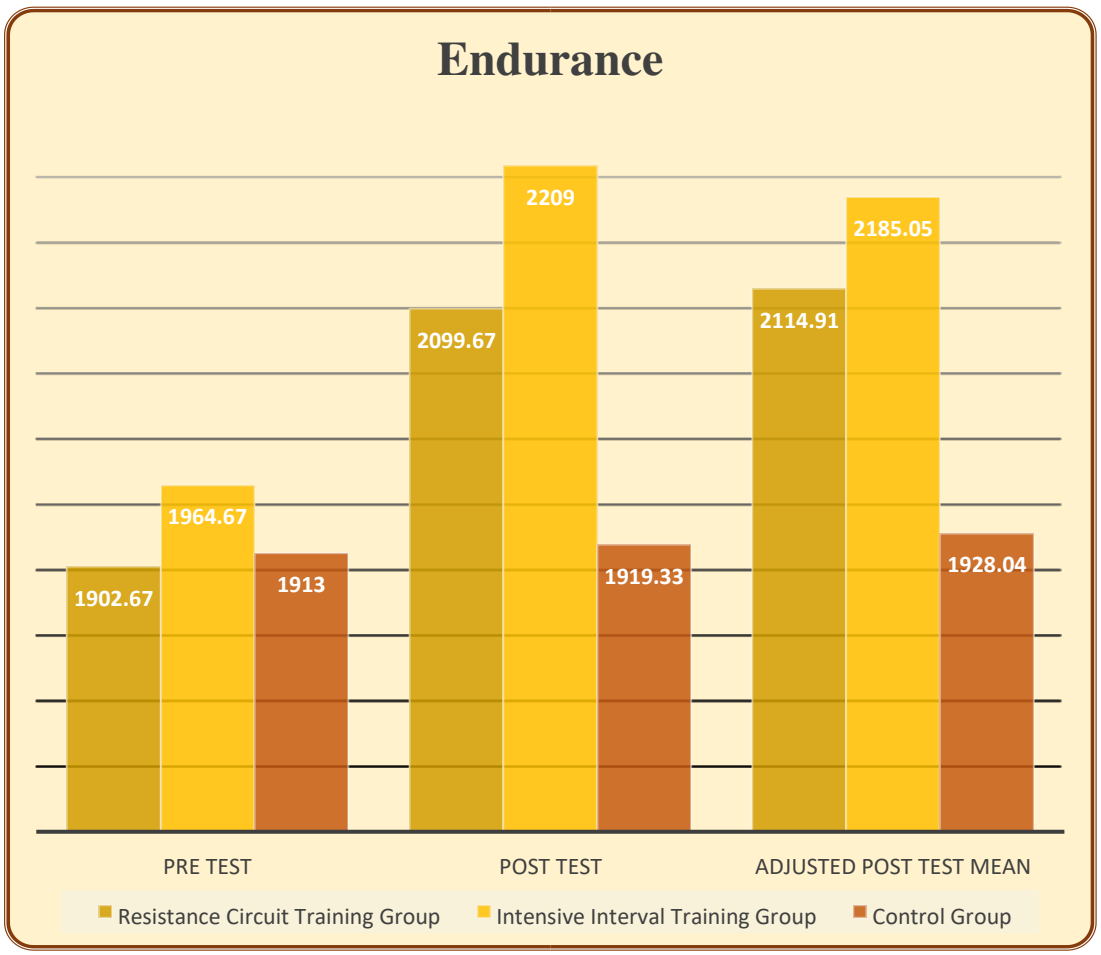


Fig .4.2 : The Mean value of Endurance are shown graphically

4.4.1.3 Agility

Table 4.5 : Analysis of Covariance on Agility among Resistance Circuit Training Group, Intensive Interval Training Group and Control Group

Test	Resistance Circuit Training Group	Intensive Interval Training Group	Control Group	Sources of Variance	Sum of Square	DF	Mean of Square	Obtain F ratio	Sig.
Pre Test Mean	9.38	8.97	9.03	B	2.91	2	1.46	2.60	0.08
	0.78	0.82	0.62	W	48.83	87	0.56		
Post Test Mean	8.93	8.41	9.01	B	6.37	2	3.18	7.31*	0.00
	0.66	0.69	0.63	W	37.89	87	0.43		
Adjusted Post Test Mean	8.72	8.54	9.09	B	4.69	2	2.35	61.37*	0.00
				W	3.29	86	0.04		

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

In accordance with table 4.5, the agility pre-test means for the resistance circuit training, intensive interval training, and control groups were 9.38, 8.97, and 9.03 respectively. The obtained F ratio was 2.60 and had a significant value of 0.08 > 0.05. Therefore, at a 0.05 level of confidence and with 2 and 87 degrees of freedom, the pretest was determined to be insignificant. This demonstrated that there were no significant differences between the resistance circuit training, intensive interval training and control group on agility.

Resistance circuit training, intensive interval training, and the control group all had post-test means on agility that were 8.93, 8.41, and 9.01, respectively. The obtained F ratio was 7.31 and significant value (0.00 < 0.05) was obtained, meaning that the post-test was significant at the 0.05 level of confidence for 2 and 87 degrees of freedom. This demonstrates that there was a significant difference in the post-test means on agility of the subjects.

The adjusted post-test means for agility in the resistance circuit training, intensive interval training, and control groups were 8.72, 8.54, and 9.09, respectively. The obtained F ratio was 61.37, and the significant value (0.00 < 0.05) was at a level of 0.05 confidence with 2 and 86 degrees of freedom. According to the findings,

resistance circuit training, intense interval training, and the control group all had significantly different post-test means

To determine which of the paired means had a significant difference, the LSD lest was used as post-hoe test and the results are presented in the table 4.6.

Table 4.6 : LSD Post Hoc Test for the Differences between the Paired Adjusted Post-Test Means Agility

Resistance Circuit Training Group	Intensive Interval Training Group	Control Group	Mean Difference	Sig.
8.72	8.54	-	0.18*	0.00
8.72	-	9.09	0.37*	0.00
-	8.54	9.09	0.55*	0.00

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

The paired adjusted post-test means for each group are shown in table 4.6. The mean difference between resistance circuit training and intensive interval training (0.18, $p<0.05$), resistance circuit training and control group (0.37, $p<0.05$) and intensive interval training and control group (0.55, $p<0.05$) which were significant at the 0.05 confidence level.

The study's findings indicated that after completing their respective training regimens, the resistance circuit training and intensive interval training groups' agility significantly increased. The study's findings also indicated that there was a significant difference in the training groups' ability to increase agility, with the intensive interval training group outperforming the resistance circuit training and control groups in this regard.

The pre, post and adjusted means on agility are illustrated through bar chart in figure - 4.3.

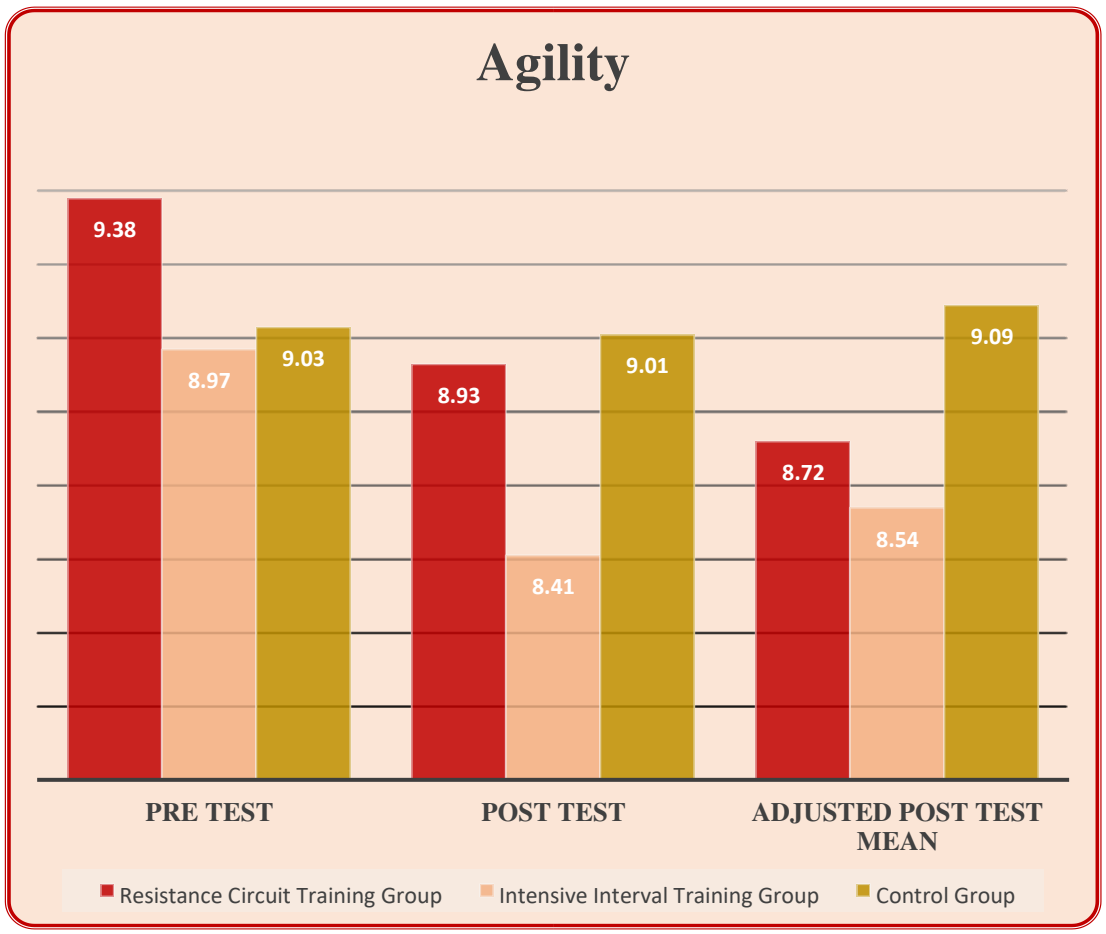


Fig .4.3 : The Mean value of Agility are shown graphically

4.4.1.4 Flexibility

Table 4.7 : Analysis of Covariance on Flexibility among Resistance Circuit Training Group, Intensive Interval Training Group and Control Group

Test	Resistance Circuit Training Group	Intensive Interval Training Group	Control Group	Sources of Variance	Sum of Square	DF	Mean of Square	Obtain F ratio	Sig.
Pre Test Mean	19.85	19.40	19.31	B	4.94	2	2.47	0.87	0.42
	1.91	1.55	1.56	W	246.02	87	2.83		
Post Test Mean	21.57	22.07	19.47	B	114.20	2	57.10	25.32*	0.00
	1.68	1.17	1.61	W	196.20	87	2.25		
Adjusted Post Test Mean	21.31	22.16	19.63	B	99.51	2	49.76	100.17*	0.00
				W	42.72	86	0.50		

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

In accordance with table 4.7, the flexibility pre-test means for the resistance circuit training, intensive interval training, and control groups were 19.85, 19.40, and 19.31 respectively. The obtained F ratio was 0.87 and had a significant value of 0.42 > 0.05. Therefore, at a 0.05 level of confidence and with 2 and 87 degrees of freedom, the pre-test was determined to be insignificant. This demonstrated that there were no significant differences between the resistance circuit training, intensive interval training and control group on flexibility.

Resistance circuit training, intensive interval training, and the control group all had post-test means on flexibility that were 21.57, 22.07, and 19.47, respectively. The obtained F ratio was 25.32 and significant value (0.00 < 0.05) was obtained, meaning that the post-test was significant at the 0.05 level of confidence for 2 and 87 degrees of freedom. This demonstrates that there was a significant difference in the post-test means on flexibility of the subjects.

The adjusted post-test means for flexibility in the resistance circuit training, intensive interval training, and control groups were 21.31, 22.16, and 19.63, respectively. The obtained F ratio was 100.17, and the significant value (0.00 < 0.05) was at a level of 0.05 confidence with 2 and 86 degrees of freedom. According to the findings, resistance circuit training, intense interval training, and the control group all had significantly different post-test means.

To determine which of the paired means had a significant difference, the LSD lest was used as post-hoe test and the results are presented in the table 4.8.

Table 4.8 : LSD Post Hoc Test for the Differences between the Paired Adjusted Post-Test Means Flexibility

Resistance Circuit Training Group	Intensive Interval Training Group	Control Group	Mean Difference	Sig.
21.31	22.16	-	0.85*	0.00
21.31	-	19.63	1.68*	0.00
-	22.16	19.63	2.53*	0.00

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

The paired adjusted post-test means for each group are shown in table 4.8. The mean difference between resistance circuit training and intensive interval training (0.85, $p<0.05$), resistance circuit training and control group (1.68, $p<0.05$) and intensive interval training and control group (2.53, $p<0.05$) which were significant at the 0.05 confidence level.

The study's findings indicated that after completing their respective training regimens, the resistance circuit training and intensive interval training groups' flexibility significantly increased. The study's findings also indicated that there was a significant difference in the training groups' ability to increase flexibility, with the intensive interval training group outperforming the resistance circuit training and control groups in this regard.

The pre, post and adjusted means on flexibility are illustrated through bar chart in figure - 4.4.

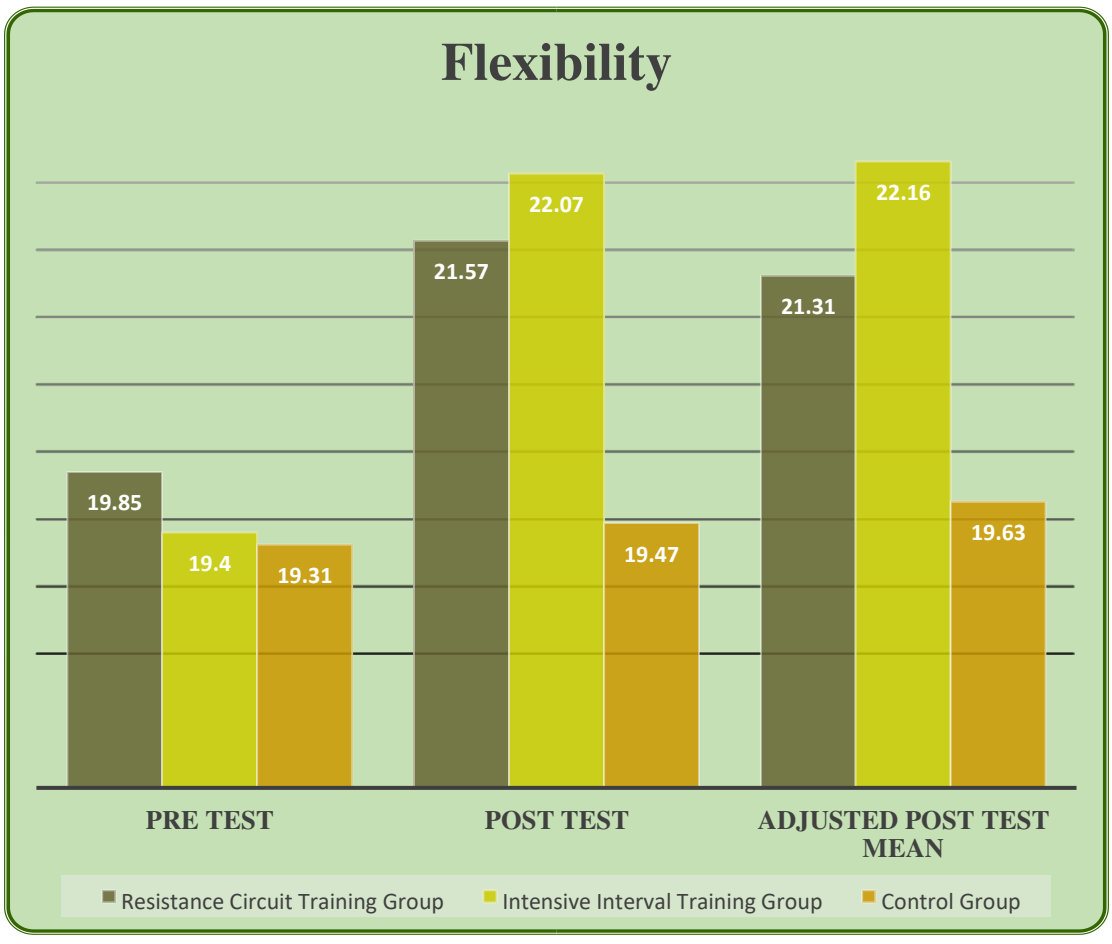


Fig .4.4 : The Mean value of Flexibility are shown graphically

4.4.1.5 Explosive Power

Table 4.9 : Analysis of Covariance on Explosive Power among Resistance Circuit Training Group, Intensive Interval Training Group and Control Group

Test	Resistance Circuit Training Group	Intensive Interval Training Group	Control Group	Sources of Variance	Sum of Square	DF	Mean of Square	Obtain F ratio	Sig.
Pre Test Mean	1.85	1.86	1.88	B	0.01	2	0.01	0.34	0.71
	0.14	0.15	0.12	W	1.64	87	0.02		
Post Test Mean	2.02	1.97	1.89	B	0.25	2	0.13	8.68*	0.00
	0.11	0.14	0.11	W	1.25	87	0.01		
Adjusted Post Test Mean	2.03	1.97	1.88	B	0.34	2	0.17	64.64*	0.00
				W	0.23	86	0.003		

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

In accordance with table 4.9, the explosive power pre-test means for the resistance circuit training, intensive interval training, and control groups were 1.85, 1.86, and 1.88 respectively. The obtained F ratio was 0.34 and had a significant value of 0.71 > 0.05. Therefore, at a 0.05 level of confidence and with 2 and 87 degrees of freedom, the pre-test was determined to be insignificant. This demonstrated that there were no significant differences between the resistance circuit training, intensive interval training and control group on explosive power.

Resistance circuit training, intensive interval training, and the control group all had post-test means on explosive power that were 2.02, 1.97, and 1.89, respectively. The obtained F ratio was 8.68 and significant value (0.00 < 0.05) was obtained, meaning that the post-test was significant at the 0.05 level of confidence for 2 and 87 degrees of freedom. This demonstrates that there was a significant difference in the post-test means on explosive power of the subjects.

The adjusted post-test means for explosive power in the resistance circuit training, intensive interval training, and control groups were 2.03, 1.97, and 1.88, respectively. The obtained F ratio was 64.64, and the significant value (0.00 < 0.05) was at a level of 0.05 confidence with 2 and 86 degrees of freedom. According to the findings,

resistance circuit training, intense interval training, and the control group all had significantly different post-test means.

To determine which of the paired means had a significant difference, the LSD lest was used as post-hoe test and the results are presented in the table 4.10.

Table 4.10 : LSD Post Hoc Test for the Differences between the Paired Adjusted Post-Test Means Explosive Power

Resistance Circuit Training Group	Intensive Interval Training Group	Control Group	Mean Difference	Sig.
2.03	1.97	-	0.06*	0.00
2.03	-	1.88	0.15*	0.00
-	1.97	1.88	0.09*	0.00

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

The paired adjusted post-test means for each group are shown in table 4.10. The mean difference between resistance circuit training and intensive interval training (0.06, $p<0.05$), resistance circuit training and control group (0.15, $p<0.05$) and intensive interval training and control group (0.09, $p<0.05$) which were significant at the 0.05 confidence level.

The study's findings indicated that after completing their respective training regimens, the resistance circuit training and intensive interval training groups' explosive power significantly increased. The study's findings also indicated that there was a significant difference in the training groups' ability to increase explosive power, with the resistance circuit training outperforming the intensive interval training group and control groups in this regard.

The pre, post and adjusted means on explosive power are illustrated through bar chart in figure - 4.5.

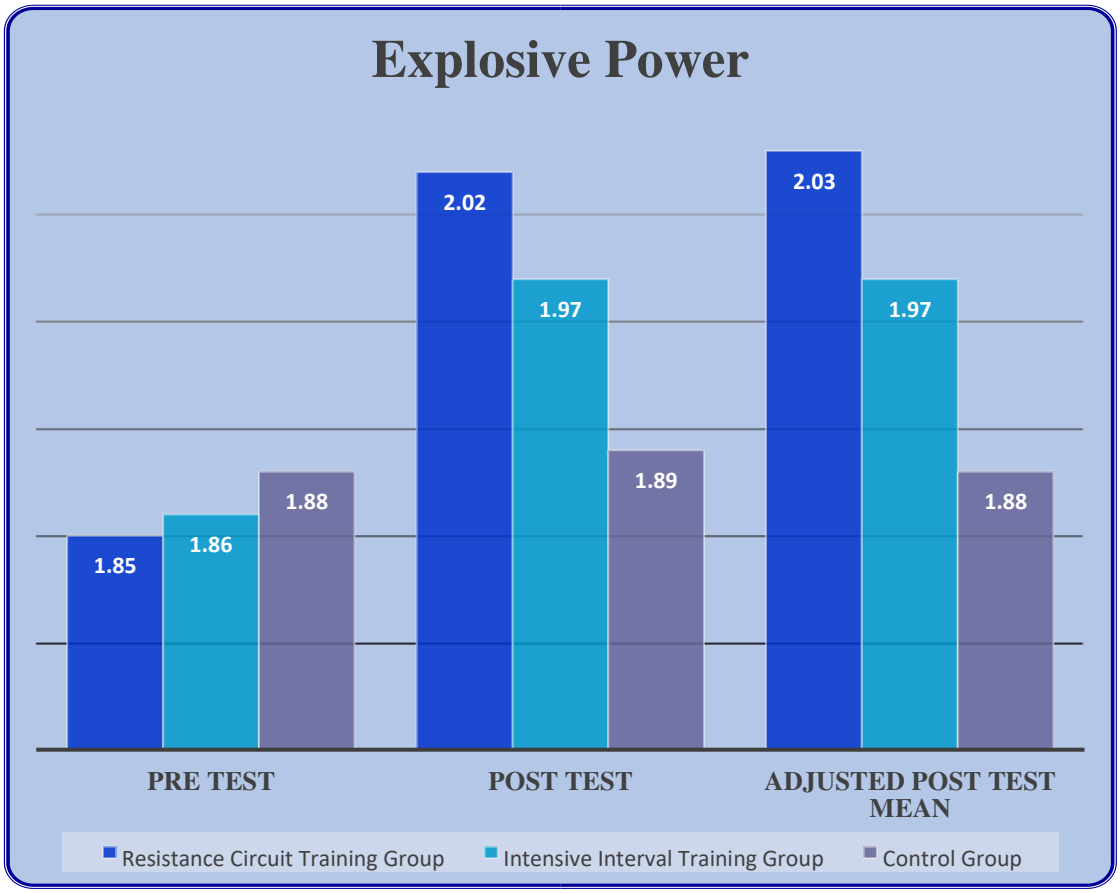


Fig. 4.5 : The Mean value of Explosive Power are shown graphically

4.4.2 Physiological Variables

4.4.2.1 Resting Pulse Rate

Table 4.11 : Analysis of Covariance on Resting Pulse Rate among Resistance Circuit Training Group, Intensive Interval Training Group and Control Group

Test	Resistance Circuit Training Group	Intensive Interval Training Group	Control Group	Sources of Variance	Sum of Square	DF	Mean of Square	Obtain F ratio	Sig.
Pre Test Mean	70.87	70.93	71.33	B	3.82	2	1.91	0.30	0.74
	2.62	2.10	2.83	W	560.00	87	6.44		
Post Test Mean	68.10	67.70	70.43	B	130.76	2	65.38	15.78*	0.00
	1.72	1.76	2.51	W	360.37	87	4.14		
Adjusted Post Test Mean	68.21	67.77	70.26	B	105.03	2	52.52	30.42*	0.00
				W	148.48	86	1.73		

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

In accordance with table 4.11, the resting pulse rate pre-test means for the resistance circuit training, intensive interval training, and control groups were 70.87, 70.93, and 71.33 respectively. The obtained F ratio was 0.30 and had a significant value of 0.74 > 0.05. Therefore, at a 0.05 level of confidence and with 2 and 87 degrees of freedom, the pre-test was determined to be insignificant. This demonstrated that there were no significant differences between the resistance circuit training, intensive interval training and control group on resting pulse rate.

Resistance circuit training, intensive interval training, and the control group all had post-test means on resting pulse rate that were 68.10, 67.70, and 70.43, respectively. The obtained F ratio was 15.78 and significant value (0.00 < 0.05) was obtained, meaning that the post-test was significant at the 0.05 level of confidence for 2 and 87 degrees of freedom. This demonstrates that there was a significant difference in the post-test means on resting pulse rate of the subjects.

The adjusted post-test means for resting pulse rate in the resistance circuit training, intensive interval training, and control groups were 68.21, 67.77, and 70.26, respectively. The obtained F ratio was 30.42, and the significant value (0.00 < 0.05) was at a level of 0.05 confidence with 2 and 86 degrees of freedom. According to the findings, resistance circuit training, intense interval training, and the control group all had significantly different post-test means.

To determine which of the paired means had a significant difference, the LSD lest was used as post-hoe test and the results are presented in the table 4.12.

Table 4.12 : LSD Post Hoc Test for the Differences between the Paired Adjusted Post-Test Means Resting Pulse Rate

Resistance Circuit Training Group	Intensive Interval Training Group	Control Group	Mean Difference	Sig.
68.21	67.77	-	0.44	0.20
68.21	-	70.26	2.05*	0.00
-	67.77	70.26	2.49*	0.00

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

The paired adjusted post-test means for each group are shown in table 4.12. The mean difference between resistance circuit training and control group (2.05, $p<0.05$) and intensive interval training and control group (2.49, $p<0.05$) which were significant at the 0.05 confidence level. And resistance circuit training and intensive interval training (0.44, $p>0.05$), which were insignificant at the 0.05 confidence level.

The study's findings indicated that after completing their respective training regimens, the resistance circuit training and intensive interval training groups' resting pulse rate significantly increased. The study's findings also indicated that there was a significant difference in the training groups' ability to increase resting pulse rate, with the intensive interval training outperforming the resistance circuit training group and control groups in this regard.

The pre, post and adjusted means on resting pulse rate are illustrated through bar chart in figure - 4.6.

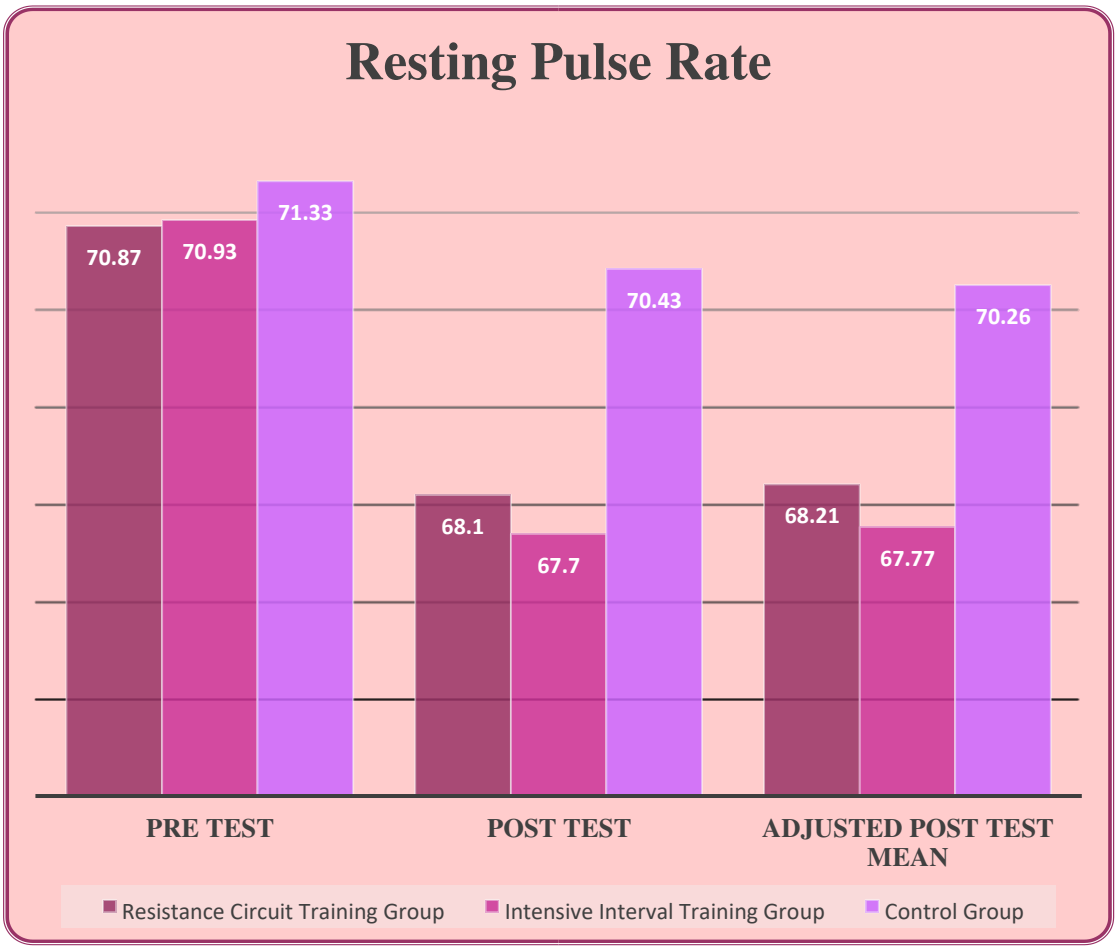


Fig .4.6 : The Mean value of Resting Pulse Rate are shown graphically

4.4.2.2 Vital capacity

Table 4.13 : Analysis of Covariance on Vital Capacity among Resistance Circuit Training Group, Intensive Interval Training Group and Control Group

Test	Resistance Circuit Training Group	Intensive Interval Training Group	Control Group	Sources of Variance	Sum of Square	DF	Mean of Square	Obtain F ratio	Sig.
Pre Test Mean	3.84	3.96	3.82	B	0.33	2	0.17	0.52	0.60
	0.46	0.73	0.48	W	28.25	87	0.33		
Post Test Mean	4.20	4.47	3.87	B	5.44	2	2.72	9.70*	0.00
	0.40	0.68	0.46	W	24.38	87	0.28		
Adjusted Post Test Mean	4.22	4.40	3.92	B	3.46	2	1.73	68.53*	0.00
				W	2.17	86	0.03		

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

In accordance with table 4.13, the vital capacity pre-test means for the resistance circuit training, intensive interval training, and control groups were 3.84, 3.96, and 3.82 respectively. The obtained F ratio was 0.52 and had a significant value of 0.60 > 0.05. Therefore, at a 0.05 level of confidence and with 2 and 87 degrees of freedom, the pretest was determined to be insignificant. This demonstrated that there were no significant differences between the resistance circuit training, intensive interval training and control group on vital capacity.

Resistance circuit training, intensive interval training, and the control group all had post-test means on vital capacity that were 4.20, 4.47, and 3.87, respectively. The obtained F ratio was 9.70 and significant value (0.00 < 0.05) was obtained, meaning that the post-test was significant at the 0.05 level of confidence for 2 and 87 degrees of freedom. This demonstrates that there was a significant difference in the post-test means on vital capacity of the subjects.

The adjusted post-test means for vital capacity in the resistance circuit training, intensive interval training, and control groups were 4.22, 4.40, and 3.92, respectively. The obtained F ratio was 68.53, and the significant value (0.00 < 0.05) was at a level of 0.05 confidence with 2 and 86 degrees of freedom. According to the findings,

resistance circuit training, intense interval training, and the control group all had significantly different post-test means.

To determine which of the paired means had a significant difference, the LSD lest was used as post-hoe test and the results are presented in the table 4.14.

Table 4.14 : LSD Post Hoc Test for the Differences between the Paired Adjusted Post-Test Means Vital Capacity

Resistance Circuit Training Group	Intensive Interval Training Group	Control Group	Mean Difference	Sig.
4.22	4.40	-	0.18*	0.00
4.22	-	3.92	0.30*	0.00
-	4.40	3.92	0.48*	0.00

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

The paired adjusted post-test means for each group are shown in table 4.14. The mean difference between resistance circuit training and intensive interval training (0.18, $p<0.05$), resistance circuit training and control group (0.30, $p<0.05$) and intensive interval training and control group (0.48, $p<0.05$) which were significant at the 0.05 confidence level.

The study's findings indicated that after completing their respective training regimens, the resistance circuit training and intensive interval training groups' vital capacity significantly increased. The study's findings also indicated that there was a significant difference in the training groups' ability to increase vital capacity, with the intensive interval training outperforming the resistance circuit training group and control groups in this regard.

The pre, post and adjusted means on vital capacity are illustrated through bar chart in figure - 4.7.

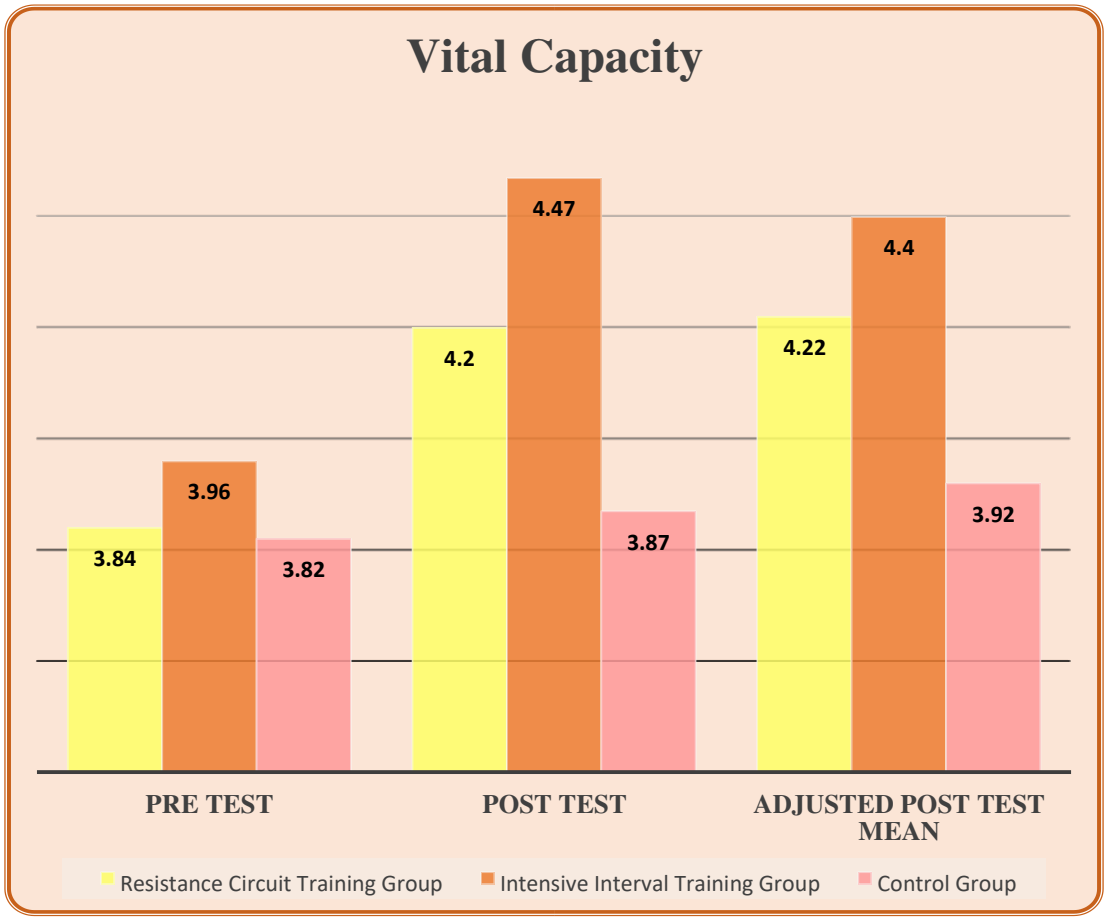


Fig .4.7 : The Mean value of Vital Capacity are shown graphically

4.4.2.3 Systolic Blood Pressure

Table 4.15 : Analysis of Covariance on Systolic Blood Pressure among Resistance Circuit Training Group, Intensive Interval Training Group and Control Group

Test	Resistance Circuit Training Group	Intensive Interval Training Group	Control Group	Sources of Variance	Sum of Square	DF	Mean of Square	Obtain F ratio	Sig.
Pre Test Mean	125.17	124.80	124.67	B	4.02	2	2.01	0.14	0.87
	3.66	4.25	3.29	W	1225.63	87	14.09		
Post Test Mean	121.43	119.87	123.03	B	150.42	2	75.21	5.91*	0.00
	3.26	4.10	3.26	W	1107.80	87	12.73		
Adjusted Post Test Mean	121.17	119.94	123.23	B	165.59	2	82.80	91.09*	0.00
				W	78.17	86	0.91		

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

In accordance with table 4.15, the systolic blood pressure pre-test means for the resistance circuit training, intensive interval training, and control groups were 125.17, 124.80, and 124.67 respectively. The obtained F ratio was 0.14 and had a significant value of 0.87 > 0.05. Therefore, at a 0.05 level of confidence and with 2 and 87 degrees of freedom, the pre-test was determined to be insignificant. This demonstrated that there were no significant differences between the resistance circuit training, intensive interval training and control group on systolic blood pressure.

Resistance circuit training, intensive interval training, and the control group all had post-test means on systolic blood pressure that were 121.43, 119.87, and 123.03, respectively. The obtained F ratio was 5.91 and significant value (0.00 < 0.05) was obtained, meaning that the post-test was significant at the 0.05 level of confidence for 2 and 87 degrees of freedom. This demonstrates that there was a significant difference in the post-test means on systolic blood pressure of the subjects.

The adjusted post-test means for systolic blood pressure in the resistance circuit training, intensive interval training, and control groups were 121.17, 119.94, and 123.23, respectively. The obtained F ratio was 91.09, and the significant value (0.00 < 0.05) was at a level of 0.05 confidence with 2 and 86 degrees of freedom. According to the findings, resistance circuit training, intense interval training, and the control group all had significantly different post-test means.

To determine which of the paired means had a significant difference, the LSD lest was used as post-hoe test and the results are presented in the table 4.16.

Table 4.16 : LSD Post Hoc Test for the Differences between the Paired Adjusted Post-Test Means Systolic Blood Pressure

Resistance Circuit Training Group	Intensive Interval Training Group	Control Group	Mean Difference	Sig.
121.17	119.94	-	1.23*	0.00
121.17	-	123.23	2.06*	0.00
-	119.94	123.23	3.29*	0.00

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

The paired adjusted post-test means for each group are shown in table 4.16. The mean difference between resistance circuit training and intensive interval training (1.23, $p<0.05$), resistance circuit training and control group (2.06, $p<0.05$) and intensive interval training and control group (3.29, $p<0.05$) which were significant at the 0.05 confidence level.

The study's findings indicated that after completing their respective training regimens, the resistance circuit training and intensive interval training groups' systolic blood pressure significantly increased. The study's findings also indicated that there was a significant difference in the training groups' ability to increase systolic blood pressure, with the intensive interval training outperforming the resistance circuit training group and control groups in this regard.

The pre, post and adjusted means on systolic blood pressure are illustrated through bar chart in figure - 4.8.

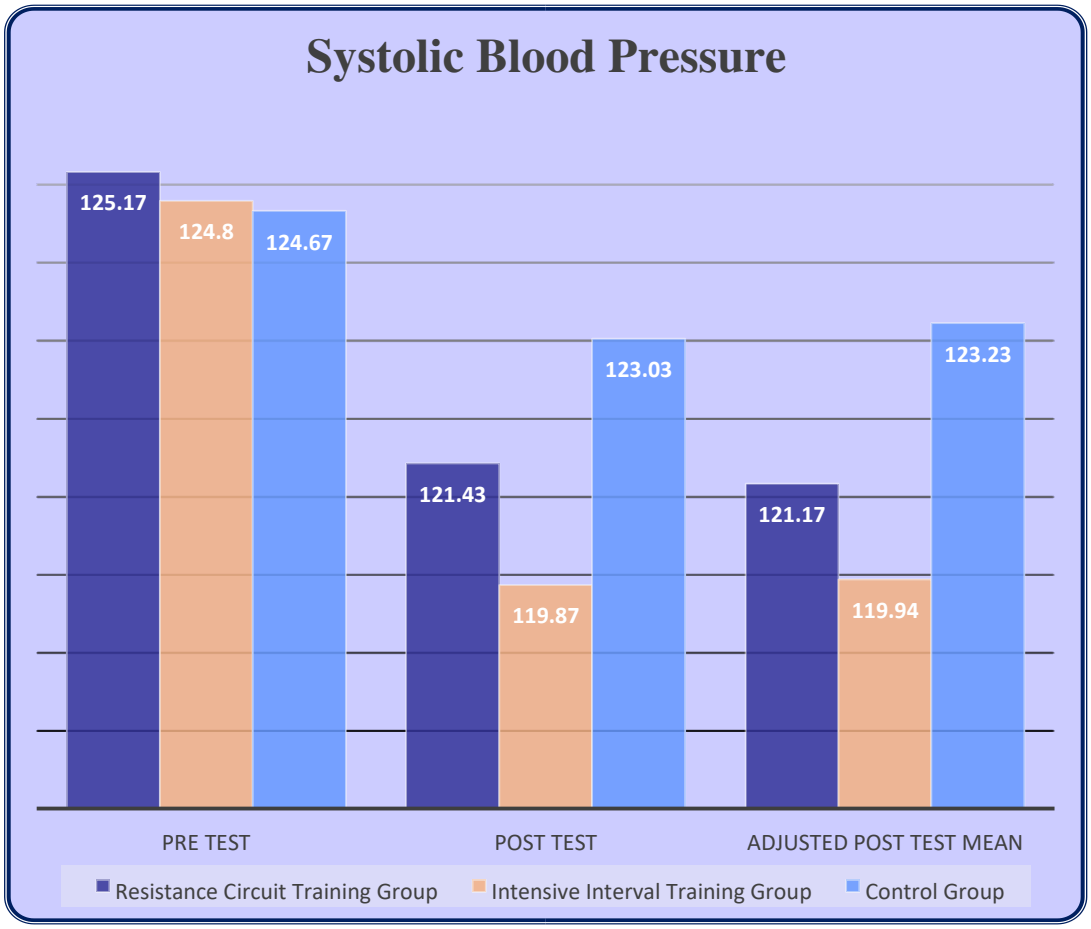


Fig .4.8 : The Mean value of Systolic Blood Pressure are shown graphically

4.4.2.3 Diastolic Blood Pressure

Table 4.17 : Analysis of Covariance on Diastolic Blood Pressure among Resistance Circuit Training Group, Intensive Interval Training Group and Control Group

Test	Resistance Circuit Training Group	Intensive Interval Training Group	Control Group	Sources of Variance	Sum of Square	DF	Mean of Square	Obtain F ratio	Sig.
Pre Test Mean	82.20	82.30	82.83	B	6.96	2	3.48	0.39	0.68
	3.11	2.61	3.16	W	769.27	87	8.84		
Post Test Mean	79.17	78.60	81.60	B	152.42	2	76.21	8.63*	0.00
	3.27	2.51	3.08	W	768.57	87	8.83		
Adjusted Post Test Mean	79.39	78.73	81.25	B	101.49	2	50.74	31.68*	0.00
				W	137.77	86	1.60		

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

In accordance with table 4.15, the diastolic blood pressure pre-test means for the resistance circuit training, intensive interval training, and control groups were 82.20, 82.30, and 82.83 respectively. The obtained F ratio was 0.39 and had a significant value of 0.39 > 0.05. Therefore, at a 0.05 level of confidence and with 2 and 87 degrees of freedom, the pre-test was determined to be insignificant. This demonstrated that there were no significant differences between the resistance circuit training, intensive interval training and control group on diastolic blood pressure.

Resistance circuit training, intensive interval training, and the control group all had post-test means on diastolic blood pressure that were 79.17, 78.60, and 81.60, respectively. The obtained F ratio was 8.63 and significant value (0.00 < 0.05) was obtained, meaning that the post-test was significant at the 0.05 level of confidence for 2 and 87 degrees of freedom. This demonstrates that there was a significant difference in the post-test means on diastolic blood pressure of the subjects.

The adjusted post-test means for diastolic blood pressure in the resistance circuit training, intensive interval training, and control groups were 79.39, 78.73, and 81.25, respectively. The obtained F ratio was 31.68, and the significant value (0.00 < 0.05) was at a level of 0.05 confidence with 2 and 86 degrees of freedom. According to the

findings, resistance circuit training, intense interval training, and the control group all had significantly different post-test means.

To determine which of the paired means had a significant difference, the LSD lest was used as post-hoe test and the results are presented in the table 4.18.

Table 4.18 : LSD Post Hoc Test for the Differences between the Paired Adjusted Post-Test Means Diastolic Blood Pressure

Resistance Circuit Training Group	Intensive Interval Training Group	Control Group	Mean Difference	Sig.
79.39	78.73	-	0.66*	0.04
79.39	-	81.25	1.86*	0.00
-	78.73	81.25	2.52*	0.00

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

The paired adjusted post-test means for each group are shown in table 4.18. The mean difference between resistance circuit training and intensive interval training (0.66, $p<0.05$), resistance circuit training and control group (1.86, $p<0.05$) and intensive interval training and control group (2.52, $p<0.05$) which were significant at the 0.05 confidence level.

The study's findings indicated that after completing their respective training regimens, the resistance circuit training and intensive interval training groups' diastolic blood pressure significantly increased. The study's findings also indicated that there was a significant difference in the training groups' ability to increase diastolic blood pressure, with the intensive interval training outperforming the resistance circuit training group and control groups in this regard.

The pre, post and adjusted means on diastolic blood pressure are illustrated through bar chart in figure - 4.9.

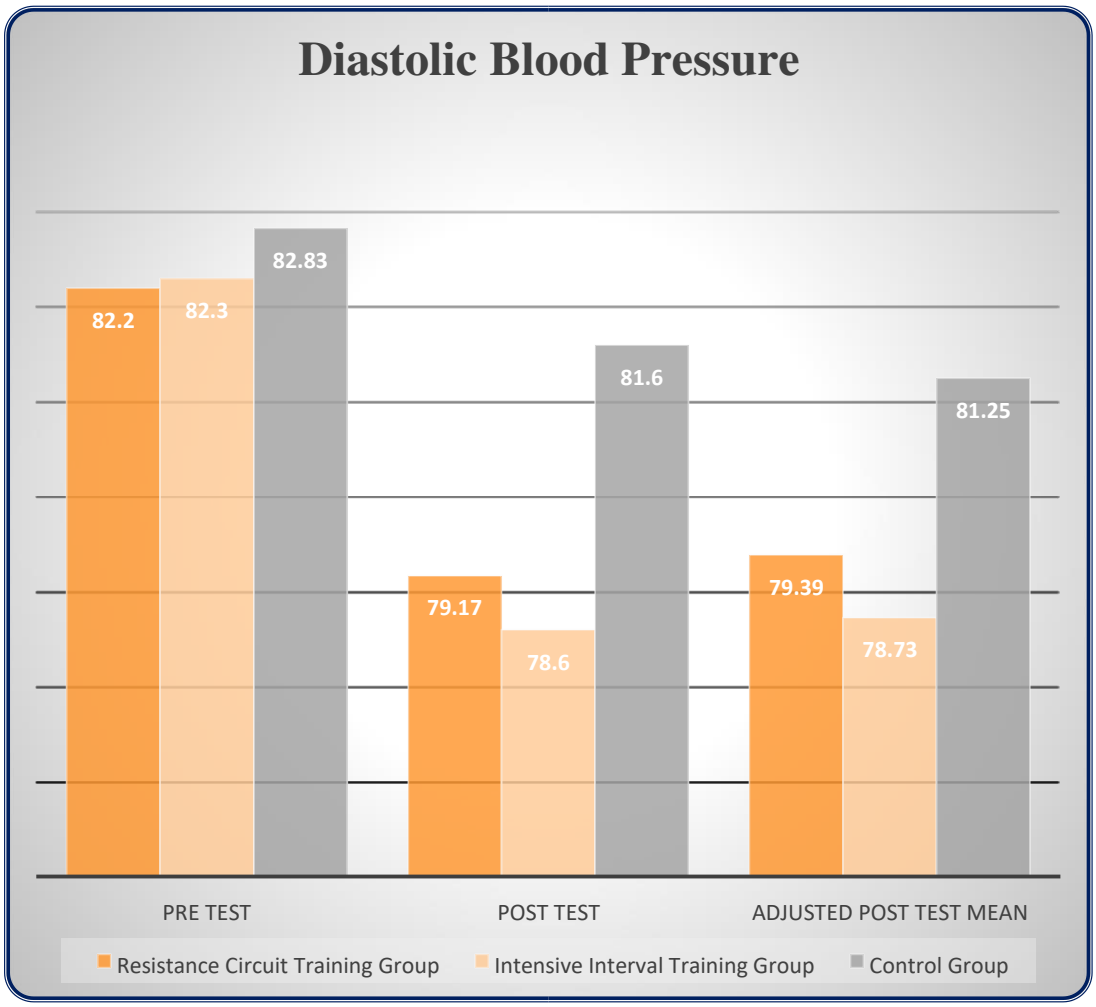


Fig. 4.9 : The Mean value of Diastolic Blood Pressure are shown graphically

4.5 Discussion on Findings

The statistical study led to the following findings.

4.5.1 Physical Variable

Due to resistance circuit training and intense interval training, there was significant improvement in selected physical fitness variables, including speed, endurance, agility, flexibility, and explosive power among male kho-kho players. With the exception of explosive power, however, the development of a selected physical fitness variables was noticeably better with intensive interval training than resistance circuit training. Due to the different training intensities used by both groups, both the resistance circuit training and intensive interval training groups improved on selected physical fitness measures.

The findings of this research are consistent with those of earlier investigations; After two weeks of the intervention, **Kumar et al. (2022)** shown a significant improvement with close observation and dynamic for both feet for single foot comparison. Agility also underwent significant adjustments. Exam in Illinois, 40-meter run. High and moderate intensity interval training significantly improved the anaerobic capacity of male state level Kho-Kho players over the course of a six-week 50-meter drill, according to **Das and Chatterjee (2019),** but high intensity interval training (HIIT) tended to do so more so than moderate intensity interval training. In their 2019 study, **Murugavel and Nirendan** examined how a speed training regimen affected the intercollegiate men's kho-kho players' speed, agility, and cardiorespiratory endurance. According to the study's findings, endurance training increased physical endurance, strength, and speed. According to **Kodgire's (2018)** findings, the explosive power of the leg was measured using standing broad leaps, with meters serving as the measurement's measurement unit. Bent knee setups with counts as the measuring unit were utilized to evaluate the muscular strength endurance. **Sumathi, S. (2017)** after six weeks of circuit training, it was discovered that the kho-kho players' chosen strength measures had significantly increased. The standing broad jump speed-endurance, shuttle run, sit-ups, and 50-meter dash scores of Kho-Kho players were all significantly different, according to **Singh (2017).** According to **Raju and Babu's (2016)** research, circuit training benefits the experimental group's endurance performance while having the opposite effect on the controlled group. It has been established that circuit training will boost the endurance of football players. Plyometric training significantly improved the performance-related aspects of female university-level Kho-Kho players, according to research by **Ali and Cherappurath (2015). Kumar (2016)** study found that the subjects' speed, leg power, arm power, and agility were all significantly improved by circuit training. The results of **Meeravali et al. (2015)** show that the experimental group has improved in terms of speed, agility, and endurance after receiving specialized training. This may be due to the effects of certain training.

4.5.2 Physiological Variable

Male kho-kho players' resting pulse rates, vital capacities, and blood pressure all significantly improved as a result of resistance circuit training and intense interval

training. However, intensive interval training significantly outperformed resistance circuit training in terms of the improvement of a few physiological indicators. Due to the different training intensities used by both groups, resistance circuit training and rigorous interval training showed improvements in a number of physiological indicators.

The study's conclusions are consistent with those of earlier investigations; According to research by **Bhomik (2023),** using specific training greatly reduces the amount of time spent holding your breath while also raising resting heart rate. Circuit training was found to be superior to interval training in the **Taufik et al. (2021)** study that compared the two modes of exercise for increasing VO2max. Interval training has been demonstrated to have a significant impact on the outcomes of VO2max (increase). **Mane (2021)** in the experimental group, systolic blood pressure dramatically dropped whereas diastolic blood pressure did not change appreciably. Both the heart rate and the rate of breathing significantly lowered. The Control Group did not show any notable differences across all variables. **Vyas's (2019)** research, schoolboy male athletes had significantly higher blood pressure, pulse rates, and levels of vitality of action. According to the study, players' physiological measures, including their systolic and diastolic blood pressure, resting heart rate, and vital capacity, all improved. Male khokho and kabaddi players had lower resting heart rates than women. 2019's **Velmurugan** It was also shown that there was a significant difference in vital capacity, resting heart rate, and breath holding time between the experimental and control groups as a result of the twelve weeks of resistance training. In contrast to the control group, the interval training and circuit training groups significantly improved their VO_2 max, according to **Balasing and Night's (2018)** study. Additionally, there are no discernible differences between the circuit training and interval training groups; however, the interval training group experienced a greater increase in VO2 max. The results of the **Meeravali et al. (2015)** study show that the experimental group had improved in physiological parameter, namely vital capacity, and had received specialized education. In contrast to pole diving and covering, stress is a psychological variable. This may be due to the effects of certain training.

The main outcome of this study is that resistance circuit training and intense interval training increase physiological variables and physical fitness the most. Resistance circuit training and intense interval training can therefore be incorporated into a training program to enhance the performance of kho-kho players by having an impact on neuromuscular parameters related to the effectiveness of the stretchshortening cycle.

4.6 Discussion on Hypotheses

- According to the first hypothesis, there would be significant improvement on selected physical variables due to the effect of resistance circuit training and intensive interval training on Kho-Kho players. The results showed that resistance circuit training and intense interval training significantly improved on physical variables, including speed, endurance, agility, flexibility, and explosive power. As a result, the researcher's first hypothesis is accepted.
- In the second hypothesis, there would be significant improvement on selected physiological variables due to the effect of resistance circuit training and intensive interval training on Kho-Kho players. The outcomes demonstrated a considerable improvement in physiological parameters such as resting heart rate, vital capacity, and blood pressure with resistance circuit training and severe interval training. The second hypothesis of the researcher is accepted.
- In the third hypothesis, there would be significant differences on selected physical and psychological variables due to the effect of resistance circuit training and intensive interval training. The study's findings revealed a significant difference between the groups, and the formulated hypothesis was therefore accepted.

CHAPTER – V

SUMMARY CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

Kho-Kho is a fast-paced game that demands agility and quick reflexes due to its fast rotations, fast play in both chasing and defending. While leg strength, endurance, rapid sit-ups, attention, and presence of mind are required for the game. Speed and agility are the physical fitness qualities that are thought to be more significant than the other elements. The reviews showed that the participants' physical fitness and level of physiological parameters had been impacted by the resistance circuit and interval training regimens. Numerous investigations have been conducted regarding the distinct impacts of circuit and interval training. The purpose of this study was to determine how a combination of resistance circuit training and intense interval training affected certain physical and physiological characteristics of kho-kho players.

To fulfil the purpose of the study Ninety (N=90) College men Kho-kho players studying in various Colleges affiliated to Veer Narmad South Gujarat University, Surat, Gujarat were randomly selected as subjects. Their age ranged from 18 to 25 years. The subjects were divided at random into three groups of thirty each (n=30). Group - I underwent resistance circuit Training, Group - II underwent Intensive Interval Training, and Group - III acted as the Control group. Every subjects underwent pre-tests on a range of physical and physiological characteristics, including speed, agility, flexibility, explosive power, blood pressure, resting heart rate and vital capacity. For eight weeks, the experimental groups engaged in their corresponding resistance circuit training and intense interval training. After eight weeks of training on all three groups; the experimental group - I, the experimental group - II, and the control group, post-tests were administered on the aforementioned dependent variables. The data collected from the three groups before and immediately after the training program were statistically analysed on the selected criteria variables with Analysis of Covariance (ANCOVA). as long as he "F" ratio for adjusted post-test means was significant, Scheffe's post hoc test was followed to determine which of the paired mean differences was significant. In all cases, a confidence level of ($p<0.05$) was set to test the hypothesis.

5.2 Conclusions

Within the constraints and parameters of this investigation, the following conclusions were reached based on the data presented and the conversations held.

1. Resistance circuit training and intensive interval training were the two experimental groups that showed the significant improvements in terms of speed, endurance, agility, flexibility, explosive power, resting pulse rate, vital capacity, and systolic and diastolic blood pressure.
2. In every one of the selected variables, speed, endurance, agility, flexibility, explosive power, resting pulse rate, vital capacity, and systolic and diastolic blood pressure; significant differences in performance were observed between resistance circuit training and intensive interval training.
3. In every one of the selected criterion variables—speed endurance, cardio respiratory endurance, endurance, muscular endurance, leg strength, heart rate, vital capacity, and systolic and diastolic blood pressure—significant differences in performance were observed between resistance circuit training and intensive interval training.
4. The resistance circuit training group demonstrated a significant increase in explosive power compared to the rigorous interval training group.
5. Among kho-kho players, the control group did not exhibit any statistically significant improvement in any of the selected physical and physiological variables.

5.3 Recommendations

The following recommendations are given in light of the research's findings, discussions, and results.

1. Resistance circuit training and intense interval training were found to have a significant impact on all criteria variables in the current investigation. Therefore, in order to enhance the overall performance of male kho-kho players, it is advised that coaches, trainers, and physical educators implement this training.
2. The same training may be used to increase performance in different games and sports since the selected trainings demonstrated a higher degree of improvement on the selected variables.
3. Other bio-chemical, physiological and physical fitness factors may be included to a study using a similar research design.

4. Similar studies could be conducted over longer time periods or with training intensities other than those described in the current study.
5. It is recommended that similar study may be conducted among state and national level kho-kho players to assess their level in the selected variables.
6. It is recommended that you continue the same investigation with a larger sample size.
7. It might be possible to do a similar study using female athletes as the subjects.
8. Similar studies could potentially be carried out with different dependent variables.

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PUBLICATIONS

Effect of Resistance Circuit Training and Intensive Interval Training on Speed of Veer Narmad South Gujarat University Kho-Kho Players

Patel Prafulkumar Rameshbhai[1*] , Dr. Hemant Pandya[2]

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Abstract :
The purpose of this research study was Effect of Resistance Circuit Training and Intensive Interval Training on Speed of Veer Narmad South Gujarat University Kho-Kho Players Male players of Kho-Kho selected at school level in Veer Narmad South Gujarat University District were selected in the present study. Total 90 male players were selected as subjects for the sample of the present study, in which 30 players were included in the Resistance Circuit training group, 30 in Intensive Interval training group and 30 players were included in the control group. The male players of 13 to 17 years age group were included in the present study. In this research study Speed was measured by 50 Yard Desh Run. Statistical technique such as analysis of covariance was applied to know the effects on Resistance Circuit training group and Intensive Interval training group. Mean difference was examined at 0.05 levels by using Least Significant Difference (Post Hoc) Test. The conclusion of which was seen as follows. Remarkable improvement was found in Speed of selected subjects by 12 weeks systematic Resistance Circuit training and Intensive Interval training programmes.

Introduction :
Sport training is a physical, technical, moral and intellectual participation of with the help of physical exercises. It is a planned process for the participation of athlete and players to achieve top-level performance.
Training is much like constructing a multi storey building. One needs for the building such as aerobic, anaerobic running, comprehensive conditioning, flexibility, etc. several kinds of materials like training intensities and modalities hold be utilized in an on going process to complete the goal of finished buildings or competitively fit athlete. As a training season develops, compressive conditioning work for strength of endurance will gradually form a transition into an emphasis on power with a substitution of intensity of volume in determining the total load.
Types of training and training methods need to be understood well in order to select and design the appropriate training program for an athlete. Training is what athletes do in order to improve their performance. However, training gains are also specific to the training. Training benefits are specific to the speed of movement, muscles used, and types of contractions, intensity and duration of the training. The basic rule of training is that the body makes specific improvements in response to the stress placed on it. If the stress is that the muscle ran out of glycogen stores then more glycogen is stored. If the stress is that the muscle could not lift the weight again, then hypertrophy occurs to enable the muscle to lift the weight again. This is always the case and so it is important that an athlete uses training types and methods that are most closely related to their sport (specificity).
Circuit Training is an everlasting and evolving training exercise program developed by R. E. Morgan and G. T. Anderson in 1953 at the University of Leeds, England. Circuit Training was developed to allow people to work at their own intensity while also training with others. In the original format, a circuit would comprise of 9 to 12 stations. A participant would move from one station to the next with little rest and performing an exercise for a set period of time or number of repetitions. During the circuit training session all the energy systems interweave to enable different intensity activities to be performed. This will result in the aerobic energy system being more predominant during some exercises and the anaerobic energy system will be more predominant in other exercises.
By circuit training we mean the training of exercise in a circle. It is special method of training in which exercise are undertaken either with equipment or without equipment. Circuit training is the most popular organized from of training method of physical exercises. The number of repetition, the intensity of the learner, the time interval etc. are pre-planned. The main aim of circuit training is to simultaneously increase tolerance, muscular strength and proficiency. The required exercises are given in a circle according to the requirement of full preparation. Such exercises are races, jumps, rolls, carrying load crossing the hurdle, pulling, pushing etc. In it the player has to complete this circle in a fixed time. These circles are to be completed I greater number by more exercise or their time and number are increased.
This training method is based on the fact that any activate sets in fatigue in the body, and rest is needed to ward off this fatigue. If a parson gets rest in between his work periods, his capacity of work increases. The circuit training bring about improvement is respiratory and blood circulation systems of our body. It improves co-ordination among various body systems. These types of co-ordination are known as cardiovascular adjustment.

Purpose of the Study :
The purpose of this research study was Effect of Resistance Circuit Training and Intensive Interval Training on Vital Capacity of Veer Narmad South Gujarat University Kho-Kho Players

Selection of Subjects :
Male players of Kho-Kho selected at school level in Veer Narmad South Gujarat University District were selected in the present study. Total 90 male players were selected as subjects for the sample of the present study, in which 30 players were included in the Resistance Circuit training group, 30 in Intensive Interval training group and 30 players were included in the control group. The male players of 13 to 17 years age group were included in the present study.

Criterion Measurement :

No.	Variable	Test	Measurement
1	Speed	50 Yard Desh	ml

Statistical Process
Statistical technique such as analysis of covariance was applied to know the effects on Resistance Circuit training group and Intensive Interval training group. Mean difference was examined at 0.05 levels by using Least Significant Difference (Post Hoc) Test.

Result of the Study :

Table – 1 Analysis of covariance of mean scores of speed of two experimental groups and a control group

Test	Groups			Analysis of variance				
	Resistance Circuit Training	Intensive Interval Training	Control	Sum of classes (SS)		*df*	MSS	*'F'*
Pretest mean	9.726	9.683	9.787	A	0.158	2	0.79	1.203
				W	35.455	87	0.408	
Post-test mean	9.249	9.596	9.907	A	6.579	2	3.289	8.369*
				W	39.258	87	0.451	
Adjusted mean	9.252	9.401	9.864	A	5.721	2	2.860	19.121*
				W	14.201	86	0.165	

***Significance criterion at 0.05 levels 'F' = 0.05 (2,87) = 3.101 & (2,86) = 3.103**

In the above table – 1 the 'F' ratio of pre-test mean of Speed test performance was found to be 1.203. Which compared to the table value (3.101) was not found to be significant at 0.05 level. The 'F' ratio of the mean of the final test of the three groups was found to be 8.369. Comparing it with the table value (3.101) was found to be significant at 0.05 level. The 'F' ratio of corrected medians was found to be 19.121. Comparing it with the table value (3.103) was found to be significant at 0.05 level. Significance was examined with logarithmic differences between adjusted medians. Which is shown in Table – 2.

Table – 2 Critical difference of mean scores of Speed of two experimental groups and a control group

Mean			Mean difference	Critical difference
Resistance Circuit Training	Intensive Interval Training	Control Group		
9.252	9.401		0.149	0.209
9.252		9.864	0.612*	
	9.401	9.864	0.463*	

*** Significance at 0.05 levels**

Difference between adjusted mean scores of Speed of two experimental groups and a control group is seen clearly in table – 2. The difference is found out between Resistance Circuit Training group and Intensive Interval Training group, Resistance Circuit Training group and control group and Intensive Interval Training group and control group and it was compared with critical difference. It is observed in table – 2 that higher significant improvement (0.612) was found in Resistance Circuit Training group with compared to the control group. Then, higher significant improvement (0.463) was found in Intensive Interval Training group with compared to the control group. Significant effect of experimental treatment was found higher in Resistance Circuit Training group and Intensive Interval Training group with compared to control group, whereas significant effect of experimental treatment was not found between Resistance Circuit Training group and Intensive Interval Training group.

Conclusion :

Remarkable improvement was found in Speed of selected subjects by 12 weeks systematic Resistance Circuit training and Intensive Interval training programmes.

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Effect of Resistance Circuit Training and Intensive Interval Training on Vital Capacity of Veer Narmad South Gujarat University Kho-Kho Players

Patel Prafulkumar Rameshbhai[1*] , Dr. Hemant Pandya[2]

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Abstract :
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Introduction :
Circuit training stations are generally sequenced in a way to alternate between muscle groups, which allows for adequate recovery. The rest interval between stations should be between 30-90 seconds and 1-3 minutes between circuits. A typical gym has several strength training machines and workstations, which enables the creation of several circuits. This benefit of variability challenges the skills of the participant and keeps them interested from session to session.
Circuit training plays an integral role in the offseason workouts of many professional athletes. It serves as a way to maintain general fitness while avoiding the high physical demands of in-season sport. Circuit training also serves as a segue to higher level strengthening programs in these athletes.
Circuit training consists of performing multiple exercises on multiple body parts in a row with little rest in between exertions. The two most basic types of circuit training are horizontal training and vertical training. In horizontal training, all sets of one exercise are performed before a person moves on to the next exercise. In vertical training, one set of every different type of exercise is performed before returning to an exercise for the second time.
The amount of weight that a person lifts during a circuit training session can vary between sets. A person can start with light weights and work up to heavier weights (increasing pyramid) or can start with heavy weights and regress to lighter weights (decreasing pyramid). The most important component of circuit training is to take little rest in between sets, whether of the same or different exercises.
Due to the lack of rest that circuit training demands, exercisers maintain elevated heart rates for the entire period of exercise. The combination of weight training and increased cardiovascular effort makes circuit training a beneficial type of cross training. The exerciser gains muscle through the resistance training. The exerciser increases his/her cardiovascular endurance during the slightly elevated heart rate that is maintained in between sets and throughout the overall program. The exerciser bums high amounts of calories during the high exertion periods of his/her sets.
Circuit training is also a convenient way to exercise. It maximizes the total exercise volume (number of sets, repetitions, and amount of weight) completed in a period of time. Exercises are completed in a row, and therefore, the time spent exercising is condensed. Separate cardiovascular training is not necessary. All body parts are trained in one session, and therefore, exercisers do not need to work out everyday.
Interval training was first introduced in the 1950s as a higher intensity form called sprint interval training, which reached 100% maximum heart rate and was used to improve the performance of elite Olympic athletes. Body weight can be used as the main form of resistance so that additional equipment is not needed.
Our body needs energy and heat. In order to maintain the energy and heat of the body, the burning process of pineapple continues in every tissue. The combustion of pineapple in the tissue takes place in the presence of oxygen. As we breathe in, oxygen accumulates in the blood cells in the lungs. That oxygen is combusted by the blood cells along with

the carbon and hydrogen in the pineapple and thereby generates energy and heat in the body. Carbon dioxide and water are produced in the body due to combustion in the tissues. We breathe it out. Thus we need breathing.
The lungs are covered in the cavity on both sides of our chest. Lungs are bluish inwardly perforated, elastic and black-brown in color. The shape of the lungs is cone-like. There are two parts of the lungs namely right lung and left lung. The right lung is larger than the left lung. The right lung has three lobes and the left lung has two lobes. Each lung has two layers. It is called pleura. One layer is attached to the lungs and the other is the lining of the chest cavity. An oily substance leaks between the two layers of the lungs. Due to this oily substance, even though pressure is exerted on both layers due to respiration, the two do not rub against each other and the lungs can slide without rubbing against the chest wall. Each lung has a breathing vessel. Each lung is lined with tiny bronchioles and air cells. Air-cell membranes are very thin. There are networks of capillaries around the air cells, air cells are also called air spheres. Its shape looks like a grape cluster.

Purpose of the Study :
The purpose of this research study was Effect of Resistance Circuit Training and Intensive Interval Training on Vital Capacity of Veer Narmad South Gujarat University Kho-Kho Players

Selection of Subjects :
Male players of Kho-Kho selected at school level in Veer Narmad South Gujarat University District were selected in the present study. Total 90 male players were selected as subjects for the sample of the present study, in which 30 players were included in the Resistance Circuit training group, 30 in Intensive Interval training group and 30 players were included in the control group. The male players of 13 to 17 years age group were included in the present study.

Criterion Measurement :

No.	Variable	Test	Measurement
2	Vital capacity	Pic flow meter	ml

Statistical Process
Statistical technique such as analysis of covariance was applied to know the effects on Resistance Circuit training group and Intensive Interval training group. Mean difference was examined at 0.05 levels by using Least Significant Difference (Post Hoc) Test.

Result of the Study :

Table – 1 Analysis of covariance of mean scores of vital capacity of two experimental groups and a control group

Test	Groups			Analysis of variance				
	Resistance Circuit Training	Intensive Interval Training	Control	Sum of classes (SS)		*df*	MSS	*'F'*
Pretest mean	242.655	263.322	240.331	A	9615.556	2	4807.778	1.281
				W	302550.00	87	3477.586	
Post-test mean	269.003	394.665	391.003	A	28895.556	2	14447.778	5.089
				W	308286.667	87	3543.525	
Adjusted mean	374.858	380.715	359.094	A	7364.878	2	3682.439	12.118*
				W	30309.693	86	352.438	

***Significance criterion at 0.05 levels 'F' = 0.05 (2,87) = 3.101 & (2,86) = 3.103**
In the above table – 1 the 'F' ratio of pre-test mean of Vital Capacity test performance was found to be 1.281. Which compared to the table value (3.101) was not found to be significant at 0.05 level. The 'F' ratio of the mean of the final test of the three groups was found to be 5.089. Comparing it with the table value (3.101) was found to be significant at 0.05 level. The 'F' ratio of corrected medians was found to be 12.118. Comparing it with the table value (3.103) was found to be significant at 0.05 level. Significance was examined with logarithmic differences between adjusted medians. Which is shown in Table – 2.

Table – 2 Critical difference of mean scores of vital capacity of two experimental groups and a control group

Mean			Mean difference	Critical difference
Resistance Circuit Training	Intensive Interval Training	Control Group		
374.858	380.715		5.857	7.136
374.858		359.094	15.763*	
	380.715	359.094	21.620*	

*** Significance at 0.05 levels**

Difference between adjusted mean scores of vital capacity of two experimental groups and a control group is seen clearly in table – 2. The difference is found out between Resistance Circuit Training group and Intensive Interval Training group, Resistance Circuit Training group and control group and Intensive Interval Training group and control group and it was compared with critical difference. It is observed in table – 2 that higher significant improvement (21.620) was found in Intensive Interval Training group with compared to the control group. Then, higher significant improvement (15.763) was found in Resistance Circuit Training group with compared to the control group. Significant effect of experimental treatment was found higher in Resistance Circuit Training group and Intensive Interval Training group with compared to control group, whereas significant effect of experimental treatment was not found between Resistance Circuit Training group and Intensive Interval Training group.

Conclusion :

Remarkable improvement was found in vital capacity of selected subjects by 12 weeks systematic Resistance Circuit training and Intensive Interval training programmes.

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THE EFFECT OF RESISTANCE CIRCUIT TRAINING AND INTENSIVE INTERVAL TRAINING ON SELECTED PHYSICAL AND PHYSIOLOGICAL VARIABLES OF VEER NARMAD SOUTH GUJARAT UNIVERSITY KHO-KHO PLAYERS

by Praful R. Patel

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