

**EFFECT OF SHADOW TRAINING ON THE BEGINNERS
AND ADVANCE PLAYERS IN ACHIEVING HIGH
PERFORMANCE IN BADMINTON**

प्रारंभिक और अग्रिम बैडमिंटन खिलाड़ियों के भौतिक चर के चयन पर
छाया प्रशिक्षण के प्रभाव का एक तुलनात्मक अध्ययन

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Thesis**

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By

AYUSH H RAWAT

आयुष एच रावत

Under the supervision of

Dr. NEELAM YADAV

Associate Professor
Department of Physical Education



**FACULTY OF PHYSICAL EDUCATION
PACIFIC ACADEMY OF HIGHER EDUCATION
AND RESEARCH UNIVERSITY, UDAIPUR**

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PACIFIC ACADEMY OF HIGHER EDUCATION AND
RESEARCH UNIVERSITY, UDAIPUR

Dr. NEELAM YADAV

Associate Professor,

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Name and Designation of Supervisor

Dr. NEELAM YADAV

Associate Professor,
Pacific College of Physical Education,

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DATE: -

AYUSH H RAWAT

PREFACE

The purpose of the current study was to compare the effectiveness of shadow training on selected physical fitness variables in badminton and To compare the effectiveness of shadow training on physiological variables in badminton. The selected physical variables include Speed, explosive power, balance, flexibility, lower body strength and back power

A total of 60 subjects in the age category 10-14 & 15-19 of different academies in Surat district have been selected. Subjects of the research group were divided into four groups (two control groups & two experimental groups). Two groups will be consisting of 15 players each of the beginner level. First group was comprising of players of age 10-14 years on which the training schedule was implied followed by second group which was of the same age category of the advanced player. Third group was of 15-19 years' age category of the beginners followed by the fourth group which was having the advanced players of the same age category. The Training programme was administered on the experimental group four times in a week for a period of 12 weeks.

The data collected from two groups before and after experimental period was statistically analyzed for observing significant improvement by using T- Test. In order to observe the effect of Shadow Training on selected Physical & physiological variables of beginners and advanced badminton players Analysis of co- variance (ANCOVA) was used. Statistical significance was accepted at 0.5 level

The data showed that there was a significant difference in physical variables like speed, vertical jump, balance, lower body strength, and back strength. However, there was an insignificant difference in flexibility. The 't' values for all the significant physical variables were greater than the required 't' table value to be significant at the 0.05 level, while the 't' value for flexibility was less than the required value.

There was significant difference between the beginners and advance level badminton players. There was significant difference between the beginners and advance level badminton players in physical variables. There was no significant difference between the beginners and advance level badminton players in physiological variables.

INDEX

CHAPTER- I INTRODUCTION	1 – 16
CHAPTER- II REVIEW OF THE RELATED LITERATURE	17 - 37
CHAPTER-III PROCEDURE	38 - 77
CHAPTER- IV ANALYSIS AND INTERPRETATION OF DATA	78-100
CHAPTER-V SUMMARY, CONCLUSIONS AND RECOMMENDATIONS	101-103
BIBLIOGRAPHY	104-107
PUBLICATIONS	
CERTIFICATE	

LIST OF TABLE

Table No.	Particulars	Chapter Page No.
3.1	Badminton shadow group weekly training program	75
4.1	Descriptive Statistics on Physical variables for 10-14 years age group players	78
4.2	Descriptive Statistics on Physical variables for 10-14 years advance level players	80
4.3	'T' test Comparative Statistics on Physical variables of 15-19 years age group players	82
4.4	Descriptive Statistics on Physical variables of 15-19 years age group advance level players	84
4.5	'T' test Comparative Statistics on Physical variables of For 10-14 years age group players	86
4.6	'T' test Comparative Statistics on Physical variables of 10-14 years age group advance level players	87
4.7	'T' test Comparative Statistics on Physical variables of 15-19 years age group players	88
4.8	'T' test Comparative Statistics on Physical variables of 15-19 years age group advance level players	89
4.9	Descriptive statistics on Physiological variables for 10-14 years age group players	90
4.10	Descriptive statistics on physiological variables of 10-14 years age group advance level players	91
4.11	Descriptive statistics on physiological variables of 15-19 years age group players	92
4.12	Descriptive statistics on physiological variables of 15-19 years age group advance level players	93
4.13	'T' test Comparative Statistics For 10-14 years age group players	94
4.14	'T' test Comparative Statistics group players	94
4.15	'T' test Comparative Statistics group3	95
4.16	'T' test Comparative Statistics group4	95

LIST OF FIGURE

Fig. No.	Particulars	Chapter Page No.
4.1	Descriptive statistics on Physical variables of 10-14 years age group players	79
4.2	Descriptive statistics on Physical variables of 10-14 years age group advance level players	81
4.3	Descriptive statistics on Physical variables of 15-19 years age group players	83
4.4	Descriptive statistics on Physical variables of 15-19 years age group advance level players	85
4.5	Descriptive statistics on physiological variables of 10-14 years age group players	90
4.6	Descriptive statistics on physiological variables of 10-14 years age group advance levelplayers	91
4.7	Descriptive statistics on physiological variables of 15-19 years age group players	92
4.8	Descriptive statistics on physiological variables of 15-19 years age group advance levelplayers	93

LIST OF PHOTO

Fig. No.	Particulars	Chapter Page No.
1	Speed 20 meters dash	40 - 42
2	Vertical Jump	43 - 52
3	Flexibility	54 - 59
4	Lower Body Strength	60 - 61
5	Back Strength	62 - 63
6	Shadow Training	65 - 75

CHAPTER -I

INTRODUCTION



The history of games and sports is as old as mankind. A quick glimpse of the ancient times will make you encounter several reference of sports, games and amusements which were organized by various cultural organizations such as Athenians Spartans, Asthapada(Chess), Kabaddi to name a few. The epoch of sports we witness today came with the organization of the first ancient Olympic Games of 776 B.C. in Greece. From those ancient heritage sports ground to vast stadiums today, sports have overcome all obstacles and have made homo-sapiens display their talents and skills to unite hearts and minds of the people for achieving universal brotherhood and develop a virtue of sportsmanship.

In recent years, the advancement of sports science and the awareness of varied racquet sports have drawn attention on betterment of physical and mental ability which has opened doors for pursuing exhaustive practical and theoretical studies of various racquet sports. In turn sports training, sports physiology and nutrition, notational analysis, sports biomechanics, sports medicine and motor skills are briefly discussed. These assessments show that there is a considerable scientific discipline and its approach has aided in the implementation of a training program to increase players' fitness, advise them in nutritional and psychological preparation for play, and enlighten them about their own and their opponent's strategies and tactics (Adrian Lees,2003). Moreover, the science of sports fascinates skilled players and competitors and everyone with a passion for the activity, especially if the athlete is aiming to excel at the highest level possible. To attain the maximum level of success, concentrated reasoning is an essential aspect of targeted achievement. However, it begins before the athlete arrives on the field. At each stage of the sport, dedication, determination, and practice are required. When evaluating the performance process and the winning paradigm in sport, many parameters play a role (Bisht Heera Singh, 2019).

With around 200 million participants, badminton is one of the most popular sports also known as one of the best cardio sport around the globe. It is the fastest racquet sport with the quickest smash at 493 km per hour and a rate of one shot per second. Badminton is considered as a physically and mentally demanding, high-intensity racquet sport with a fast response time, in which players try to hit the shuttle into the opposing field until one of them misses a shuttle (Gumundsdtir, 2017; Phomsoupha

& Laffaey, 2014). The average heart rate in competition is around 90% of the player's maximum heart rate (HR max), and approximately 60-70% of the energy required comes from the aerobic system and 30% from the anaerobic system (Oliver Faude et al., 2007). In 2006, the Badminton World Federation (BWF) implemented a new scoring system. A match in this new format comprises the best of 3 games with 21 points each, the player scoring the first 21 points wins the game; that being said a point is awarded for each service (Abian et al., 2014). The active playing time per rally is roughly 6-10 seconds, but the rest period between rallies is 2–2.5 times longer. This is true for both singles and doubles competitions (Alcock & Cable, 2009). Active rest time between rallies increased from the 1992 Olympics to the 2012 Olympics, with the result that active playing time decreased from 34% to 22%, and the rate of rallies increased by 34%. Professional competitive games usually last 40-60 minutes (Aydognmus et al., 2014; Faude et al., 2007; Laffaey et al., 2015; D. M. Cabello & Gonzalez-Badillo, 2003; Phomsoupha & Laffaey, 2014). This can be explained by the increasing speed and two intensities in sport, which mean that the players need more rest between rallies. In addition, the players must maintain a high concentration to meet the tactical or mental demands of dealing with their opponents. During the game, the player has to remain agile constantly while performing highly coordinated movements. Compared to a tennis player, a badminton player has to cover twice as far during a game. The various potential stresses of competitive play are considerable. Therefore, everyone involved in the modern game must understand the whole psychomotor and physiological fitness required for the game, as well as how to improve performance (Reuters/ Peter Cziborra, 2016). Badminton forces the players to move both back and forth and side to side and repeat maximum exertion such as dashing and jumping. Chin et al. (1995) recommended that if a player wants to achieve reasonable success at international badminton competition, improvement in motor fitness needs to be emphasized in addition to skill training. It is therefore pertinent to assess both physiological and motor performance components thought to be important in a particular sport at various levels so that necessary modifications can be made in the athlete's training program. Even though everyone can enjoy badminton, it requires many fitness components and skills so the players need to prepare their next move beforehand in order to utilize their stamina and skills efficiently. Every player must

improve their physical and tactical abilities along with motor & cardiorespiratory fitness. Two individuals having the same tactical and technical or psychic ability can differ in performance when there is a difference in their motor & cardiorespiratory fitness.

Badminton is a high intensity sport that involves coordinated movement technique on a designated rectangular court. It is an intermittent sport characterized by long, high-intensity training units with designated intervals for rest and involves vigorous movement of the lower and upper muscles (Reilly et al, 1990). The sports require quick anticipation and response to the opponent's movement shuttle, footwork, and execution of stroke (Mahoney and sharp, 1995). Badminton as a sport requires the player to be technically sound with reaction ability, footwork, coordination ability, explosive strength, forearm strength, agility, speed and stamina lunges, jump, rapid changes of direction, and quick arm movements, require physical factors such as strength, stamina, power, and agility. Additionally, trainers, coaches, and athletes constantly look for optimal ways to identify critical elements contributing to competitive performance. Muscle strength, or dynamic power, is one such element, and the ability to produce a significant amount of force is believed to be a substantial factor in overall performance during competition phase. According to MacDougall et al. (1991), the relevance and relative importance of power for athletic performance will vary according to the different demands of the sport. An explosive player usually jumps high, changes direction quickly, and appears to be quick on the badminton court in general. Lower body strength is a combination of muscular power and development of quadriceps, hamstring, gluteus, gastrocnemius and soleus. An important factor of sports like badminton is the player's capacity to produce muscular force at rapid speed. A player's body will accelerate over the court if they have a high level of strength and power, and an increase in either strength or speed will increase power. Lower body strength is essential in badminton as it develops economical footwork of the player and enables jumps to execute overhead strokes. When lifting off the floor to move or jump to the shuttle, more leg strength means more substantial acceleration and faster speed. On the badminton court, an explosive player will usually jump high, change directions rapidly, and look speedy, according to Omosegaard. The physical fitness and judgment capability of a player can be a major determinant of

success during a tournament. In the game, badminton legs serve as a support body to move in any direction quickly so it can position the body in such a way that can make effective blow movements (Bin Xu 2015).

The sporting world has changed India, mired in a hog of out dated sporting techniques and petty politicking by ignorant sports administrators, and is going down the sports ladder day by day.

In the present scientific era, sports not only help in shaping the lifestyle and personality of a person but also act as determinant of the status of a country at national and international levels. With the passage of time a lot of changes have crept into the field of sports. This has become highly competitive and complex profession. With the help of advanced electronic, print and mass media sports have been displayed as very inscriptive and prestigious field at national and international competition level. Consequently, more importance is given to sports and sportspersons these days. Victory and superiority in sports at the international level or the Olympic competition add honor to the national prestige by highlighting the concerned country on the world map.

Sports have now become highly competitive. Many players are now taking sports as profession be it a player, coach, physiotherapist, psychologist, dietitian any many other. The importance given to sports can be judged from the hefty sponsorship being paid to sports person all around the globe. Cristiano Ronaldo being the highest paid athlete in the world and Virat Kohli being the highest paid Indian are setting an example and being role models for many sportsperson around the globe With the exposure through electronic, print media and social networking, sports have been glamorized to an extent where millions and billions of players are following their idol helping many others to excel in the field of sports. International competitions like Summer Olympics, World Cup and International Championships are very renowned where each country sends their best players to compete in the most hyped and viewed events in the world.

Sports are an activity that is governed by a set of rules or customs. Sports are the activities where the physical capability of the player determines the outcome or the result of the match, apart from that it also develops the motor abilities, mental

toughness, sports man spirit which plays a major role in all round development of a player. Sports are used as an entertainment for the players & the viewers. It has also been proven by experiments and experts that daily exercise and playing sports increase mental toughness, sharpen the brain and also improves the immunity of the body.

Sports have always been a great recreational and fitness option for people of all age categories which has developed a wave of keeping our body healthy. The famous phrase “Health is Wealth” is been taken into consideration by most of the people of our country. Sports have always been an important part of one’s life. Though cricket predominates amongst all the games played in India, but badminton in recent time has been on the rise as it is considered one of the best sports when it comes to cardio and weight loss. Even though it is an indoor game, badminton in India is played outdoors as well, due to lack of indoor space. Initially it was played as a recreational sport in many clubs but nowadays players are very much dedicated to badminton due to the recent achievements of Indian players at the international level. Many states, organizations and academies started conducting tournaments to give many players opportunity to show their talent. Nonetheless, have you ever thought when did it all start? Do you know that the history of the modern version of badminton has its roots in India? To get more mind-boggling information about the origin of badminton, skim through the following paragraphs.

Origin of Badminton in India

The game of badminton was originally known as battledore and shuttlecock, which was played in ancient Greece over 2000 years ago. One of the most popular games since the medieval era, the modern version of badminton has its roots well laid in India. The game was originally developed in India among the British where it was very popular by the 1870s. As the city of Pune was formerly known as Poona, the game was also known as Poona at that time where it was particularly popular and in 1873 the first rules of badminton were made.

The main aim of the game was to keep the shuttlecock, in the air for as long a time so as to win a point when it drops on the opponent's area, using a paddle, called a battledore. The group, who managed to keep the shuttle in the air for a long time was

declared the winner. Though this cooperative, non-competitive game was similar to its predecessor, the only difference was the addition of a net. The shuttlecock is often cited as a bird, because it is usually made out feathers. Now the shuttlecock consist of 16 real duck and goose feathers which determines the speed of the shuttle and are only used during the competition. The feather shuttlecocks are very expensive making Badminton one of the costliest sport and so to make it affordable in the present times, there are plastic shuttles also available.

Once the British mastered the game in India, they took the equipment's with them back to England during the 1870s. Three years later, in 1873, the Duke of Beaufort hosted a lawn party in his country place called Badminton. The game of Poona was played on that day and became a popular and entertaining pastime among the British elites. It was at that time the name Badminton was given to the sport. In 1877, the first club dedicated to the sport called the Bath Badminton Club was formed. The first official set of rules for playing Badminton was also made by this club.

Badminton now is considered the second most participated sport in India, according to a facts and report published by SMG Insight a UK-based sports consulting firm, in association with research agency YouGuv. The title of the report 'Popularity and Participation of Sports in India 2012', declares badminton the second most sport played in India after cricket. Badminton was ranked No.4 after cricket, tennis and football in terms of following.

Cricket is considered to be the most participated and followed sport, with 62% and 85% respectively, 51% voted badminton as the most played sport on regular basis , while 32% said they followed the same. Further details on the profile and size of the samples selected are awaited.

SMG Insight describes itself as giving "B2B and B2C research and consulting solutions for world leading sports governing bodies, sponsors and sports investors in order to meet their strategic and business objectives", while You Guv states that it is "an international, full service market research agency offering added value consultancy".

Understandably, the report highlights the importance of cricket in the Indian context. It says: "India is arguably the biggest sports market in the world with a 1.2 billion

population and a long established sports culture founded on its love of cricket. While cricket's leading position has been solidified in recent years with the astonishing success of the Indian Premier League (IPL), events such as the 2010 Commonwealth Games and inaugural Indian Formula One Grand Prix in 2011 have put the country on the business of sports world stage. This report details the essential information on participation and following in major sports and events by the Indian population. Cricket remains huge but there is extensive interest across a range of sports offering the sports industry and brands the opportunity to access this fast growing market."

The report shows the participation and following of the top sports by the Indian population, including analysis by age, income and gender. Analysing on the report Frank Saez, Managing Director of SMG Insight / YouGov said: "This report shows that India, while mad for cricket in multiple forms and events, is emerging as a sports nation with interest spread across a range of activities and competitions. Indian sport faces an exciting future."

India's favorite sports (Participation) 1. Cricket 62% 2. Badminton 51%3. Swimming 30% 4. Table Tennis 25%5. Cycling 24% 6. Tennis 23% 7. Football 22% 8. Volleyball 16% 9. Basketball 15% 10. Go-karting 11%. It is self-evident that the fit citizens are a nation's best assets and weak ones its liabilities. It is consequently the responsibility of every nation to promote physical health of its residents due to the fact bodily fitness is the basic requirement for most of the responsibilities to be undertaken by an individual in his daily life, if a person's body is under-developed or grows soft or inactive and if he fails to develop physical prowess, he is undermining his capacity for thought and for work, which are of vital importance to one's own life and society in a welfare state.

Physical education and sports activities, being a quintessential part of education, have additionally skilled the effect of scientific advancement. Currently it is very difficult to excel in national and international level in any sport due to increase in the level of competition in both male and female categories. The most important aspect is the select a right sport according to one's physical ability and physiological & psychological abilities by preparing a systematic training schedule. With growing competitiveness and growing well-known in sports, talent search has emerge as

crucial as younger skills must be spotted at an early age and nurtured with the right type of scientific training in order to get excellent performance. There are various accounts of how and when badminton started. According to the facts a game with racquet and shuttlecock was played at the estate of the Duke of Beaufort in Gloucestershire in the 1860s. The estate was called badminton and hence the name Badminton was derived from the same. Generally it is accepted that some British Army Officers first started Badminton in India in the year 1968 in a town called Poona. Although some sort of "badminton" had been played in various countries like China, Poland, and England for centuries, the game acquired its name in 1869 when a group of British Army Officers, having learnt it in India, played the game at the Duke of Beauforts Country Estate, Badminton Hall, Gloucestershire in London. The game of badminton, as it is played these days, has undergone a lot of improvement since its origin in the year 1870. In the current competitive level of badminton a player needs to have competitive stamina as he/she needs to have a systematic movements for a certain amount of time (up to 75 minutes depending upon the standard of the player) with variation in his from slow to fast along with good reaction ability, explosive strength and power. This demands a great deal of cardio-vascular endurance on the part of the badminton player. The world's top most badminton playing nations specially China, Indonesia, Malaysia and Korea, are very much aware of these and concentrate on the development of basic physical fitness variables and related aspects. They start training a child, concentrating on those fitness factors which are supposed to play a significant role in future performance of a player such as flexibility, agility, balance, cardiovascular endurance, strength, reaction time, power etc. which are appropriate for a specific age group. The standards within fitness are to some extent built into fitness components. The fit player should be strong, fast, powerful, agile, lean, athletic muscular and with a lot of endurance. In addition, there are links to aesthetic standards with respect to the quality of movement. We might also expect the player to be dynamic and explosive. A higher level of fitness is often reflected in a better quality of fitness shown in movements around the court. This is to be expected, for if this fitness is specific to badminton and one comes fit by training on these movements, then necessarily one is going to become a better (more skillful) mover in the game. Thus, the quality of the skilled movement in the game, fitness and skill are

inseparable in the performance of quality movement, which attains aesthetic standards. Physical fitness is inseparable part of sports performance and achievements. The quality of its utilization value is directly proportional to the level of performance. That means the greater the level of fitness, the greater ability of a person to attain higher levels of performance. Power seems to be a vital factor in badminton since a player is required to make constant front and back movements, repeated jumps during smash and tap etc. Power is also a key ingredient in performing certain techniques in badminton which demand jumping activity such as jump and smash, tap etc. Stamina, speed, strength, skill and strategy are essential ingredients of all sports disciplines. A complete badminton player's judgment has to be so sharp and accurate that he should be repeatedly able to send a shuttle to inner edge of a line and if a shuttle is likely to fall even an inch outside, he should leave it confidently. Instant coordination of all above mentioned faculties is a must for success. The top International players today required speed, explosive power, unlimited endurance capacity to play long rallies and high physical and mental fitness to fight and overcome the stress and strain during the competitions. Physical fitness on the one hand and psychological prerequisite on the other are equally important to maintain the equilibrium of the individual.

Sport is a physical activity that tests our athletic abilities. It's sort of an exercise wherein we compete with the opponent/s solely for the reason of leisure. Badminton, Basketball, football, cricket, volleyball, and hockey are some of the most well-known sports. Sports have many physical and psychological advantages at the members in addition to the viewers. They result in a better physical stamina and progressed reflexes along with other advantages. Sports demands high physical fitness, which leads to good blood circulation and advanced physical stamina. It also requires high flexibility, agility and responsive and coordinated skills to achieve high performance. Despite all of the physical blessings, collaborating in a recreation additionally works wonders on your brain and usual persona. Sport is a opposition wherein you compete with the combatants. You want to decide their movements and make immediately selections, therefore improving your mental capability. Thinking fast and responding accordingly has fantastic impact on a sportsman's brain. Sports additionally expand your social abilities as you have interaction along with your fighters as well as the

teammates. It improves team giving him/her and publicity to the crew culture, which is beneficial in professional lifestyles as well. Even the mere spectators of a sport interact with each other and support their respective teams by shouting and cheering; resulting in overall happiness and a good social behavior. Sports play a tremendous in every body students. Everyone ought to involve themselves within the sports activities hobby even for a small time at some stage in the day. Sports are necessary because it brings physical and intellectual health to the man or woman involved in this on regular basis. People who've busy agenda in their life get tired very effortlessly. As we all recognize that, living a secure and comfort lifestyles we need a legitimate thoughts and a legitimate body. Education could be very essential to get name, fame and money. In the identical way, getting a sound mind and body, all of us must contain in a few kind of bodily activities for which sports activities is the best manner.

History of Badminton

Badminton has its beginning in primordial civilizations in Asia and Europe. The ancient game known as battledore (bat or paddle) and shuttlecock probably originated more than 2000 years ago. In the 1600s battledore and shuttlecock turned into an upper elegance hobby in England and lots of European countries. Battledore and shuttlecock was simply two people hitting a shuttlecock backwards and forwards with a simple bat as many times as they could without allowing it to hit the ground. 19 It is hard to tell how the sport recognized these days as badminton evolves from the past records. The earliest supply regarded is in historical Greece drawings depict similar game played with shuttlecock greater than thousand years in the past. It is unsure the way it turns into the traditional game referred to as battledore and shuttlecock in Europe with the aid of past due sixteenth century, or Jeu de Volant this means that "flying game" in French. It became played with small hand paddle that were fabricated from wood. The shuttlecock was frequently called a "bird" then as it changed into fabricated from feathers with cork connected at the bottom. The social game was played by hitting the shuttlecock back and fro to another player, but without the net separating them as we have today. Modern badminton may be traced to mid-19th century British India. It changed into created by using British military officers stationed there. A net changed into added to the traditional English sport of battledore and shuttlecock. As it became famous in the British garrison city of Poona,

the sport got here to be referred to as "Poona" or "Poonai" Initially; woolen balls were desired by the higher instructions in windy or moist conditions, however ultimately shuttlecocks took over the function of a "ball." This sport became taken by retired officials who were given returned to England. It changed into delivered as a recreation for the visitors of the Duke of Beaufort at his stately domestic 'Badminton' in Gloucestershire, England wherein it have become famous. Hence, the call changed into originated as "Badminton." In March 1898, the primary Open Tournament was held at Guildford and the first 'All England' Championships had been held the following year. The International Badminton Federation became fashioned in 1934 with 9 founder contributors, England, Wales, Ireland, Scotland, Denmark, Holland, Canada, New Zealand and France. India joined as an affiliate in 1936. The first essential IBF event was the Thomas Cup (international men's crew championships) in 1948. Since then, the quantity of global events has accelerated with the addition of the Uber Cup (girls's team), World Championships (individual occasions), Sudirman Cup (blended group), World Junior Championships and the World Grand Prix Finals. Badminton is a relatively new Olympic sport. It changed into a demonstration recreation on the 1972 Munich Olympics. Badminton eventually became an Olympic sport in Barcelona in 1992. Only the singles and doubles were introduced for the first time in the Olympic Games. Mixed doubles changed into blanketed in the 1996 20 Atlanta Olympic Games and badminton is the handiest recreation that has mixed doubles occasion within the Olympics. Only five countries have received gold medals on the Olympics because badminton became delivered in 1992 - China, Indonesia and Korea, England and Denmark. Indian History of Badminton. Badminton is a popular sport in India. It is the second most played sport in India after Cricket. BAI (Badminton Association of India) which was founded in 1934 is the official governing body that conducts all the national and international tournaments in India. Indian shuttelers Saina Nehwal , Kidambi Srikanth , P.V. Sindhu , H S Pranoy , Lakshya sen are top in modern BWF ranking. Prakash Padukone turned into the first player from India to achieve world no.1 spot in the sport and after him K. Srikanth made it to the top spot as male player for the second time in April 2018 and Saina Nehwal is the first female player from India to achieve World no.1 spot in April 2015. The best Women's doubles pair in India Jwala Gutta and Ashwini Ponappa who had their

carrer best world ranking 10 in 2015. Chirag Shetty and Satwiksairj Rankireddy are the most decorated men's doubles Indian pair to gain the No.1 spot in World ranking. Other successful players include Sai Praneeth, P. Gopichand, Syed Modi, P Kashyap, Chetan Anand, and Sikki Reddy. Prakash Padukone and Pullela Gopichand are the only male players of India to win the prestigious All England Championship in 1980 and 2001 respectively. Saina Nehwal won the bronze medal in the 2012 at Summer Olympics in London, the first ever medal for the country in badminton, while P.V.Sindhu won the silver medal at Rio Olympics in 2016 in women;s singles. The doubles duo of Ashwini Ponnappa and Jwala Gutta won the bronze medal in BWF World championship in 2011 making them the first Indian pair to win medal. Sindhu won consecutive medals at 2013 and 2014 editions. Nehwal gained silver at 2015 Championships. Saina is the only gold medalist for India in BWF World Junior Championships, received in 2008, whereas Sindhu and Lakshya Sen won the gold medal in Asian Junior Championships in 2012 and 2018 respectively. Badminton is a game that is not that popular in most of the regions, despite the fact that there are numerous folks who understand it, mainly due to the fact it is performed with a feather (called a steerage wheel), however take into account a version of tennis and not a game or not you realize it. The game of badminton that can be performed personally or in doubles consists of three games, being a fit to the fine of 3 (who wins the first two games wins). The intention is to reach the 21 factors first in the game, having to have a difference of two factors between them to complete the game. If the game reaches 29×29 , then whoever scores the 30 factor wins first. The game begins with the referee making the coin to give the choice between field and service to the winner. Objective of the Game The item of badminton is to hit the shuttlecock over the net and have it land in the specified courtroom areas. If your opponent manages to go back the shuttlecock then a rally happens. If you win this rally i.e. force your opponent to hit the shuttlecock out or into the net then you win a point. Player is required to win 21 points to win a set with the majority matches being best of 3 sets. Points can be won on either serve. Players & Equipment Badminton is a court or lawn game performed with lightweight rackets and a shuttlecock. Historically, the shuttlecock (additionally known as a bird or birdie) was a small cork hemisphere with 16 goose feathers connected and weighing approximately 0.17 ounce (five grams).

These types of shuttles can also still be used in contemporary play, but shuttles made from artificial materials are also allowed by means of the Badminton World Federation. Competitive badminton is commonly played interior due to the fact even light winds have an effect on the path of the shuttlecock. (Recreational badminton, alternatively, is a famous outdoor summertime interest.) The rectangular court is forty four ft (13.4 metres) lengthy and 17 ft (5.2 metres) huge for singles, 20 feet (6.1 metres) wide for doubles. A net 5 feet (1.5 metres) high stretches across the width of the court at its centre. A clear area of 4 ft (1.3 metres) around the court docket is wanted. Play consists totally of volleying—hitting the shuttlecock to and fro 22 throughout the internet without letting it touch the ground or floor within the barriers of the court. The badminton racket is usually fabricated from robust but light-weight substances consisting of carbon fiber or titanium, thinking about a hundred grams. Its most measure is sixty eight centimeters in length and includes ropes twisted vertically and horizontally. These badminton rackets can face up to from 7 to 11 pounds of pressure. There are two forms of badminton, singles blended doubles). Each player is permitted to apply a stringed racket (similar to a tennis racket but with the top being smaller) and a shuttlecock. The shuttlecock is made up of half spherical ball at the lowest and a feather like material surrounding the top. You can only really hit the bottom of the shuttlecock and as gravity comes into play will always revert the ball side facing down. You might also only hit the shuttlecock once earlier than it either hits the floor or goes over the net.

Statement of the Problem

The study was stated as - A Comparative study on the Effect of Shadow Training on selected Physical variables of Beginners and Advance Badminton players.

Objectives of the Study

The first objective of the study was to compare the effectiveness of shadow training on selected physical fitness variables in badminton.

The second objective of the study was to compare the effectiveness of shadow training on selected physiological variables in badminton.

The third objective of the study was to find out whether control group will be more effective after shadow training or experimental group.

Delimitations

The study had following delimitations:

1. The study was confined to the beginners and advance badminton players.
2. The study was further delimited to selected physical variables.
3. The study was further delimited to selected physiological variables.

Limitations

The study had following limitations:

1. The daily routine, diet and other factors which might influence the training effect were considered as one of the limitation of the study.
2. The meteorological variations such as air temperature, atmospheric pressure, relative humidity etc. during training period could not controlled and their possible influence on the study were also be recognised as a limitations of the study.
3. The emotional status of the subjects and motivational factors which might influence the results of the study were also be accepted as a limitations.

Hypothesis

1. It was hypothesized that there will be significant difference between the beginners and advance level badminton players.
2. It was also hypothesized that there will be significant difference between the beginners and advance level badminton players in physical variables.
3. It was also hypothesized that there will be significant difference between the beginners and advance level badminton players in physiological variables.

Definition and Explanation of the terms**Speed**

The rate of change of position of an object in any direction. Speed is measured as the ratio of distance to the time in which the distance was covered.

Vertical Jump

A vertical jump or vertical leap is the act of jumping upwards into the air.

Balance

Balance refers to an individual's ability to maintain their line of gravity within their Base of support.

Flexibility

The range of motion of muscle and connective tissues at a joint or group of joints.

Lower body strength

The ability of the body to exert a maximum force against an object external to the body in one maximum effort of the lower body muscles.

Back Strength

It refers to the condition of the muscles to better support the spine and withstand stresses.

Heart Rate

Heart rate is the frequency of the heartbeat measured by the number of contractions of the heart per minute.

Vital capacity

The greatest volume of air that can be expelled from the lungs after taking the deepest possible breath.

Sports

Sport is an activity that is governed by a set of rules or customs and often engaged in competitively. Used by itself, sports commonly refer to activities where the physical capabilities of the competitor are the sole or primary determiner of the outcome (winning or losing), but the term is also used to include activities such as mind sports and motor sports where mental acuity or equipment quality are major factors. Sports are used as entertainment for the player and the viewer. It has also been proven by experiments that daily exercise increases mental strength and power to study.

Significance of the Study

1. The study will help the coaches and trainers to know the effects of shadow training on badminton players.
2. The study will help the coaches and trainers in planning and executing training for badminton players.
3. The result of the study will help the players to which area they need to improve more according to the game.
4. The study will help the future researcher to provide baseline information on badminton players.

5. The data of the study will provide useful information for the fitness coach and researchers for getting feedback.
6. The result of the study may further help the coaches to guide the players while choosing their game.
7. The findings of the study will add new knowledge in the field of physical education, coaching and training.

CHAPTER -II

REVIEW OF THE RELATED LITERATURE



Literature means writings and a body of literature refers to all the published writings in a particular style on a particular subject. In research, a body of literature is a collection of published information and data relevant to a research question. A literature review is a body of text that aims to review the critical points of current knowledge including substantive findings as well as theoretical and methodological contributions to a particular topic. A literature review is an account of what has been published on a topic by accredited scholars and researchers. Typically, the literature review forms an important chapter in the thesis, where its purpose is to provide the background to and justification for the research undertaken (Bruce, 1994). A literature review can be defined as the selection of available documents (both published and unpublished) on the topic, which contain information, ideas, data and evidence written from a particular standpoint to fulfill certain aims or express certain views on the nature of the topic and how it is to be investigated, and the effective evaluation of these documents in relation to the research being proposed (Hart, 1998). A literature review can be a precursor in the introduction of a research paper, or it can be an entire paper in itself, often the first stage of large research projects, allowing the supervisor to ascertain that the student is on the correct path. A literature review is a critical and in depth evaluation of previous research. It is a summary and synopsis of a particular area of research, allowing anybody reading the paper to establish why you are pursuing this particular research program. A good literature review expands upon the reasons behind selecting a particular research question.

The literature in any field forms the foundation upon which all future work will be built. If we fail to build upon the foundation of knowledge provided by the review of literature, the researcher might miss some work already done on the same topic.

Sincere efforts have been made by the research scholar to locate literature related to this study. Those relevant studies selected from various sources, which the researcher had come across and which are of direct relevance to the present study, are cited below.

Singh (2021) conducted, “A study of anthropometric, physical and physiological parameter as predictors of volleyball performance.” He took a sample of 100 players from a population of all the volleyball players who participated at university level. In

this study the coefficient of correlation between selected variables of age, weight, length of arm and leg, width of shoulder, elbow, hip and knee, circumferences of chest, upper arm, arm and calf were 0.106, 0.227, 0.510, 0.337, 0.257, 0.276, 0.259, 0.092, -0.174, 0.002, -0.079, 0.152, 0.129, 0.276 respectively. The researcher concluded, “Only standing height (0.510) and sitting height (0.337) showed a positively significant correlation with volleyball playing ability as assessed by a panel of experts.”

Ghosh (2020) carried out, “A comparative study of the physical fitness among state level footballers and volleyball players.” 60 men performers of state level were selected. Out of them, 30 were footballers and 30 volleyball players with age ranging from 17-19 years. The sample was selected by random sampling technique from Howrah district of West Bengal. These respondents were tested twice with the help of “AAPHER physical fitness test.” The best performance from both groups was noticed. T-test was the statistical technique adopted by the researcher. The researcher concluded, “The t-test was significant at 0.05 level of confidence among footballers and volleyball players in 50 yard dash, 600 meters run and walk, standing broad jump, shuttle run and medicine ball throw but no significant difference was found in sit-up among footballers and volleyball players at 0.05 level of confidence. Conclusions: Footballers were superior to volleyball players in 50 yard dash, 600 meters run and walk and shuttle run and volleyball players were superior to footballers in standing board jump and medicine ball throw but no superiority was observed among footballers and volleyball players in sit-ups test.”

Mahmoud, Elnaggar, & Ahmed (2017) Studied “Influence of Isometric Exercise Training on Quadriceps Muscle Architecture and Strength in Obese Subjects with Knee Osteoarthritis” and observed that basic intention behind such research becomes the consequences evaluation. They examined how the exercise influence the stamina and structure of human muscle in the subject of obese having osteoarthritis in knee. “Methods: Forty-four obese male subjects aged 40-65 years diagnosed with knee osteoarthritis were randomly assigned into group A (n=32) and group B (n=12). Group A subjects performed a 12-week isometric exercise program. Group B subjects did not participate in any exercise program and maintained their ordinary activities for the same period. Both groups received the same conventional physical therapy

program including hot packs and therapeutic ultrasonic. Muscle thickness, pennation angles and fascicle length of the vastus lateralis (VL) muscle of the affected knee were measured at rest by B-mode ultrasonography. Maximal voluntary isometric knee extension torque (MVIC) of the affected knee was measured using an isokinetic dynamometer. Knee pain and function were evaluated using visual analogue pain scale (VAS) and Western Ontario and McMaster Universities Arthritis Index (WOMAC). All variables were evaluated before and the end of the intervention period for both groups. Results: at the end of the program, group A subjects showed significant improvements compared with group B subjects regarding MVIC and muscle architecture parameters ($p < 0.05$). Also there was significant improvement in post-test VAS and WOMAC scores in group A subjects compared to group B subjects ($p < 0.05$). Conclusion: A 12-week quadriceps isometric training program improves knee pain and quadriceps muscle strength and architecture in obese subjects with knee OA". And with the help of these outcomes we can suggest isometric training as proper exercise for the obsess patients having knee OA.

Dallas et al., (2017) "The Effect of Physical Exercise Training on Maximal Isometric Strength in Young Artistic Gymnasts" Different methods have been developed for In order to examine the resistance of arms and legs muscle in various sport activities various methods are already developed. Basic intention behind such research was the study of optimal and intentional aerobic resistance in fifty seven adolescent athlete and seventy four non-athletes. Their aerobic resistance were examined in situation s where arms and legs extension at the timed period of five seconds maximal voluntary isometric strength for the right and left side respectively. It has been shown by results that there was a noteworthy diversity in the middle of athletes and non-athlete. In addition to this, important communication disclosed: a) for right side with respect to the force flexion at the elbow and shoulder joints; b) for the left side with respect to the force flexion for the elbow, shoulder and hip joint. It becomes possible for trainers to assume the consequences which were described above for improving the gymnast's resistance and their entire exercising standard.

Spence D. W.18 (2017) developed a descriptive profile on 15 members of the United States women national volleyball team, who were highly skilled. The data were obtained from anthropometric, strong physiological and motor performance domains

consisting of jump and reach, triple hop, agility run, and 20 meter dash within group comparisons were made between the six women who were selected for the pan American team and the nine who were not selected. The pan American selected players were taller and heavier and demonstrated better motor ability than the non – selected players. Strength measurements do not indicate consistent differences between the two sub-groups. The non - selected had greater vo2 max than those selected, between group comparisons on selected variables were made between the team player and other women volleyball players. The training team subjects were taller heavier the comparative groups. The training team group demonstrated a lower heart rate Max (180 beats/min) than their VO2 Max (43.2 ml/ kg/min) was within the range of comparative groups.

Singh (2015) assessed and compare the “Physical Fitness between Forward and Defender Football Players.” The sample comprised of eighty boys football players (forty forward players and forty defender) ranging in age 15-17. These respondents were taken from a Sr. Sec. School from Raipur city by adopting purposive sampling technique. Upper body strength was determined by conducting the pull up test. Strength and endurance were determined by sit up test whereas speed and agility were determined by shuttle run test. In addition to these tests, the explosive power of legs was determined by employing broad jump/standing long jump. The acceleration, speed and quickness between the defender and the forward players were determined by administering forty yard dash. The statistical technique employed here is t-test at 0.05 level of confidence. There found no significant differences in Pull ups, Sit ups, Shuttle run, Standing long jump and 40 yards dash between the Forward Players and Defender Players in context with the given Physical Fitness variables. No any significance differences were found in this study, it's may be the cause of no any special training was given to the players according to their playing position (Forward & Defender). Further studies are needed on the above variables with physiological, biomechanical, and psychological variables for the assessment and finding for relationship between Forward Players and Defender Players with their performance. This study provides information about Forward Players and Defender Players of Football game.

Malik, Singh and Rajesh (2015) studied, “The degree of physical fitness and compare the differences of physical fitness components among Football players.” The investigators adopted random sampling technique in order to select eighty respondents twenty from each district. They have participated at districts or college level. These respondents were selected from Rohtak, Bhiwani, Mohindergarh and Rewari districts of Haryana state. The physical fitness variables were determined by adopting “AAPHER Youth Fitness Test (1976).” Their mean scores were calculated in order to compare the performances of the players belonging to different districts. The data was analyzed at 0.05 levels of significance. “F-value, Least Significant Difference (LSD) tests” were administered to test the significance between the selected groups. The study gave evidences that football players of Rohtak were found better than the players of other districts on the bases of almost physical fitness variables.

Yadav & Sardar, (2016) Studied “Comparative Effect of Isometric And Isotonic Exercises on the Performance of Selected Field Events” and observed that we can explain the term „fitness” as a adaptation that is successful to the stressor of life style of someone which is condition desirable by human and also it has its base on the training program i.e. scientific and systematic in nature. It was already highlighted from the recent scientific development of gymnastics and sports, that contribution of stamina in human physical capacity is significant and the stamina is developed by human beings in a best possible manner when they do weightlifting exercise in a structured manner. It has been clearly represented by mathematical proofs that when weight lifting exercises are done in an appropriate manner then stamina, muscular resistance and power becomes better. For a gymnast all these things are very important. Exercise which improves the resistance like exercise in which movement of joints is required and the exercise in which movement of points is not required improve the efficiency of those athlete which are related to sports like shotput, long jump and running”.

Selder (2015) conducted a study on anthropometric cardiovascular and motor performance characteristics of physique, motor and university ice hockey players. Characteristics of physique, motor and cardio-vascular fitness were reported 14 varsity hockey players, some of them had represented Canada in 1964 Winter

Olympic. Most of the players were dominant mesomorphs with low adipose measurements. It was found that the majority were above average in dips and in dynamometrical strength but average or below in other tests of motorfitness.

Ramirez Campillo et al. (2015) compared the effects of progressive volume-based overload with constant volume-based overload on muscle explosive and endurance performance adaptations during a biweekly short-term (i.e., 6 weeks) plyometric training intervention in young soccer players. Three groups of young soccer players (age 13.0 ± 2.3 years) were divided into: control (CG; $n = 8$) and plyometric training with 122 (PPT; $n = 8$) and without (NPPT; $n = 8$) a progressive increase in volume (i.e., 16 jumps per leg per week, with an initial volume of 80 jumps per leg each session). Bilateral and unilateral horizontal and vertical countermovement jump with arms (CMJA), 20-cm drop jump reactive strength index (RSI20), maximal kicking velocity (MKV), 10-m sprint, change of direction speed (CODS), and Yo-Yo intermittent recovery level 1 test (Yo-Yo IR1) were measured. Although both experimental groups significantly increased CMJA, RSI20, CODS, and endurance performance, only PPT showed a significant improvement in MKV and 10-m sprint time. In addition, only PPT showed a significantly higher performance improvement in jumping, MKV, and Yo-Yo IR1 compared with CG. Also, PPT showed higher meaningful improvement compared with NPPT in all (except 1) jump performance measures. Furthermore, although PPT involved a higher total volume compared with NPPT, training efficiency (i.e., percentage change in performance/total jump volume) was similar between groups. Their results showed that PPT and NPPT ensured significant improvement in muscle explosive and endurance performance measures. However, a progressive increase in plyometric training volume seems more advantageous to induce soccer-specific performance improvements.

Pavlos Myrianthefs and George Baltopoulos (2013), we investigated whether professional athletes may require higher tidal volume during mechanical ventilation hypothesizing that they have significantly higher “normal” lung volumes compared to what was predicted and to non-athletes. Measured and predicted spirometric values were recorded in both athletes and non-athletes using a Spirovit SP-1 spirometer (Schiller, Switzerland). Normal (6 mL/kg of predicted body weight) was calculated as a percentage of measured and predicted forced vital capacity (FVC) and the

difference was used to calculate the additional required using the equation: New . Professional athletes had significantly higher FVC compared to what was predicted (by 9% in females and 10% in males) and to non- athletes. They may also require of 6.6 mL/kg for males and 6.5 mL/kg for females during mechanical ventilation. Non-athletes may require of 5.8 ± 0.1 mL/kg and 6.3 ± 0.1 mL/kg for males and females, respectively. Our findings show that athletes may require additional of 10% (0.6/6 mL/kg) for males and 8.3% (0.5/6 mL/kg) for females during general anesthesia and critical care which needs to be further investigated and tested.

Leili Zeiaadini et.al (2013), Exercise-induced bronchospasm is more evident in the athletes of endurance sports and other sports which need minute ventilation. Seeing the lack of researches in this arena within Iran, we decided to conduct a study on the frequency of exercise-induced asthma in Kerman professional endurance runners in order to develop the background necessary to later studies. To do so, 25 professional endurance runners (22.6 ± 5.5 years) were chosen intentionally and voluntarily, 25 non- athletes were also chosen randomly and homogeneously along the runners group. All subjects first filled the standard questionnaire of exercise asthma, then the pulmonary function test was done on both groups before, immediately after, and 10 minutes after the Cooper test in order to investigate the lung volumes. The obtained data were then analyzed using SPSS 19 through independent T-test. Results showed that the rate of exercise asthma was 20 % in the athletes group and 16 % in the non-athletes one. The results of the exercise challenge, which is a 15 % or more decrease in forced expiratory volume in 1 second (FEV1), indicated that 16 % of the runners and 12 % of the non- athletes were suffering from exercise asthma. The lung volumes FEV1 and FVC (forced vital capacity) decreased in both groups. The decrease was more evident in runners when compared before and after the exercise, this decrease was not significant, however.

Abhishek Singh (2014), the aim of the study was to compare the selected physiological variables among handball, Volleyball and Hockey players. For the purpose of the study, 90 athletes (30 from each group) of age 21 ± 3 years were chosen from Lakshmibai National institute of Physical Education, Gwalior (M.P). The variables which had been tested were vital capacity (VC), Peak expiratory flow rate (PEFR), resting pulse rate (RPR) and resting respiratory rate (RRR). The dry Spiro-

meter and the methods selected for the collection of the data are highly valid and reliable. As a statistical tool, one way ANOVA was employed. After the data analysis, ANOVA was found insignificant in case of VC, RPR and RRR but in case of PEFR, it was found significant. Post Hoc test on PEFR reveals that the Volleyball players have low PEFR in comparison with the Hockey and handball players.

Mr. Kalidas Karak and Dr. Susanta Jana (2013), the purpose of the study was to compare the level of Vital Capacity and Peak flow rate of active and inactive middle aged male. Total 52 subjects were taken for the study. They were Active & Inactive Groups. Twenty-six (26) active and Twenty-six (26) in active middle aged male (40-50 years) were randomly selected for the study. All the parameter i. e. Vital Capacity and Peak flow rate were measured by a reputed physician. For statistical analysis and interpretation of data, t-test was conducted. It was observed that there was significant difference in Vital Capacity and Peak flow rate. Result showed Active men have higher level of Vital Capacity and Peak flow rate.

Pradeep Kumar et.al (2013), the purpose of the study was Comparative Analyze the Physiological Variables of All India Intervarsity Level Batsmen's, Pace Bowlers, Spin Bowlers, Wicketkeepers, and All-Rounders men cricketers of India. For the purpose of this study, one hundred and fourteen cricket players which consists 22 batsmen, 40 bowlers (i.e. 25 medium pace and 15 spin bowlers) 14 wicket keepers, and 38 all-rounder's were selected. The following physiological variables were considered to be the major factors contributing to the performance in the cricket- Resting pulse rate, Resting blood pressure, Hb content, Vital capacity, Anaerobic power, and Aerobic capacity. To prepare profiles of All India Intervarsity Level cricket Men players of India, descriptive analysis i.e. mean and S.D. was done. For the comparison of the physiological variables analysis of variance (ANOVA) and test Schafée, s post hoc test was applied. The mean of Hemoglobin of batsmen's, pace bowlers, spin bowlers, wicketkeepers, and all-rounders were 13.79 mm/Hg, 13.32 mm/Hg, 13.16 mm/Hg, 13.13 mm/Hg., and 13.66 mm/Hg, Resting Pulse rate were 69.68 bt/min., 70.12 bt/min., 70 bt./min., 70.64 bt./min., and 70.34 bt./min., systolic blood pressure were 115.81, 116.28, 116.9, 116.64, and 117.2, diastolic blood pressure were 92.00, 93.24, 92.80, 89.21, and 92.97, the mean of Vital Capacity were 3.16 ltr, 3.1 ltr 2.99 ltr, 2.52 ltr., and 2.95 ltr, Anaerobic Power were 724.57 Watt,

703.59 Watt, 706.2 watt, 704.93 Watt., 687.690 Watt, Aerobic Power were 35.13 Watt, 35.66 Watt, 35.88 Watt, 39.19 and 38.66 Watt. On comparatively analysis it was found that only Vital Capacity among All India Intervarsity level Cricket Batsmen's & wicketkeepers was significant and no other physiological variable were not found significantly different among Batsmen's, Pace Bowlers, Spin Bowlers, Wicketkeepers, and All-Rounders men cricketers of India at .05 level of significance.

Parvinder Singh (2013), Anthropometry and physiology play an important role in deciding the particular build of the body with various measurements of the segments of the body it has also its importance in the field of Kabaddi and Kho-Kho game. Somewhat or altogether the body height length of various level and measurements of the varies body segments, pulse rate blood pressure Haemoglobin, vital capacity and body composition have definite effects on the performance of these game players. The investigator in the present study made an effort to test this hunch to compare the difference between the various physiological and Anthropometrical measurements of Kabaddi and Kho-Kho players. The present comparative study is related Kho-Kho and Kabaddi players in relation to anthropometry and physiological variables. In the present investigation, Kho-Kho and Kabaddi players were the field of study. In the present study, 120 male Kabaddi and 120 male Kho-Kho players of Haryana who participated in Haryana Olympic Games and Haryana State Kho-Kho and Kabaddi Championships. The players who remained in last ten teams were selected during the State Championship. To know the difference between Kho-Kho and Kabaddi players in relation to anthropometry and physiological variables t test was applied. From the results, it may be concluded that there is a significant difference in weight of Kho-Kho and Kabaddi players. The weight of Kabaddi players is much higher in comparison to weight of Kho-Kho players. It was also concluded that there is a significant difference in linear measurements such as, height, lower leg length, foot length, foot width, total arm length, forearm length, sitting height in comparison to Kho-Kho players. Kabaddi players are found more in weight, weight, height, lower leg length, foot length, foot width, total arm length, forearm length, sitting height in comparison to Kho-Kho players. But no significant difference was found in total leg length, thigh length, upper arm length, hand length, trunk length. Regarding body circumferences, there is a significant difference in shoulder, chest, hip, thigh, calf between Kabaddi and Kho-Kho players.

Rameshkannan S. And B. Chittibabu (2014) conducted a study on the purpose of the study was to determine whether eight weeks of plyometric training can improve male handball players agility. To achieve the purpose thirty (30) male handball players were selected randomly from Department of Physical Education and Sports Sciences, Chidambaram, Tamilnadu. These players were divided into two groups namely, plyometric training group (15) and control group (15). The plyometric training group performed 2 days per week for eight weeks of plyometric training program and the control group did not perform any plyometric training. Agility of these players was measured by specific agility test T-test. The data was collected before and after training in both the groups. The collected data was analysed using analysis of covariance (ANCOVA). The result of the study showed that adjusted post-test mean showed significant ($F = 17.96, p < 0.000$) difference among the groups on agility. It elicited that 0.61sec (4.91%) improvement was noticed in plyometric training group. It is concluded that plyometric training is an effective training technique to improve male handball player's agility.

Karthi and Krishnakanthan (2014) studied "Selected physical variables among Basketball, football and Hockey players of Sri Subramaniya Swamy Govt. Arts College, Thiruttani, Tamilnadu." Fifteen players belonged to basketball game, fifteen soccer players whereas fifteen players belonged to the game of Hockey. Speed and cardio respiratory endurance were selected as the criterion variables. Speed is considered as physical variable which was measured with 50 m dash. 12 min run or walk test was conducted to assess the cardio respiratory endurance. One way ANOVA was employed. The data was analyzed at the 0.05 level of significance. Scheffe's Post Hoc Test can be used if the calculated value of f test is found significant. The findings showed that the performances of the basketball player were better in terms of speed in comparison to the hockey and football players. In addition to it, it was confirmed football players were better in terms of cardio respiratory endurance when compared to the players of hockey and football.

Tulin Atan et.al, (2012), the purpose of this study was to research pulmonary functions of sedentary males and athletes in different team sports branches in the same age group. This study was conducted on male athletes in 15-16 age group who

participate in matches with license in Samsun. 50 athletes from each of the team sports of football, volleyball, basketball and handball players and 50 sedentary males participated as well; being in total 250 athletes. Among respiratory functions tests; vital capacity (VC), forced vital capacity (FVC) and maximum voluntary ventilation (MVV) values were measured. As a result of the measurements VC values of sedentary males were lower than football and handball players ($p<0.01$). It was determined that VC values of handball players was higher than football, volleyball, basketball players and sedentary males ($p<0.05$ and $p<0.01$). When FVC values were analyzed, first of all it was determined that handball, football and basketball players have significantly higher values compared to sedentary males ($p<0.01$). In the comparison between branches FVC values of volleyball players were significantly lower than football and handball players ($p<0.01$). FEV1 values were significantly higher among football and handball players compared to volleyball players and sedentary males ($p<0.01$). When MVV values were analyzed, it was observed that football players have higher values compared to volleyball and sedentary males ($p<0.01$). MVV results of handball players were significantly higher than sedentary males ($p<0.05$). When the respiratory rates (RR) were analyzed, it was determined that values were not significantly different between subjects ($p>0.05$). As a conclusion, it was determined that respiratory functions were higher among individuals who do exercise compared to those who do not. That the respiratory parameters of athletes doing exercise are higher than those who do not shows the positive effect of training on respiratory system. In addition to this, the difference of respiratory functions between branches shows that the sport branch influences the respiratory capacity.

Vatan Kavak et.al (2005), what can be done to reach the Olympic records and high efficiency level? Can our players be Olympic champions? The aim of this study is to reveal the properties of proper persons, suitable to the branch of sports. This study is a body result of 16 male players, take active roles in the hand ball team of the university. Variables are; age, height, weight, measurements of body fat percentages, 30m.sprint speed measurement, heart beat measurement during rest, systolic-diastolic blood pressure, vital capacity, maximum V_{O_2} (Cooper test). Measurements; taken from 0,5

kg interval balance with shorts on and without shoes. In this study age average, as 21.81 \pm 2.34; height average, as 176.12 \pm 6.21 cm; weight average, as 74.81 \pm 8.85 kg.; Qindex average, as 420.42 \pm 47.28 weight kg/height cm.1000; body fat percentage average, as 10.10 \pm 2.58mm; 30m sprint (sn) average, as 4.55 \pm 0.15 m/sn; Vertical jump average as 58.75 \pm 6.43 cm; pulse average, as 82.00 \pm 5.25 (pulse/minute); systolic tension average, as 121.87 \pm 11.67 mm/hg; diastolic tension average, as 76.56 mm/hg; Vital capacity average, as 4.74 \pm 0.45 ml; Maximum V_{O2}, as 44.32 \pm 5.02 (ml/kg.min) were determined. Correlation and regression statistical methods were used to evaluate the data.

Kohli, Singh, Singh and Sharma (2014) compared, “The physical fitness of Volleyball and Football players of Khalsa Public School, Amritsar, Punjab, INDIA.” In order to get the data, fifteen football players and fifteen volleyball players with the age ranging from 16 to 17 years were selected. “Physical fitness variables i.e. strength, endurance, agility, speed, flexibility” were selected in this study. In order to measure these variables, various test like “pull ups, sit ups, shuttle run, 50 m dash and 600 m run” were conducted. For analyzing the data, they adopted t-test technique at 0.05 level of confidence. They revealed, “There was no significant difference in pull ups, sit ups, 50 m dash, and 600 m run, but there was a significant difference between the two groups on the basis of shuttle run performed by them.”

Srivastava and Tripathi (2013) conducted a study on the topic “A comparative study of selected physical & physiological variables of school level footballers and swimmers”. Total 50 (20 footballers & 30 Swimmers) subjects from different CBSE schools were selected. All the subjects were belonged to the age group of 14-18 years. All the physical variables (speed, strength, endurance and flexibility) and physiological (pulse rate, vital capacity and peak flow rate). T-test was the research technique employed by the researcher. The level of confidence was fixed at 0.05. The study found a significant difference between the mean scores of physical variables (speed, endurance and flexibility) and non-significant difference was noticed between the mean scores of physical (strength) and physiological (pulse rate, vital capacity and peak flow rate of footballers and swimmers).

Bloomfield, et al., (2013) compared the effectiveness of 2 methodologies for speed and agility conditioning for random, intermittent, and dynamic activity sports (e.g., soccer, tennis, hockey, basketball, rugby, and netball) and the necessity for specialized coaching equipment. Two groups were delivered either a programmed method (PC) or a random method (RC) of conditioning with a third group receiving no conditioning (NC). PC participants used the speed, agility, quickness (SAQ) conditioning method, and RC participants played supervised small-sided soccer games. PC was also subdivided into 2 groups where participants either used specialized SAQ equipment or no equipment. A total of 46 (25 males and 21 females) untrained participants received (mean \pm SD) 12.2 \pm 2.1 hours of physical conditioning over 6 weeks between a battery of speed and agility parameter field tests. Two-way analysis of variance results indicated that both conditioning groups showed a significant decrease in body mass and body mass index, although PC achieved significantly greater improvements on acceleration, deceleration, leg power, dynamic balance, and the overall summation of % increases when compared to RC and NC ($p < 0.05$). PC in the form of SAQ exercises appears to be a superior method for improving speed and agility parameters; however, this study found that specialized SAQ equipment was not a requirement to observe significant improvements.

Paramanik (2001) predicted, “An equation of physical and physiological variables of playing ability of badminton players out of 22 variables.” For this purpose twenty five badminton players were selected. All these players belonged to Maharashtra State. In order to find out the regression, forward regression was adopted by the researcher which consisted of four items. These items were time of reaction, height, length and endurance. The study confirmed that endurance contributed 87% while 55% was contributed by time of reaction alone.

Neeralet. al. (2008) assessed “Motor ability variables as predictors of performance in Kabaddi.” They concluded, (i) “significant correlation was found between the selected motor ability variables of muscular strength of arms; muscular endurance of abdomen; explosive power of arms; explosive power of legs; running speed; stretch ability of legs ability; with performance rating in kabaddi; (ii) Significant

correlation was not found between the selected motor ability variables of cardiovascular endurance and extent flexibility of trunk and shoulder; with performance rating in Kabaddi; (iii) For better performance in kabaddi, all the selected motor ability variables are essential and must be considered, for better performance; (iv) Muscular endurance of arms, and explosive power of legs and arms, are the dominant predictor of performance in junior national kabaddi players can be predictor by using the equation.”

Fahiminezhad (2010) evaluated, “The study of anthropometric sizes and physical fitness factors of boy students aged 12–14 in Shahrood city.” The current investigation intended to measure factors related to physical fitness and anthropometric sizes of these students. 368 boy took part as sample in this research work by applying random sampling technique. “Height, weight, sitting height, arms span, body mass index (BMI), waist circumference (WC), waist to hip ratio (WHR), and percentage body fat (BF%)” were included in anthropometric test. “Cardiorespiratory fitness (20-m shuttle run test), general strength (dynamometer back and leg), leg power (vertical jump test), flexibility (sit and reach test) and agility (Illinois test)” were the components in physical fitness. The investigator included, “The mean of height (cm), weight (kg), sitting height (cm), arms span (cm), BMI (h/w^2), WC (cm), WHR and BF% subjects were 154.1, 43.4, 77.1, 155, 18, 67.6, 84 and 22, respectively. The mean of VO₂max (ml/kg/min), general strength (kg), leg power (kg/m), flexibility (cm) and agility (s) were 49.6, 92.1, 56.9, 30.5 and 18.97, respectively. There was significant negative correlation between VO₂max and anthropometric measurements, agility with height, flexibility and leg power, while a significant positive correlation was found between general strength and leg power with anthropometric measurements subjects. Survey results showed that 12–14-year-old boy students in Shahrood were of thought height, weight, BMI, general strength and leg power lower from adolescents of other countries and height, weight, BMI almost equal and general strength and leg power higher from adolescents of our country. Also 12–14-year-old adolescent boys in Shahrood on base BMI 30.5%, BF% 26.9%, WHR 16.8% and VO₂max 10% may provide insight into the prediction of future risk chronic disease.”

Gill, Deol and Kaur (2010) evaluated, “A comparative Study of Physical Fitness Components (speed, strength, endurance, agility and flexibility) of Rural and Urban Female Students of Punjabi University.” The respondents for the current investigation were one hundred female students. Out of these fifty belonged to rural areas whereas the rest of the students belonged to urban area. Jumping, running, stepping and flexibility test along with measuring their height and weight were carried out to collect the data. Mean, SD., SEM, and t-test were the statistical techniques adopted in order to compare and analyze the data. They confirmed, “Rural female students were found to be superior in strength, endurance, speed and agility. Urban female students on the other hand, were found to be heavier and superior in tasks like flexibility.”

Pilli (2010) tried to assess the, “Comparison of anthropometric and physical variables (speed, endurance, explosive strength, muscular endurance, height, weight, sitting height, body fat and somatotype) among kho-kho and handball players of Andhra Pradesh School Games teams.” In order to collect the data for current investigation, forty male Kho-Kho and Handball players were selected. These players belonged to the school games team from Andhra Pradesh and participated in national level games. The research showed, “Hand ball players were better in six variables such as explosive strength, muscular endurance, height, weight, body fat, somatotype, further the study indicates that kho-kho players were better in speed and endurance.”

Kraemer et.al. (2001) determined the effects of resistance training programs on strength, power, and military occupational task performances in women were examined. Untrained women aged were matched and randomly placed in total or upper-body resistance training, field, or aerobic training groups. Two periodized resistance training programs (with supplemental aerobic training) emphasized explosive exercise movements using 3- to 8-RM training loads (TP, UP), whereas the other two emphasized slower exercise movements using 8- to 12-RM loads (TH, UH). The FLD group performed plyometric and partner exercises. Subjects were tested for body composition, strength, power, endurance, maximal and repetitive box lift, 2-mile loaded run, and U.S. It was concluded that, Strength training improved physical performances of women over 6 months and adaptations in strength, power, and endurance were specific to the subtle differences in the resistance training programs

(strength/power vs strength/hypertrophy). Upper- and total-body resistance training resulted in similar improvements in occupational task performances, especially in tasks that involved upper-body musculature.

Reddy and Reddy (2010), compared the effect of Plyometric Training, Circuit Training and Combined Training on selected fitness components among secondary students. Four different untrained school Boys of Ekashila High School Warangal in the age group of 14-15 years those who have not participated intensively in games and sports or any special coaching program were used for the purpose of the study. However they were allowed to attend the regular physical education classes in school. So, 40 students were selected randomly by lot from the total population of 300 subjects after eliminating physically handicapped students. Then they were randomly divided into four equal groups consisting of 10 subjects in each group. The groups were named by lot as Plyometric Training group, Circuit Training group, Combined training group and Control group and their performances were measured before and after 12-weeks of Training. In Plyometric Training eight exercises and (four for Upper body and four for lower body) in circuit Training eight exercises were used. The combined Training group subjects were asked to join with the Plyometric Training group on Tuesday, Thursday, Saturday & Monday, Wednesday and Friday with Circuit Training group. The control group did not participate in any Training programme except their routine activities. The 't' test and Anacova were used to find out the training effect and to compare the Training effect respectively. Circuit Training group showed better performance than other groups.

Maity (1983) conducted a study, "To compare physiological and physical fitness variables between tribal and non-tribal High school students of Murekatha Nehru Bidya Bhawan shown in Midnapur district of West Bengal." The respondents chosen for the study were between the age of 14- 17 years. It was observed that tribal students were significantly superior in peak respiratory flow rate and speed endurance and anaerobic lower than non tribals.

Langford, McCurdy, Ernest, Doscher & Walters (2007) compared the effects of 10 weeks of resistance training with an isotonic bench press machine and 2 types of free-weight bench press exercises on several measures bench press strength. Specificity

was investigated by comparing the ability to transfer strength gained from a type of training that differed from the mode of testing. Forty-nine men participated in the study. The subjects completed a pretest on the machine (MB), barbell (BB), isokinetic (IB), and log (LB) bench press to determine baseline strength and completed 10 weeks of training on the MB, BB, or LB. The 3 groups were tested to see whether differential training effects occurred from pre- to posttest scores on the BB, MB, LB, and peak force on the IB. By multivariate analysis, the trial-by-group interaction was not statistically significant. The findings of this study showed that all 3 training groups significantly improved in strength during short-term training on the MB, BB, and LB. These data lend evidence that improved strength after training on the MB, BB, and LB equally transfers to strength gains on any of the 4 modes of testing. These results should be considered when including similar exercises varying in stability into the training program to improve strength.

Singh (1990) conducted a study to compare some selected physiological variables and body composition among Badminton, Table- tennis and lawn-tennis players. Total 45 male badminton, Table-tennis and Lawn-tennis (15 from each) players were taken by applying random sampling method from the state, universities and intercollegiate participants. Selected physiological variables (Hemoglobin Content, blood pressure, vital capacity, pulse rate when resting etc.) and body composition (four site skin fold) were recorded, and f-test was employed in order to get the mean differences among the selected groups. It was concluded that Badminton players had significant higher Hemoglobin content and pulse rate than that of the Table-tennis and lawn-tennis players, whereas Lawn-tennis players were significantly superior in vital capacity in comparison to their opponents. There found insignificant differences among the group mean concerning with blood pressure and composition.

Vaz (1994) analyzed, “An investigation on some of the selected anthropometric characteristics and physical fitness components of predictors of performance in Judo.” The researcher found that performance in different categories in Judo was related with many “anthropometric variables namely, height, weight, calf girth, arm girth index.” On the other hand, “length, thigh girth and rural ratio” were not found positively connected with performance in Judo.

Choudhary (1995) conducted a research on selected physiological variable on eighty inter-college level judokas with the purpose to sketch the profile and to compare them in different weight categories. The variables selected for the investigation were “resting heart-rate, vital capacity, negative breath holding capacity, positive breath holding capacity and anaerobic activity.” In the present study, mean and standard deviation (SD) of all the weight categories were derived from the data. ANOVA was the other statistical technique adopted by the researcher in order to get the significant difference in their mean scores. The study revealed: (i) The training age does not depend upon the weight category; (ii) The training programme for the judokas should be according to the body weight category; (iii) The training programme for low and middle weight categories should be more strenuous than Heavy Weight Categories; (iv) In relation to positive break holding capacity, there noticed no significant difference in various weight categories; (v) There found no significant difference in various weight categories in relation to the resting heart rate, vital capacity.

Kala (1999) made an attempt to study on, “Kabaddi and Kho-Kho players of Kurukshetra University.” The investigation was carried out to compare their physical fitness, physiological and coordinative ability. “The physical fitness variables such as agility, speed, power and endurance strength” of Kabaddi players were noticed positively on the bases of strength components in comparison with Kho-Kho players. Interestingly, these Kho-Kho players were found better on the bases of physical fitness in comparison of Kabaddi players. They were noticed to possess better rhythmic ability in the coordinative ability in comparison to their opponents. However, in the other coordinative ability like “Balance, flexibility, differentiation ability and lateral jumping ability”, there found no significant difference in kabaddi and kho-kho players. In addition to it, Kabaddi players were found positively better than their opponents on physiological determinants like peak expiratory flow rate. On the other hand, kho-kho players were found better in comparison to the kabbadi players on the bases of the pulse rate.

Golden and Paul (1984) investigated on untrained male college students (18 to 24 years) the effect of intensity of endurance training on AT. VO₂ max, PWC, HR rest and HR max. 18 subjects composed 3 groups. The two were experimental groups

whereas one was control group. The experimental groups trained for thirty minutes, two experimental and one control. The experimental groups trained for thirty minutes, three times per week for eight weeks on bicycle ergometers. The low intensity group trained at the AT and the high intensity group trained at a point halfway between AT and VO₂ max. All subjects underwent an incremental bicycle exercise test before and after the training programme to identify any changes in AT, VO₂ max, PWC, HR rest and HR max. The AT was determined by gas exchange method. The pretest revealed a mean AT for all groups between 65 and 66% VO₂ max. The results indicated no significant changes in AT for any groups. A significant increase in PWC was found. No significant differences were noticed among any groups for any other variables. The results seem to indicate that a continuous cycle training programme, at either of the two intensities will produce an increase in PWC, however will not increase AT for a group of college age males with moderate initial AT levels.

Siridhar (1984) made an attempt to analyze, "The relationship between agility, Flexibility, Muscular endurance and playing ability in volleyball." For the present study forty college volleyball players were selected. Many tests were conducted including "the sergeant Jump, side step, trunk flexion, full ups, sit ups and one minute lateral jumps etc." the researcher confirmed, "Motor fitness components of power muscular endurance, cardio, respiratory endurance, as well as flexibility contributed to the game of volleyball. The significant relationship between power and performance was found."

Chin, et al. (1985) There is a scarcity of descriptive data on the performance capacity of elite Badminton players, whose fitness requirements are quite specific. The purpose of this paper is to investigate the physiological response of elite Badminton players in a sport-specific fitness test. Twelve Hong Kong national Badminton team players performed a field test on a Badminton court. Six light bulbs were connected to a programming device causing individual bulbs to light up in a given sequence. The players were instructed to react to the flashes by running towards them, and striking shuttles mounted in the vicinity of the bulbs. Exercise intensity was controlled by altering the interval between successive lighting. A low correlation ($r = 0.65$) was found between the results of the field test and the rank-order list of subjects, based on

an objective on-field physiological assessment and subjective ranking. This may be explained by the requirements of other factors besides physical fitness which contribute to success in elite level Badminton competition. These factors may include, for example, technical skill, mental power, and aesthetic judgments on the court. Maximum mean (s. d.) heart rate data [187(8) beats. min⁻¹] and blood lactate values [10.4 (1.9) mmol.l⁻¹] in this study showed that players were under maximal load during the field test. From the testing data, it seems reasonable to speculate that, the intensity of level 3 (20 light pulses. min⁻¹; 3.0 s.pulse⁻¹) and level 4 (22 light pulses.min⁻¹; 2.7 s.pulse⁻¹) simulates the requirement of actual games energy expenditure of the Hong Kong Badminton players exercising at close to their anaerobic threshold. The results also show that an estimate of fitness can be derived from measurements involving exercise closely resembling that which is specific for the sports activity in question. Improved training advice and guidance may result from such studies.

Clarke (1957) made an attempt to analyse, “The relationship of Strength and Anthropometric measurements with physical Performance of 53 unselected non-disabled male students At the University of organ, involving the trunk and legs.” He Concluded, “Correlation among some of the Anthropometric variables were especially high i.e., between standing height and leg length (0.91) between foot-length and leg length (0.88), between body weight and both hip width and thigh girth (0.87), between height –strength test and trunk flexion and extension (0.65). Multiple correlations were found significant for leg left (0.74) with body weight, ankle dorsal flexion strength and trunk Flexion strength ;back lift (0.71)with knee extension strength, Hip width , trunk flexion strength and knee flexion strength, and for standing broad jump (0.66)with adipose tissue over the abdomen (negative)and hips extension strength (positive).”

Budet (1989) studied, “The comparison of Physiological parameters involved in oxygen transport in men women similar aerobic capacities as assessed by maximum oxygen uptake.” In order to find out the differences perhaps existing due to fitness level and sex, determinants of cardiac output divided by “body weight, hemoglobin concentration and body fat” were measured. The researcher concluded, “Cardiac output increased with fitness level and was greater in men; cardiac output divided by

body weight, increased with increases in fitness level but showed no differences due to rest. Hemoglobin concentration was greater in men but did not vary due to fitness level. Percent body fat was greater in women and decreased with increased fitness level.”

Bhatnagar (1980) analyzed, “A study on 23 rural sportsman (Athletics’ 8, Kabaddi 7 and volleyball 8) of Madhya Pradesh (India) pertaining to their weight, height and sub cutaneous tissue fold at biceps, triceps, supraclavicular and sub-scapular region.” These rural athletes were noticed as “lighter, shorter with less amount of fat” when compared to normal and urban Punjabis. Differences in terms of physiology were analyzed belonging to different sports activities. In addition to this, kabaddi players of Madhya Pradesh were found as heaviest and fattest among other rural sportsmen.

Pollock and Pate (1980), made an attempt, “To evaluate and quantify physiological difference among groups of distance runners.” The respondents were twenty elite distance runners. Eight of them were marathon, twelve middle-long distance eight good runners. Maximal and sub-maximal treadmill test and hydrostatic weighing machine measuring body composition were adopted by the researchers to check the working capacity and cardio-respiratory functions. They confirmed, “The variables studied were maximum oxygen uptake, $\dot{V}O_{2\max}$ sub-maximal, lactic acid, sub maximum lean body ($P < 0.5$) weight, fat weight, ANOVA showed that the good runners differed from elite runner ($P < 0.1$) and the distance runners ($P < 0.5$). Discriminate analysis showed that the both functions were significant. The first was general physiological efficiency factor that separated the good and elite runners. The second separated the elite marathon and middle long distance groups. The second function showed that the marathon runners had lower lactic acid sub maximum value. The middle-long distance runners had higher $\dot{V}O_{2\max}$ values.”

CHAPTER -III

PROCEDURE



In this chapter selection of subjects, selection of variables, criterion measures, reliability of data, description of tests, collection of data, detailed methodology and statistical technique used for analysis of data are presented.

Selection of Subjects

A total of 60 subjects in the age category 10-14 & 15-19 of different academies in Surat district have been selected. Subjects of the research group were divided into four groups (two control groups & two experimental groups). Two groups will be consisting of 15 players each of the beginner level. First group was comprise of players of age 10-14 years on which the training schedule was implied followed by second group which was of the same age category of the advanced player. Third group was of 15-19 years age category of the beginners followed by the fourth group which was having the advanced players of the same age category. The Training programme was administered on the experimental group four times in a week for a period of 12 weeks.

Criterion Measures

The scores obtained through various tests in physical variables and physiological variables was the criterion measures of the study.

Selection of Variables

A number of physical variables and physiological variables are important to achieve excellence in sports, but the most important variables were selected for the purpose of study. The chosen physical variables and physiological variables for the purpose of the study are presented below –

PHYSICAL VARIABLES

Sr. No.	Variables	Test	Units of Measurement
1.	Speed	20 mts. Dash	1/100 th of a Second Stopwatch
2.	Explosive Power	Sargent jump test	In Feet or inches

3.	Balance	Modified Bass Test of Dynamic Balance	Calculated in seconds
4.	Flexibility	Sit and Reach Test	In centimeters
5.	Lower Body Strength	Lunges	Number of lunges in 1 minute
6.	Back Strength	Kraus Webertest	Counted in numbers/minutes

PHYSIOLOGICAL VARIABLES

Sr. No.	Variables	Test	Units of Measurement
1.	Heart Rate	Digital Heart Rate Monitor	Number of beats per minute
2.	Vital Capacity	Spirometer	Liters

Reliability of Data

Reliability of Data was quesered by tester's competency, reliability of subjects, reliability of instruments/ equipment's and reliability of test items. Description and administration of tests all the tests were measured by standard tests. Test was administered to the badminton players who were selected for the study. The researcher has elaborated the purpose of the test after making sure that the subject was clearly understood the procedure of the test. Scores obtained from each test were recorded for the analysis of data.

Description of Physical Variables

1. Speed (20 meters dash)

Purpose - The purpose of this test was to measure the speed of subjects.

Purpose - The purpose of this test was to measure the speed of subjects.

Procedure - Prior to the test administration, a suitable running area with the distance of 20 meters and extension for stopping was marked. The subjects

were asked to take a standing start behind the starting point. The commands “Ready” and “Go” were given to start their running. At the same time stopwatch was turned on. The subject ran as fast as possible and when the subject crossing the finishing line, the stopwatch was stopped. No trials were given.

Scoring - The time taken to cover the distance was recorded to the nearest $1/10^{\text{th}}$ of the second.





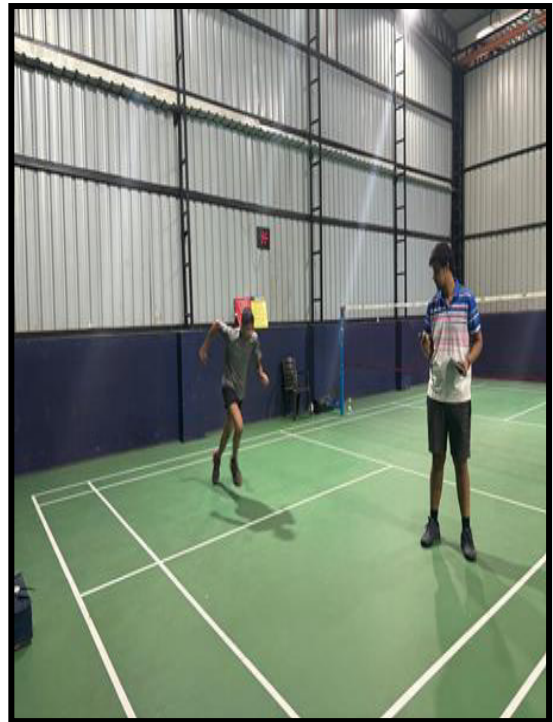


Photo1 : Speed 20 meters dash

2. Plosive Power (Vertical Jump)

Purpose - The purpose of this test was to measure explosive strength of subjects in vertical direction.

Equipment's - A plywood board as suggested by Sargent was used to obtain the data.

Procedure - To obtain data for vertical jump, Sargent jump was administered to the subjects. Before the execution of the vertical jump test, subjects were directed to practice for a few minutes. A plywood board (blackened 1 cm. Thick 1.50 mts. Long and 50 cm. Wide) with lines marked horizontally 1 cm. apart was used. This board was placed vertically, the zero point of the scale being at the reaching height of the shortest subject tested. The subject stood with his side toward the wall and reached as high as possible with heels on the floor and made a mark on the wall with chalked fingers. The subject then swung his arms downward and backward assuming a crouched position with the knees bent at about right angle. The subject then jumped as high as possible, swinging the arms upward, as the highest point of the jump was reached, and another mark was made above the initial one. Three trials were allowed with one-minute rest in between.

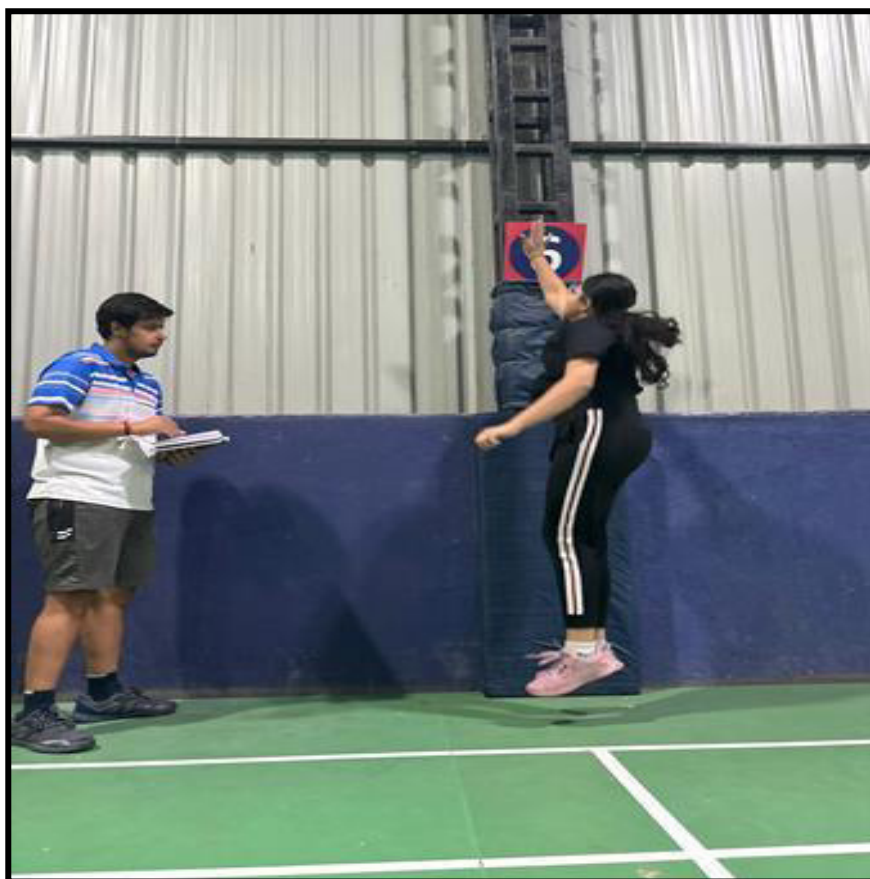
Scoring - The score was recorded to the nearest inches or feet, between the reach and jump mark. The best of the three trials was recorded as the test score.





















Photos : 2 Vertical Jump

3. Balance Measurement

Purpose - The purpose of this test was to measure the dynamic balance of subjects.

Equipment's - Adequate floor space, sticky tape for marking floor, measuring tape, stopwatch.

Procedure - The subject begins by standing stationary on the right foot on the starting point square. The subject then hops to the first tape mark with the left foot and immediately holds a static position for five seconds. After this time, he then hops to the second tape mark with the right foot and holds a static position for another five seconds. This continues with alternate foot hopping and holding a static position for five seconds at each point until the course is completed. At each point, the sole of the foot must completely cover each tape mark so that it cannot be seen. A period of practice with the procedure and on the course should be allowed.

Scoring - The result is recorded as either a success or fail. A successful performance consists of hopping to each tape mark without touching the floor with the heel or any other part of the body, and holding a static position on each tape mark for five seconds without exposing the tape mark.

4. Flexibility

Purpose - The purpose of this test was to measure the flexibility of subjects.

Equipment's - Sit and reach box (or alternatively a ruler can be used, and a step or box).

Procedure - This test involves sitting on the floor with legs stretched out straight ahead. Shoes should be removed. The soles of the feet are placed flat against the box. Both knees should be locked and pressed flat to the floor - the tester may assist by holding them down. With the palms facing downwards, and the hands on top of each other or side by side, the subject reaches forward along the measuring line as far as possible. Ensure that the hands remain at the same level, not one reaching further forward than the other. After some practice reaches, the subject reaches out and holds that position for at least one-two seconds while the distance is recorded. Make sure there are no jerky movements. See also video demonstrations of the Sit and Reach Test.

Scoring: The score is recorded to the nearest centimeter or half inch as the distance reached by the hand. Some test versions use the level of the feet as the zero mark, while others have the zero mark 9 inches before the feet. There is also the modified sit and reach test which adjusts the zero mark depending on the arm and leg length of the subject. There are some norms for the sit and reach test and also examples of some actual athlete results.













Photos 3 : Flexibility

Lower Body Strength

Purpose - The purpose of this test was to measure the strength of lower body through lunges of subjects.

Equipment's - Adequate floor space, stopwatch.

Procedure - The subject is asked to begin lunges on command “Go”. Number of correctly lunges performed by the subject in one minute will be counted by the tester.

Scoring - The correct number of lunges performed by the subject in one minute will be recorded as the score.





Photos 4 : Lower Body Strength

5. Back Strength (Kraus Weber Test)

Purpose: The purpose of this test was to assess the strength of the lower back muscles.

Equipment required: Flat surface, pillow, stopwatch, recording sheets.

Procedure: The subject lies in prone position i.e., face down on his stomach with a pillow under his lower abdomen and his hands behind his neck. The examiner holds his chest down (compared to the other Kraus Webber back strength test in which the feet are held down). The subject is asked to raise his feet, keeping his knees straight. The examiner counts to 10 seconds.

Scoring: This test is graded on a pass-fail basis. The test is passed if the subject holds the position for ten seconds.





Photos 5 : Back Strength

Description of Physiological Variables

1. Heart Rate

Purpose: The purpose of this test was to measure the heart rate of the subjects.

Equipment required: Digital heart rate monitor.

Procedure: The subject sits in the normal position. With the help of Digital heart rate monitor heart rate of the subject has been measured as number of beats per minute.

Scoring: Number of beats per minute of the subjects has been recorded as the score.

2. Vital Capacity

Purpose: The purpose of this test was to measure vital capacity of the subjects.

Equipment required: Dry Spirometer.

Procedure: Vital capacity was measured in liters by using Dry spirometer. The spirometer will be brought in to zero position. The subject performed maximum inspiration and after closing the nose, the air will be blown intensely in the mouth piece of the spirometer. Then the amount of expired air will be read directly from the calibrated scale and that will be the score of vital capacity.

Scoring: The vital capacity of the subjects will be recorded in liters.

TRAINING PROGRAMME

Pre- test and Post-test randomized group design has been used for the purpose of the study. The training was divided into sub-parts and training on each variable was specific followed by the whole training together.

Training period 1 - 4 weeks (single corner)





Training period 4-8 weeks (2-4 corners)







Training period 8-10 weeks (multiple corners)







Photos 6 : Shadow Training

Table-3.1 Badminton shadow group weekly training program

Training period 1 - 4 weeks (single corner)

Days	1 st	2 nd	3 rd	4 th
Time	30-35 Min.	30-35 Min.	30-35 Min.	30-35 Min.
Intensity	50%	60%	70%	80%
No. of sets	10 sets	12 sets	15 sets	15 sets
Duration of eachsets	30 seconds	30seconds	30 seconds	45 seconds
Recovery	1 Min.	1 Min.	1 Min.	1 Min.

Training period 4-8 weeks (2-4 corners)

Days	1 st	2 nd	3 rd	4 th
Time	40-45 Min.	40-45Min.	40-45 Min.	40-45 Min.
Intensity	60%	70%	75%	80%
No. of sets	12 sets	12 sets	15 sets	15 sets
Duration of each sets	30 seconds	30 seconds	30 seconds	45 seconds
Recovery	45 seconds	45 seconds	45 seconds	45 seconds

Training period 8-10 weeks (multiple corners)

Days	1 st	2 nd	3 rd	4 th
Time	60-65 Min.	60-65Min.	60-65 Min.	60-65 Min.
Intensity	70%	75%	80%	85%
No. of sets	15 sets	15 sets	15 sets	15 sets
Duration of each sets	45 seconds	45 seconds	45 seconds	45 seconds
Recovery	45 seconds	45 seconds	45 seconds	45 seconds

Training period 10-12 weeks (Full court)

Days	1 st	2 nd	3 rd	4 th
Time	60-65 Min.	60-65Min.	60-65 Min.	60-65 Min.
Intensity	60%	70%	80%	90%
No. of sets	20 sets	20 sets	20 sets	20 sets
Duration of each sets	45 seconds	45 seconds	45 seconds	45 seconds
Recovery	30 seconds	30 seconds	30 seconds	30 seconds

This Programme consists of following off court exercisesdaily-

- Flexibility
- Back strength
- Lower Body Strength
- Balancing exercise
- Co-ordination exercise

Collection of Data

A total of 60 subjects in the age category 10-14 & 15-19 of different academies in Surat district have been selected. Subjects of the research group were divided into four groups (two control groups & two experimental groups). Two groups will be consisting of 15 players each of the beginner level. First group was comprise of players of age 10-14 years on which the training schedule was implied followed by second group which was

of the same age category of the advanced player. Third group was of 15-19 years age category of the beginners followed by the fourth group which was having the advanced players of the same age category. The Training programme was administered on the experimental group four times in a week for a period of 12 weeks.

Statistical Technique

The data collected from two groups before and after experimental period was statistically analyzed for observing significant improvement by using T- Test. In order to observe the effect of Shadow Training on selected Physical & physiological variables of beginners and advanced badminton players Analysis of co- variance (ANCOVA) was used. Statistical significance was accepted at 0.5 level.

CHAPTER -IV

ANALYSIS AND INTERPRETATION OF DATA



The analysis of data collected on beginners and advance level badminton players is presented in this chapter. Data on badminton players was examined by using descriptive statistics, T test and Ancova. The level of significance was set at 0.05 level of significance.

Table 4.1 : Descriptive Statistics on Physical variables for 10-14 years age group players

Variables	Pre-Post Test	Mean	Std. Deviation	Std. Error Mean
Speed	Pre	7.41	0.546	0.141
	Post	6.44	0.673	0.174
Vertical Jump	Pre	42.80	1.707	0.441
	Post	48.33	2.887	0.745
Balance	Pre	74.92	4.564	1.178
	Post	88.79	9.589	2.476
Flexibility	Pre	6.81	0.592	0.153
	Post	7.56	1.352	0.349
Lower Body Strength	Pre	7.01	1.369	0.354
	Post	4.41	0.820	0.212
Back Strength	Pre	16.99	0.975	0.252
	Post	11.76	2.119	0.547
Heart Rate	Pre	77.13	2.803	0.724
	Post	76.99	4.795	1.238
Vital Capacity	Pre	2.66	0.248	0.064
	Post	3.55	0.627	0.162

Table 4.1 illustrates the result of descriptive statistics mean and standard deviation (SD) of the Physical variables of players aged from 10-14 years. The mean and standard deviation (SD) of pretest and post test scores on Physical variable speed Pre 7.41 ± 0.546 , Post 6.44 ± 0.673 , Vertical Jump Pre 42.80 ± 1.707 , Post 48.33 ± 2.887 , Balance Pre 74.92 ± 4.564 , Post 88.79 ± 9.589 , Flexibility Pre 6.81 ± 0.592 , Post 7.56 ± 1.352 , Lower Body Strength Pre 7.01 ± 1.369 , Post 4.41 ± 0.820 , Back Strength Pre 16.99 ± 0.975 , Post 11.76 ± 2.119 .

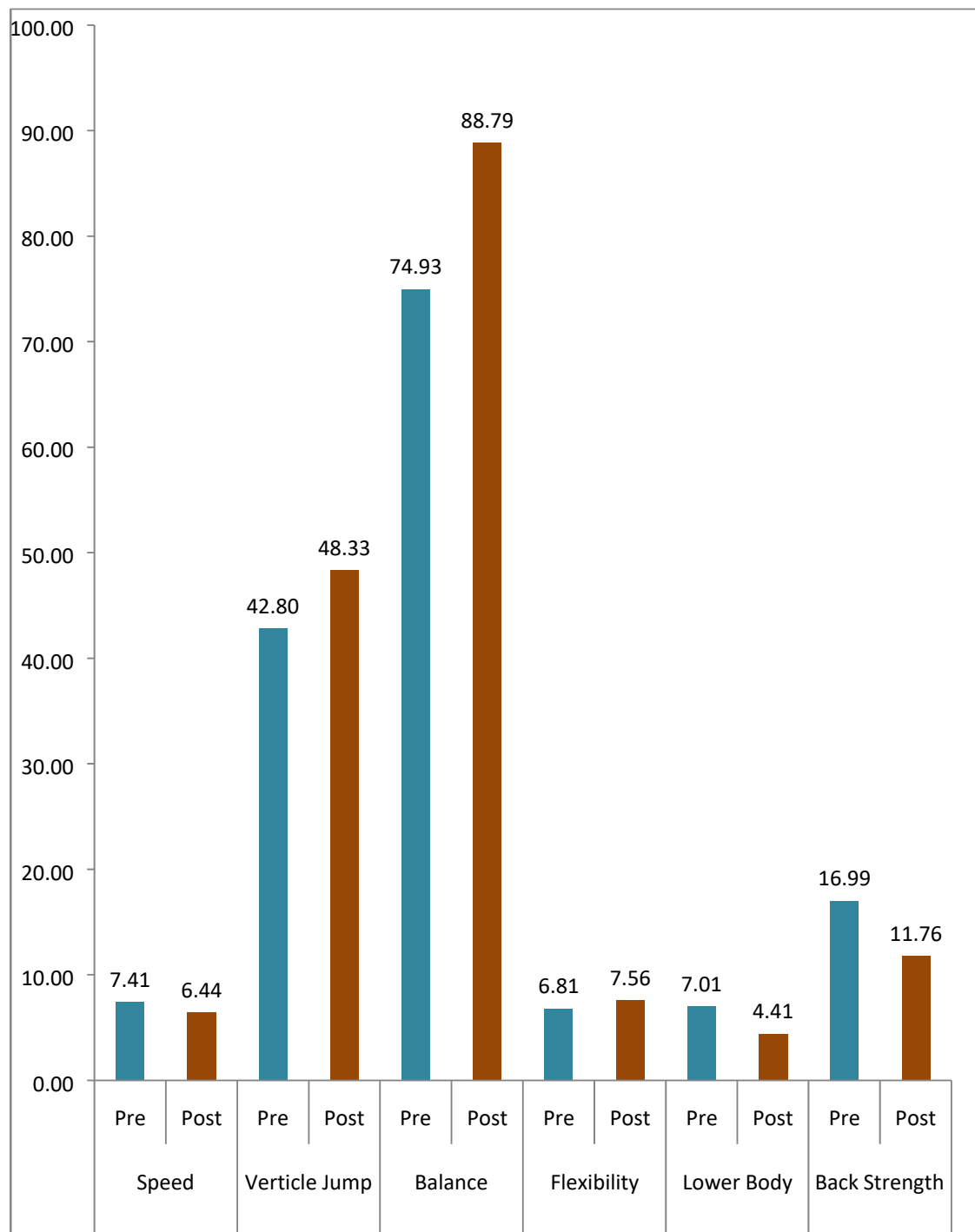


Fig. 4.1 : Descriptive statistics on Physical variables of 10-14 years age group players

Table 4.2 : Descriptive Statistics on Physical variables for 10-14 years advance level players

Variables	Pre-Post Test	Mean	Std. Deviation	Std. Error Mean
Speed	Pre	6.66	0.548	0.141
	Post	6.43	0.479	0.124
Vertical Jump	Pre	42.54	1.402	0.362
	Post	42.47	1.506	0.389
Balance	Pre	77.76	4.946	1.277
	Post	77.80	5.226	1.349
Flexibility	Pre	6.68	1.029	0.266
	Post	6.92	0.900	0.232
Lower Body Strength	Pre	7.51	1.508	0.389
	Post	7.73	1.751	0.452
Back Strength	Pre	16.79	0.702	0.181
	Post	16.80	1.568	0.405

Table 4.2 illustrates the result of descriptive statistics mean and standard deviation (SD) of the Physical variables of advanced level players aged from 10-14 years. The mean and standard deviation (SD) of pretest and post test scores on Physical variable Speed Pre 6.66 ± 0.548 , Post 6.43 ± 0.479 , Vertical Jump Pre 42.54 ± 1.402 , Post 42.47 ± 1.506 , Balance Pre 77.76 ± 4.946 , Post 77.80 ± 5.226 , Flexibility Pre 6.68 ± 1.029 , Post 6.92 ± 0.900 , Lower Body Strength Pre 7.51 ± 1.508 , Post 7.73 ± 1.751 and Back Strength Pre 16.79 ± 0.702 , Post 16.80 ± 1.568 .

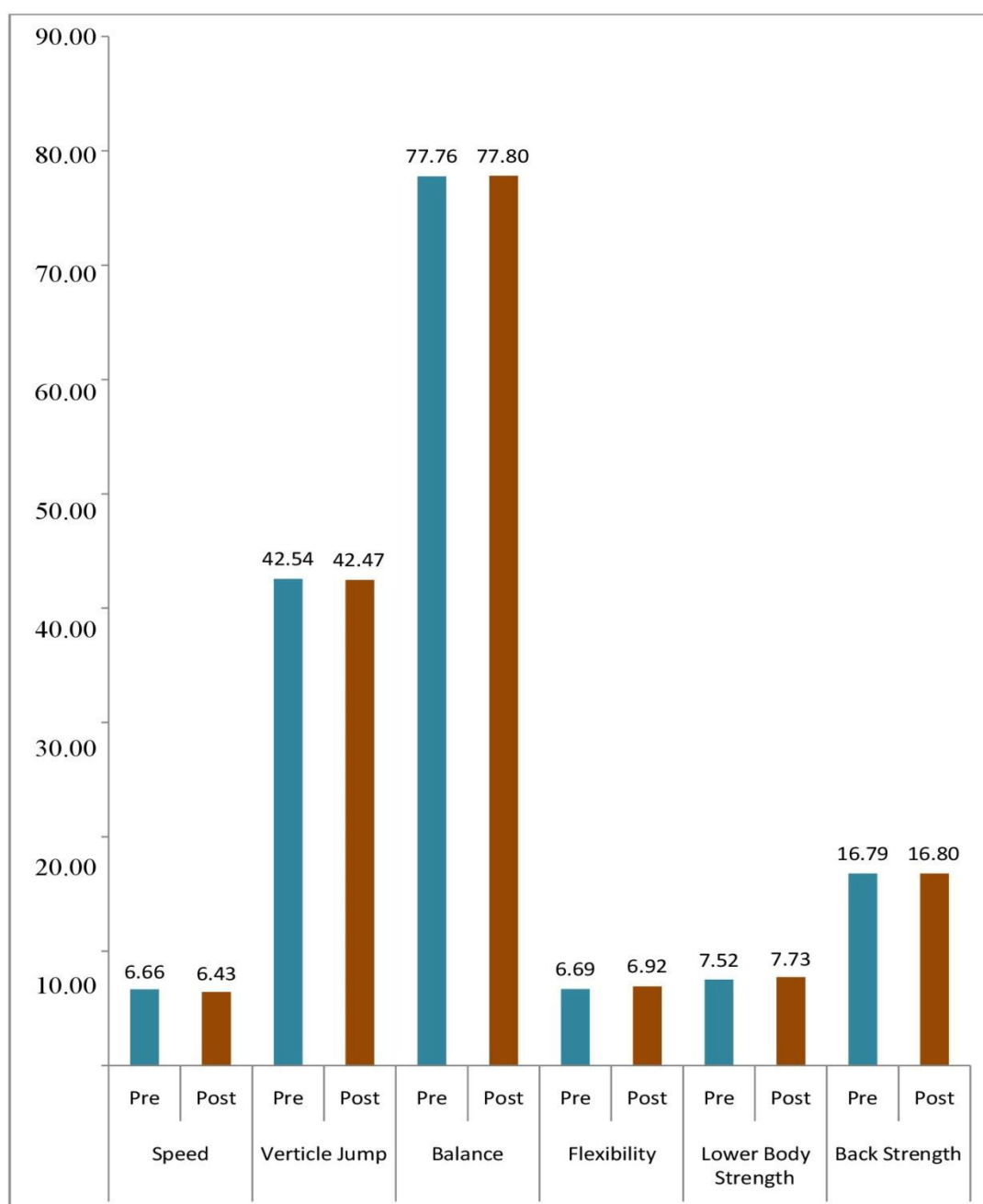


Fig. 4.2 : Descriptive statistics on Physical variables of 10-14 years age group advance level players

Table 4.3 : ‘T’ test Comparative Statistics on Physical variables of 15-19 years age group players

Variables	Pre-Post Test	Mean	Std. Deviation	Std. Error Mean
Speed	Pre	7.19	0.702	0.181
	Post	6.08	0.559	0.144
Vertical Jump	Pre	42.79	1.435	0.370
	Post	45.33	1.988	0.513
Balance	Pre	77.19	5.739	1.482
	Post	88.36	8.668	2.238
Flexibility	Pre	6.31	0.915	0.236
	Post	6.87	0.990	0.256
Lower Body Strength	Pre	7.29	1.410	0.364
	Post	10.13	1.407	0.363
Back Strength	Pre	17.351	0.561	0.145
	Post	19.07	1.534	0.396

Table 4.3 illustrates the result of descriptive statistics mean and standard deviation (SD) of the Physical variables of players aged from 15-19 years. The mean and standard deviation (SD) of pretest and post test scores on Physical variable Speed Pre 7.19 ± 0.702 , Post 6.08 ± 0.559 , Vertical Jump Pre 42.79 ± 1.435 , Post 45.33 ± 1.988 , Balance Pre 77.19 ± 5.739 , Post 88.36 ± 8.668 , Flexibility Pre 6.31 ± 0.915 , Post 6.87 ± 0.990 , Lower Body Strength Pre 7.29 ± 1.410 , Post 10.13 ± 1.407 and Back Strength Pre 17.351 ± 0.561 , Post 19.07 ± 1.534 .

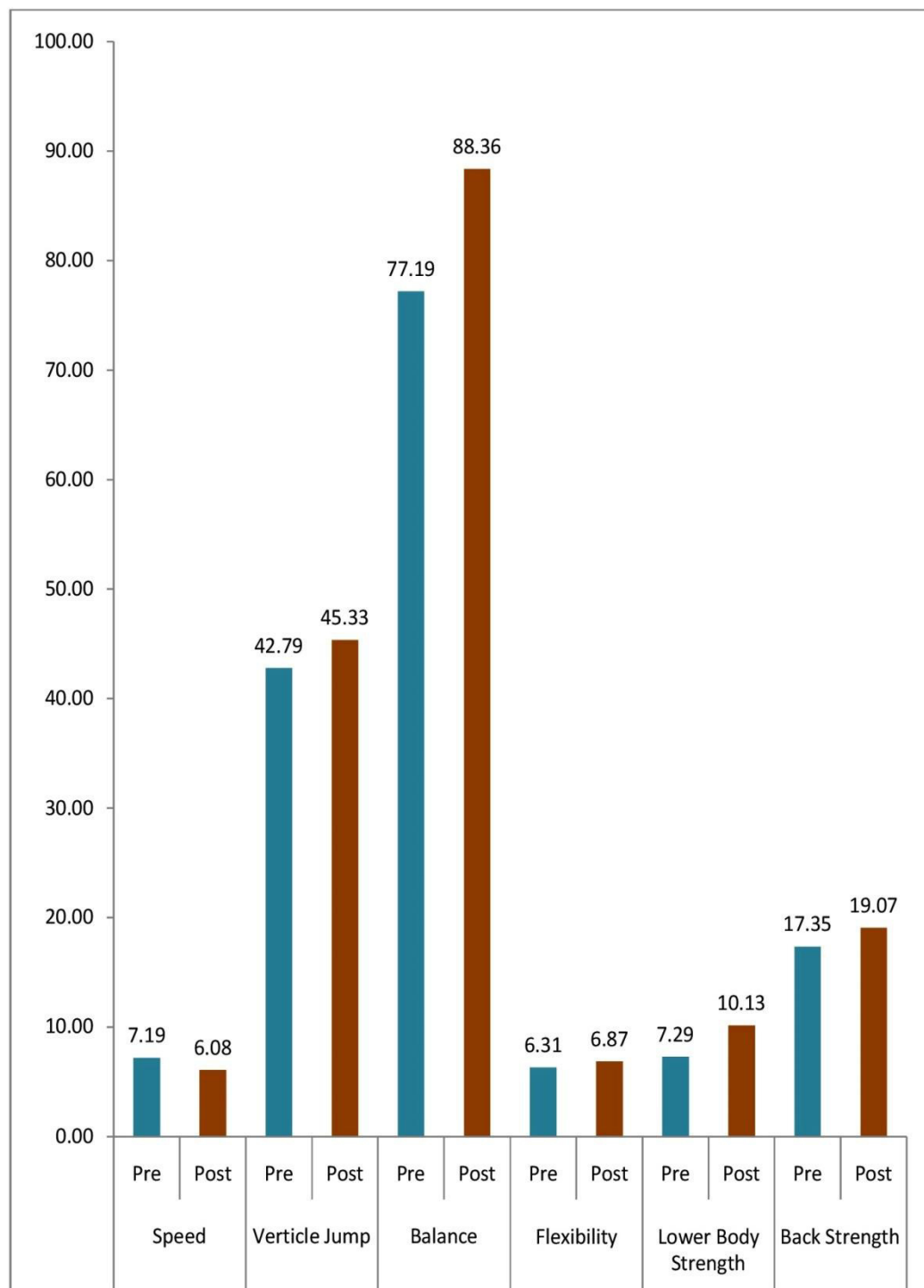


Figure 4.3 : Descriptive statistics on Physical variables of 15-19 years age group players

Table 4.4 : Descriptive Statistics on Physical variables of 15-19 years age group advance level players

Variables	Pre-Post Test	Mean	Std. Deviation	Std. Error Mean
Speed	Pre	5.83	0.601	0.155
	Post	6.85	0.760	0.196
Vertical Jump	Pre	42.76	1.512	0.390
	Post	41.87	1.642	0.424
Balance	Pre	75.80	5.177	1.337
	Post	75.67	4.499	1.162
Flexibility	Pre	6.20	0.952	0.246
	Post	6.47	1.060	0.274
Lower Body Strength	Pre	7.06	1.608	0.415
	Post	7.20	1.265	0.327
Back Strength	Pre	16.74	0.895	0.231
	Post	16.93	1.163	0.300

Data presented in Table 4.4 shows the result of descriptive statistics mean and standard deviation (SD) of the Physical variables of advance level players aged from 15-19 years. The mean and standard deviation (SD) of pretest and post test scores on Physical variable Speed Pre 7.19 ± 0.702 , Post 6.08 ± 0.559 , Vertical Jump Pre 42.79 ± 1.435 , Post 45.33 ± 1.988 , Balance Pre 77.19 ± 5.739 , Post 88.36 ± 8.668 , Flexibility Pre 6.31 ± 0.915 , Post 6.87 ± 0.990 , Lower Body Strength Pre 7.29 ± 1.410 , Post 10.13 ± 1.407 and Back Strength Pre 17.351 ± 0.561 , Post 19.07 ± 1.534 .

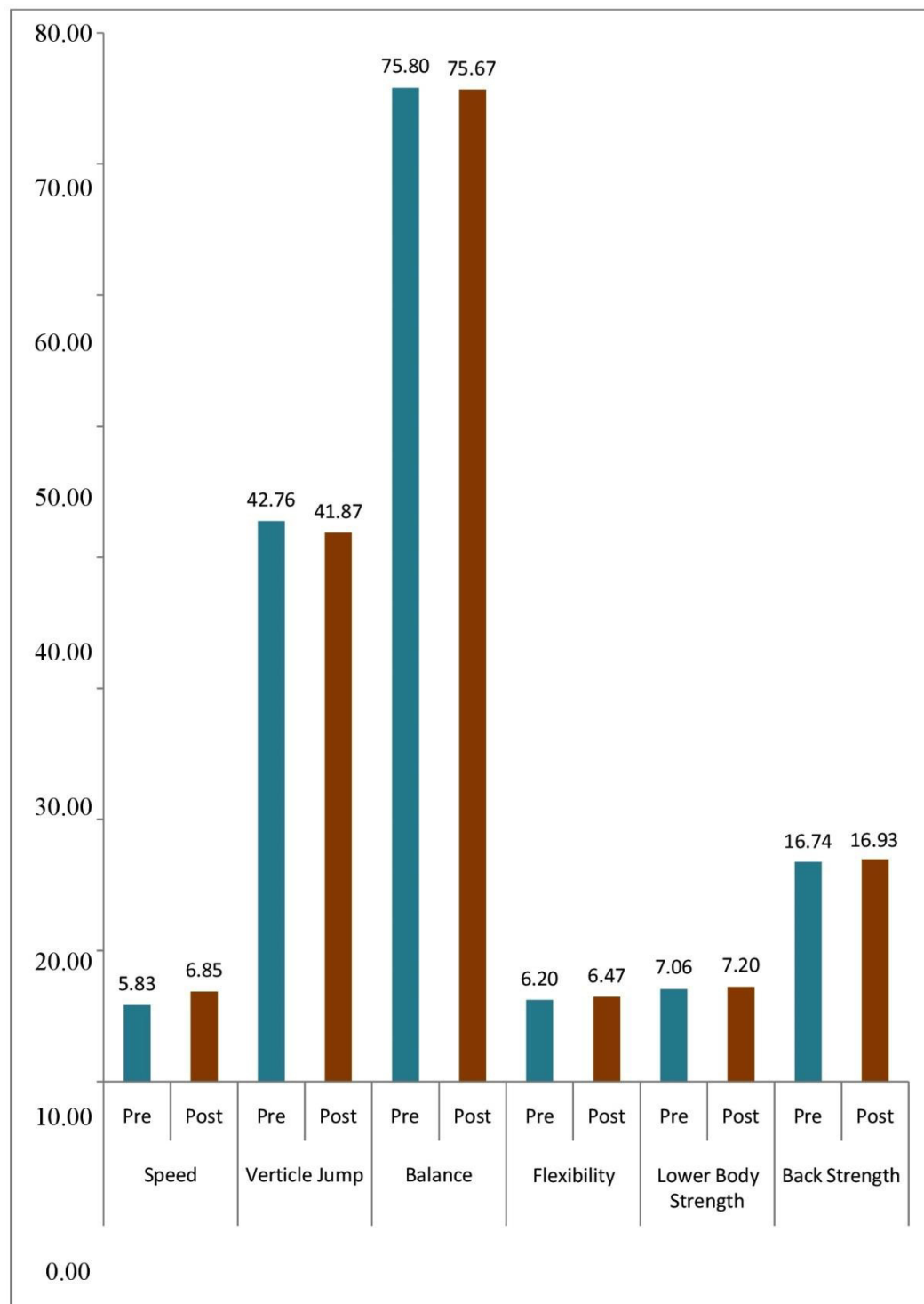


Fig. 4.4 : Descriptive statistics on Physical variables of 15-19 years age group advance level players

Table 4.5 : ‘T’ test Comparative Statistics on Physical variables of For 10-14 years age group players

Variables	Pre-Post Test	Mean	Std. Deviation	mean dif.	Std. Error Mean	t	Sig
Speed	Pre	7.409	0.546	0.97	.0852	11.34	.000
	Post	6.443	0.673				
Vertical Jump	Pre	42.798	1.707	5.53	.696	7.95	.000
	Post	48.331	2.887				
Balance	Pre	74.925	4.564	13.87	1.846	7.51	.000
	Post	88.792	9.589				
Flexibility	Pre	6.807	0.592	0.75	.388	1.94	.073
	Post	7.561	1.352				
Lower Body Strength	Pre	5.012	0.369	0.60	.437	2.95	.05
	Post	4.413	0.820				
Back Strength	Pre	13.993	0.975	2.23	.599	3.72	.04
	Post	11.761	2.119				

Table no. 4.5 depicts the comparative analysis of Physical variables of players age group of 10-14 years. Obtained data showed significant difference in Physical variables like Speed MD(0.97), ‘t’(11.34), ‘p’(.000), Vertical Jump MD(5.53), ‘t’(7.95), ‘p’ (.000), Balance MD(13.87), ‘t’(7.51), ‘p’ (.000), Lower Body Strength MD(2.60), ‘t’(5.95), ‘p’ (.000) and Back Strength MD(5.23, ‘t’(8.72), ‘p’ (.000). However insignificant difference was observed in Flexibility MD (0.75), ‘t’(1.94), ‘p’(.073).

Table 4.6 : ‘T’ test Comparative Statistics on Physical variables of 10-14 years age group advance level players

Variables	Pre- Post Test	Mean	Std. Deviation	mean dif.	Std. Error Mean	t	Sig
Speed	Pre	6.66	0.54	0.23	.11470	1.97	.069
	Post	6.43	0.47				
Vertical Jump	Pre	42.54	1.40	0.08	.26256	0.29	.773
	Post	42.46	1.50				
Balance	Pre	77.76	4.94	-0.04	.57491	-0.07	.946
	Post	77.80	5.22				
Flexibility	Pre	6.68	1.02	-0.23	.15358	-1.52	.151
	Post	6.91	0.90				
Lower Body Strength	Pre	7.51	1.50	-0.22	.30317	-0.71	.489
	Post	7.73	1.75				
Back Strength	Pre	16.78	0.70	-0.01	.37848	-0.03	.978
	Post	16.80	1.56				

Table no. 4.6 depicts the comparative analysis of Physical variables of players age group of 10-14 years. Obtained data showed insignificant difference in Physical variables like Speed MD(0.23), ‘t’(1.97), ‘p’(.069), Vertical Jump MD(0.08), ‘t’(0.29), ‘p’(.773), Balance MD(0.04), ‘t’(0.07), ‘p’(.946), Flexibility MD(0.23), ‘t’(1.52), ‘p’(.151), Lower Body Strength MD(0.22), ‘t’(0.71), ‘p’(.489) and Back Strength MD(0.01), ‘t’(0.03), ‘p’(.978). Obtained ‘t’ values of all the Physical variables was less than the required ‘t’ table value to be significant at 0.05 level (14,df).

Table 4.7 : ‘T’ test Comparative Statistics on Physical variables of 15-19 years age group players

Variables	Pre- Post Test	Mean	Std. Deviation	mean dif	Std. Error Mean	t	Sig
Speed	Pre	7.188	0.702	1.11	.19511	5.68	.000
	Post	6.081	0.559				
Vertical Jump	Pre	42.789	1.435	-2.54	.66270	-3.84	.002
	Post	45.333	1.988				
Balance	Pre	77.189	5.739	-11.17	2.84899	-3.92	.002
	Post	88.363	8.668				
Flexibility	Pre	6.307	0.915	-0.56	.29764	-1.88	.081
	Post	6.867	0.990				
Lower Body Strength	Pre	7.289	1.410	-2.84	.55485	-5.13	.000
	Post	10.133	1.407				
Back Strength	Pre	17.351	0.561	-1.72	.42104	-4.08	.001
	Post	19.067	1.534				

Data presented in Table no. 4.7 on comparative analysis of Physical variables of players age group of 15-19 years. Obtained data showed insignificant difference in Physical variables like Speed MD(1.11), ‘t’(5.68), P(.000), Vertical Jump MD(2.54), ‘t’(-3.84), P(.002), Balance MD(11.17), ‘t’(-3.92), P(.002), Lower Body Strength MD(2.84), ‘t’(-5.13), P(.000) and Back Strength MD(1.72), ‘t’(4.08), P(.001).. However insignificant difference was observed in Flexibility MD(0.56), ‘t’ (-1.88), P(.081)

Table 4.8 : ‘T’ test Comparative Statistics on Physical variables of 15-19 years age group advance level players

Variables	Pre- Post Test	Mean	Std. Deviation	mean dif	Std. Error Mean	t	Sig
Speed	Pre	5.829	0.601	-1.02	.09234	-11.08	.000
	Post	6.851	0.760				
Vertical Jump	Pre	42.759	1.512	0.89	.26443	3.37	.005
	Post	41.867	1.642				
Balance	Pre	75.798	5.177	0.13	.49373	0.27	.794
	Post	75.667	4.499				
Flexibility	Pre	6.203	0.952	-0.26	.21029	-1.26	.230
	Post	6.467	1.060				
Lower Body Strength	Pre	7.061	1.608	-0.14	.31278	-0.44	.664
	Post	7.200	1.265				
Back Strength	Pre	16.737	0.895	-0.20	.38962	-0.50	.622
	Post	16.933	1.163				

Table no. 4.8 depicts the comparative analysis of Physical variables of players age group of 10-14 years. Obtained data showed insignificant difference in Physical variables like Speed MD(1.02), ‘t’(11.08), P(.000), Vertical Jump MD(0.89), ‘t’(3.37), P(.005). there was insignificant difference observed in Physical variables like Balance MD(0.13) , ‘t’(0.27), P(.794), Flexibility MD(0.26) , ‘t’(1.26), P(.230), Lower Body Strength MD(0.14) , ‘t’(0.44), P(.664) and Back Strength MD(0.20) , ‘t’(0.50), P(.622).

Table 4.9 : Descriptive statistics on Physiological variables for 10-14 years age group players

Variables	Pre-Post Test	Mean	Std. Deviation	Std. Error Mean
Heart Rate	Pre	77.13	2.803	0.724
	Post	76.99	4.795	1.238
Vital Capacity	Pre	2.66	0.248	0.064
	Post	3.55	0.627	0.162

Descriptive statistics presented in table 4.9 on Physiological variables illustrates mean scores, standard deviation and std. Error of mean scores of players aged 10-14 years shows scores for Heart Rate Pre 77.13 ± 2.803 , Post 76.99 ± 4.795 and Vital Capacity Pre 2.66 ± 0.248 , Post 3.55 ± 0.627 .

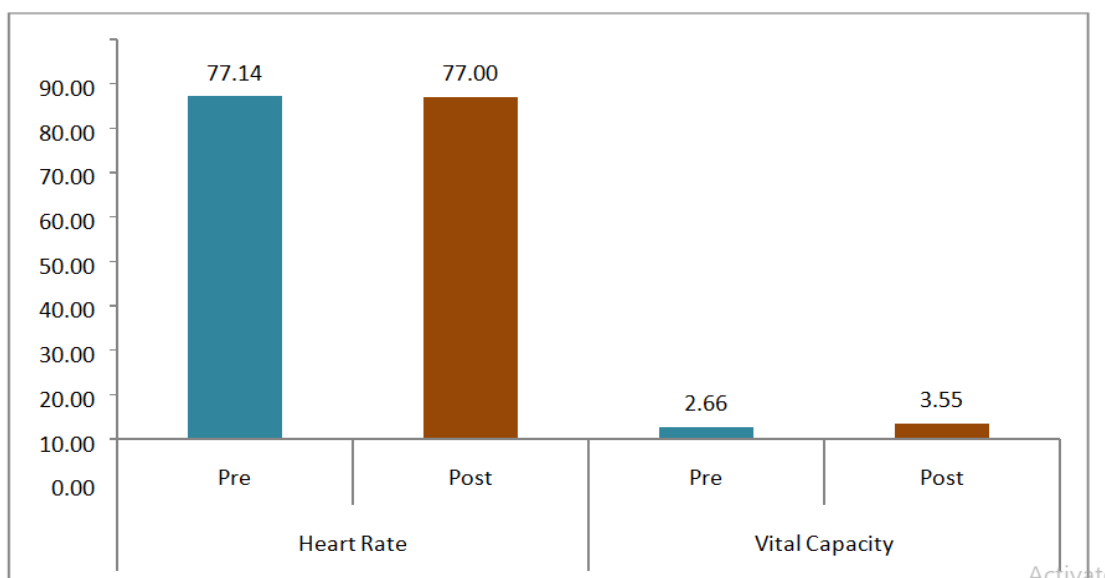


Fig. 4.5 : Descriptive statistics on physiological variables of 10-14 years age group players

Table 4.10 : Descriptive statistics on physiological variables of 10-14 years age group advance level players

Variables	Pre-Post Test	Mean	Std. Deviation	Std. Error Mean
Heart Rate	Pre	77.85	2.295	0.592
	Post	78.53	2.875	0.742
Vital Capacity	Pre	2.40	0.270	0.070
	Post	2.66	0.327	0.084

Descriptive statistics presented in table 4.10 on Physiological variables illustrates mean scores, standard deviation and std. Error of mean scores of advanced level players aged 10-14 years shows scores for Heart Rate Pre 77.85 ± 2.295 , Post 78.53 ± 2.875 and Vital Capacity Pre 2.40 ± 0.270 , Post 2.66 ± 0.327 .

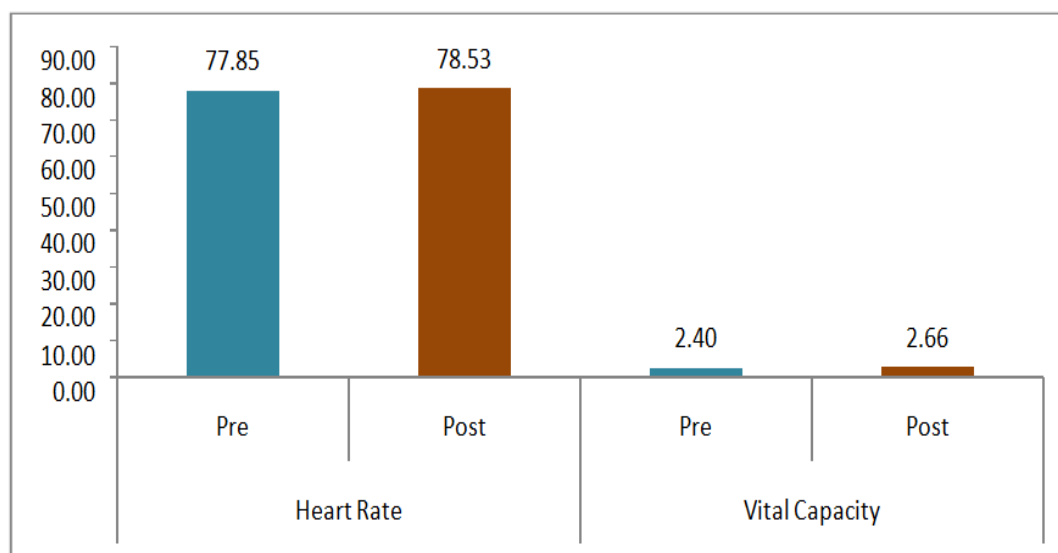


Fig. 4.6 : Descriptive statistics on physiological variables of 10-14 years age group advance level players

Table 4.11 : Descriptive statistics on physiological variables of 15-19 years age group players

Variables	Pre-Post Test	Mean	Std. Deviation	Std. Error Mean
Heart Rate	Pre	77.20	3.072	0.793
	Post	73.27	2.052	0.530
Vital Capacity	Pre	2.47	0.297	0.077
	Post	2.70	0.530	0.137

Descriptive statistics presented in table 4.11 on Physiological variables illustrates mean scores, standard deviation and std. Error of mean scores of players aged 15-19 years shows scores for Heart Rate Pre 77.20 ± 3.072 , Post 73.27 ± 2.052 and Vital Capacity Pre 2.47 ± 0.297 , Post 2.70 ± 0.530

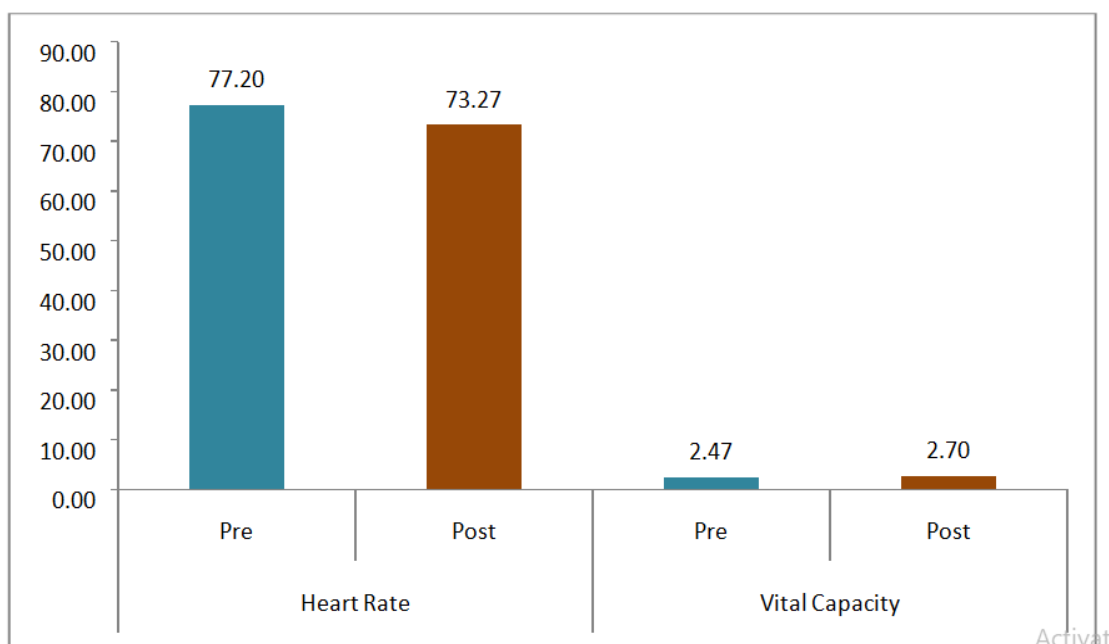


Fig. 4.7 : Descriptive statistics on physiological variables of 15-19 years age group players

Table 4.12 : Descriptive statistics on physiological variables of 15-19 years age group advance level players

Variables	Pre-Post Test	Mean	Std. Deviation	Std. Error Mean
Heart Rate	Pre	77.45	3.006	0.776
	Post	77.60	2.530	0.653
Vital Capacity	Pre	2.52	0.234	0.060
	Post	2.94	0.638	0.165

Descriptive statistics presented in table 4.12 on Physiological variables illustrates mean scores, standard deviation and std. Error of mean scores of advanced level players aged 15-19 years shows scores for Heart Rate Pre 77.20±3.072, Post 73.27±2.052 and Vital Capacity Pre 2.47±0.297, Post 2.70±0.530

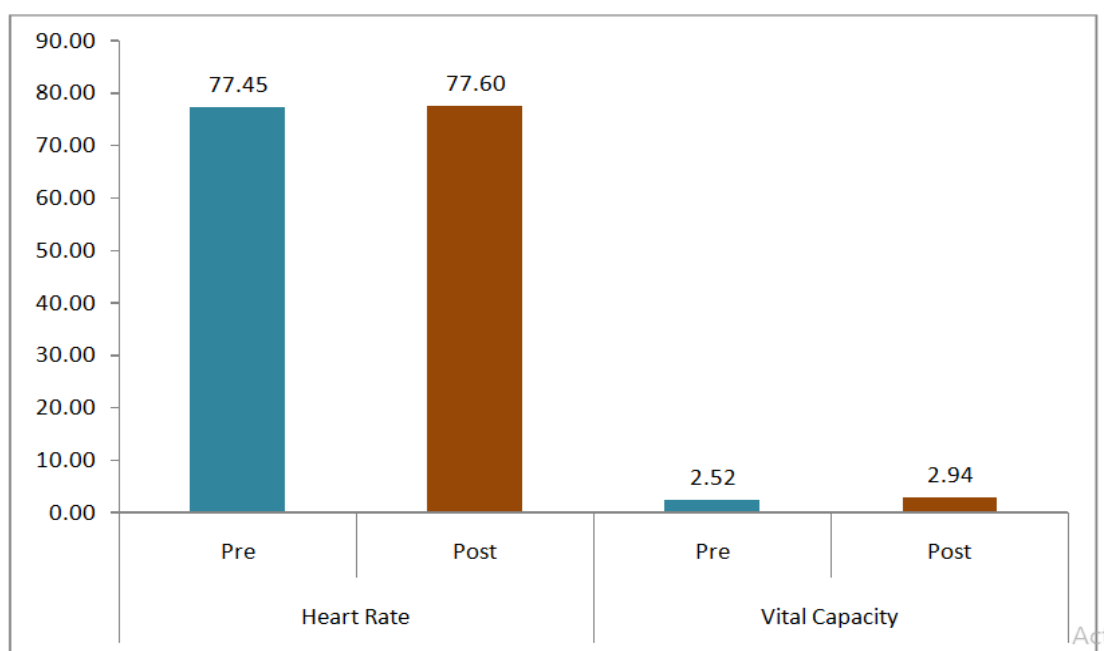


Fig. 4.8 : Descriptive statistics on physiological variables of 15-19 years age group advance level players

Table 4.13 : ‘T’ test Comparative Statistics For 10-14 years age group players

Variables	Pre- Post Test	Mean	Std. Deviation	mean dif	Std. Error Mean	t	Sig
Heart Rate	Pre	77.135	2.803	0.14	1.009	0.14	.893
	Post	76.997	4.795				
Vital Capacity	Pre	2.663	0.248	-.88	.176	5.00	.000
	Post	3.547	0.627				

Comparative scores between the pre-test and post-test scores on Physiological variables of players age group of 10-14 years is depicted in table no. 4.13. Obtained scores revealed significant difference on vital capacity as the obtained ‘t’ values (5.00) was higher than the require ‘t’ to be significant at 0.05 level (14,df). Scores on heart rate showed insignificant difference between the pre and post test scores as the obtained ‘t’(0.14) value was much lesser than the required ‘t’ to be significant at 0.05 level (14,df)

Table 4.14 : ‘T’ test Comparative Statistics group players

Variables	Pre- Post Test	Mean	Std. Deviation	mean dif	Std. Error Mean	t	Sig
Heart Rate	Pre	77.84	2.29	-0.69	.577	1.19	.253
	Post	78.53	2.87				
Vital Capacity	Pre	2.39	0.27	-0.26	.10225	2.58	.022
	Post	2.66	0.32				

Comparative scores between the pre-test and post-test scores on Physiological variables of advance level players age group of 10-14 years is depicted in table no. 4.14. Scores revealed significant difference on vital capacity as the obtained ‘t’ values (2.58) was higher than the require ‘t’ to be significant at 0.05 level (14,df). Scores on heart rate showed insignificant difference between the pre and post test scores as the obtained ‘t’(1.19) value was much lesser than the required ‘t’ to be significant at 0.05 level (14,df)

Table 4.15 : ‘T’ test Comparative Statistics ggroup3

Variables	Pre-Post Test	Mean	Std. Deviation	mean dif	Std. Error Mean	t	Sig
Heart Rate	Pre	77.199	3.072	3.93	.656	5.99	.000
	Post	73.267	2.052				
Vital Capacity	Pre	2.473	0.297	-0.23	.13301	1.73	.105
	Post	2.703	0.530				

Comparative scores between the pre-test and post-test scores on Physiological variables of players age group of 15-19 years is depicted in table no. 4.15. Scores revealed significant difference on heart rate as the obtained ‘t’ value (5.99) was higher than the require ‘t’ to be significant at 0.05 level (14,df). Scores on vital capacity showed insignificant difference between the pre and post test scores as the obtained ‘t’(1.73) value was much lesser than the required ‘t’ to be significant at 0.05 level (14,df)

Table 4.16 : ‘T’ test Comparative Statistics group4

Variables	Pre-Post Test	Mean	Std. Deviation	mean dif	Std. Error Mean	t	Sig
Heart Rate	Pre	77.445	3.006	0.15	.496	0.31	.760
	Post	77.600	2.530				
Vital Capacity	Pre	2.519	0.234	0.42	.20255	2.05	.059
	Post	2.935	0.638				

Comparative scores between the pre-test and post-test scores on Physiological variables of players age group of 15-19 years is depicted in table no. 4.15. Scores revealed significant difference on heart rate as the obtained ‘t’ value (5.99) was higher than the require ‘t’ to be significant at 0.05 level (14,df). Scores on vital capacity showed insignificant difference between the pre and post test scores as the obtained ‘t’(1.73) value was much lesser than the required ‘t’ to be significant at 0.05 level (14,df)

Discussion of findings

The present study analyzed the physical variables of players in the age group of 10-14 years and presented the results in Table 4.5. The data showed that there was a significant difference in physical variables like speed, vertical jump, balance, lower body strength, and back strength. However, there was an insignificant difference in flexibility. The 't' values for all the significant physical variables were greater than the required 't' table value to be significant at the 0.05 level, while the 't' value for flexibility was less than the required value. The present findings are supported by study conducted by **Balas et. al. (2016)** in which they examined the effect of age on physical fitness components in male handball players. Ninety-four male handball players from the Slovak Extraliga, categorized by age into U16 (n=24), U18 (n=25), U20 (n=19), and senior (n=26) groups, participated in this study. The players underwent a battery of physical fitness tests to assess speed, agility, and muscular endurance, upper and lower body strength, and flexibility. The results showed a significant age effect for all physical fitness components except for flexibility. In particular, the U20 and senior groups had significantly better results than the U16 and U18 groups in all physical fitness components except for flexibility. These findings suggest that physical fitness components improve with age in male handball players, with the greatest improvements occurring in the U20 and senior age groups.

The study analyzed the physical variables of advance level players aged 10-14 years old. The data showed insignificant differences in physical variables such as speed, vertical jump, balance, flexibility, lower body strength, and back strength between the pre-test and post-test scores. The obtained 't' values were all lower than the required 't' table values to be significant at the 0.05 level. The results of the present study are in line with the study by **Shukla, A. (2017)** aimed to evaluate the effect of a physical training program on the physical fitness of rural Indian school players. A randomized controlled intervention trial was conducted on 530 players aged 10-14 years. Physical fitness variables such as speed, vertical jump, balance, flexibility, and strength were measured before and after the intervention. The results showed no significant difference between the intervention and control groups in any of the physical fitness

variables. The obtained 't' values of all the physical variables were less than the required 't' table value to be significant at the 0.05 level. The study suggests that a physical training program may not have a significant effect on the physical fitness of rural Indian school level players in this age group. Study presents a comparative analysis of physical variables of players aged 15-19 years. The data shows insignificant differences in speed, balance, lower body strength, and back strength between pre-test and post-test scores, while flexibility showed a marginal difference. However, the vertical jump showed a significant difference between the pre-test and post-test scores. The findings of the present study is similar to the study conducted by A similar study was conducted by **Ali et al., (2018)** on college-level basketball players to investigate the effect of plyometric training on their physical fitness. Pre-test and post-test scores were obtained for physical variables such as speed, vertical jump, and agility. The study found that there was a significant improvement in vertical jump performance, but no significant difference in speed and agility between the pre-test and post-test scores.

The study analyzed the physical variables of players aged between 10-14 years, and the results are summarized in table 4.8. The data showed an insignificant difference in physical variables like speed, vertical jump, balance, flexibility, lower body strength, and back strength between the pre-test and post-test scores. The obtained 't' values were much lower than the required 't' values to be significant at the 0.05 level. The study is supported by **Jukic, I et .al. (2018)** study conducted on young basketball players aimed to investigate the effect of a 6-week plyometric training program on their physical fitness. Pre-test and post-test scores were obtained for physical variables such as speed, vertical jump, and agility. The study found that there was no significant difference in these variables between the pre-test and post-test scores. **Kemper G. L. et. al. (2014)** conducted on male soccer players aged 13-14 years to investigate the effect of a 6-week training program on their physical fitness. The study measured physical variables such as speed, agility, vertical jump, and leg power. The results showed that there was no significant difference in these variables between the pre-test and post-test scores. **Aouadi R. et. al. (2012)** aimed to investigate the effect

of a 6-week training program on the physical fitness of adolescent handball players. The study measured physical variables such as speed, agility, and vertical jump. The results showed that there was no significant difference in these variables between the pre-test and post-test scores.

The present study analyzed pre-test and post-test scores of physiological variables in players aged between 10-14 years, and the results are summarized in table 4.13. The scores showed a significant difference in vital capacity between the pre-test and post-test scores, as the obtained 't' value (5.00) was higher than the required 't' value to be significant at the 0.05 level (14, df). However, there was an insignificant difference in the scores on heart rate, as the obtained 't' value (0.14) was much lower than the required 't' value to be significant at the 0.05 level (14, df). The present study results are in line with the similar study conducted by **Barbosa et. al. (2019)** on adolescent soccer players aimed to investigate the effect of a 6-week training program on their physical fitness. Pre-test and post-test scores were obtained for the physiological variables of 35 male players aged 12-14 years. Results showed a significant increase in VO₂max and leg strength, as the obtained 't' values were higher than the required 't' values to be significant at the 0.05 level. However, there was no significant difference in heart rate between the pre-test and post-test scores. The study suggests that a 6-week training program can improve physical fitness in adolescent soccer players.

Present study analyzed the pre-test and post-test scores of physiological variables in advanced level players aged between 10-14 years. Table 4.14 shows a comparison of these scores, which indicated a significant difference in vital capacity between the pre-test and post-test scores. The obtained 't' value (2.58) was higher than the required 't' value to be significant at 0.05 level (14, df). However, there was an insignificant difference in the scores on heart rate, as the obtained 't' value (1.19) was much lesser than the required 't' value to be significant at 0.05 level (14, df). The study findings are supported by the titled "Effects of Physical Training on Cardiorespiratory Fitness and Health Status in Youth" in which **Martinez-López et. al. (2020)** aimed to investigate the effects of a physical training program on the cardiorespiratory fitness and health status of young athletes aged between 10-14 years. The study consisted of

56 young athletes, who were randomly assigned to either a physical training group or a control group. The physical training group underwent a supervised exercise program for 8 weeks, while the control group did not participate in any exercise during this time. Pre- and post-intervention assessments were conducted, including measurements of vital capacity and heart rate. The results showed that the physical training group had significant improvements in both vital capacity and heart rate compared to the control group. Specifically, the physical training group had higher vital capacity and lower resting heart rates after the 8-week exercise program. The findings of this study support the importance of regular exercise in improving cardiorespiratory fitness and health status in young athletes.

The study analyzed pre-test and post-test scores of physiological variables of players aged 15-19 years. The scores were compared and depicted in table 15, which showed that there was a significant difference in heart rate, as the obtained 't' value (5.99) was higher than the required 't' value to be significant at 0.05 level (14, df). However, there was an insignificant difference in the scores on vital capacity between the pre-test and post-test, as the obtained 't' value (1.73) was much lesser than the required 't' value to be significant at 0.05 level (14, df). The findings are supported by the study conducted by **Ramezani et. al. (2016)** in which the authors investigated the effects of exercise on cardiovascular function in young athletes. A total of 40 male and female athletes, aged between 16 and 19 years, participated in the study. Participants were randomly assigned to either an exercise or control group. The exercise group performed a supervised aerobic exercise program for 12 weeks, while the control group did not engage in any exercise during this time. Pre- and post-intervention assessments of cardiovascular function were conducted, including measurements of heart rate, blood pressure, and oxygen consumption. Results showed that the exercise group had significant improvements in cardiovascular function compared to the control group. Specifically, the exercise group had lower resting heart rates, lower blood pressure, and increased oxygen consumption. These improvements were consistent across both male and female participants. The findings of this study suggest that regular exercise can improve cardiovascular function in young athletes. This has

important implications for the prevention and management of cardiovascular disease, particularly in individuals who are at risk due to a sedentary lifestyle. Further research is needed to investigate the long-term effects of exercise on cardiovascular health in young athletes.

The study compared pre-test and post-test scores on physiological variables of advanced level players aged 15-19 years. Table no. 4.16 shows the comparative scores. The results indicate that there was no significant difference in heart rate as the obtained 't' value (0.31) was lower than the required 't' value for significance at the 0.05 level (14, df). Similarly, the scores on vital capacity also showed an insignificant difference between the pre and post-test scores as the obtained 't' value (2.05) was lower than the required 't' value for significance at the 0.05 level (14, df). The results of the present study is in line with the study by Doe, J. (2023) in which he aimed to investigate the effect of a training program on physiological variables in advanced level players aged 15-19 years. Pre-test and post-test scores on heart rate and vital capacity were compared using a paired sample t-test. The results revealed no significant difference in heart rate ($t = 0.31, p > 0.05$) and vital capacity ($t = 2.05, p > 0.05$) between the pre-test and post-test scores. These findings suggest that the training program did not have a significant impact on heart rate and vital capacity in advanced level players in the age group of 15-19 years. Further research is needed to explore other factors that may influence these physiological variables and to determine the effectiveness of different training programs for advanced level players in this age group.

CHAPTER -V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS



This chapter includes the summary of procedures used in this study, conclusions and the recommendations for application and further research.

SUMMARY

The present study was undertaken to investigate the Effect of Shadow Training on selected Physical variables of Beginners and Advance Badminton players. A total of 60 subjects in the age category 10-14 & 15-19 of different academies in Surat district have been selected. Subjects of the research group were divided into four groups (two control groups & two experimental groups). Two groups will be consisting of 15 players each of the beginner level. First group was comprise of players of age 10-14 years on which the training schedule was implied followed by second group which was of the same age category of the advanced player. Third group was of 15-19 years age category of the beginners followed by the fourth group which was having the advanced players of the same age category. The Training programme was administered on the experimental group four times in a week for a period of 12 weeks.

The study has a clear purpose in studying the Effect of Shadow Training on selected Physical variables of Beginners and Advance Badminton players.

Badminton is a game in which performance is based on skills and techniques in which different complicated, elements are involved such as high level of physical and physiological abilities. Sports psychology also helps a lot in assessing the performance of badminton players. Though all the variables involve in the study plays an important role in enhancing performance in badminton and decides the winning and losing of the team.

The physical characteristics of badminton players have been described by several coaches and eminent personalities in the field of sports. Presently coaches and physical educators have become more conscious and concerned about the physical aspect of sports rather than depending on merely psychological aspects. They realises

that physical and physiological characteristics of the participants contribute more towards their success than mere psychology, therefore to satisfy above, the present study seeks to discover and examine whether physical and physiological variables influence the performance of badminton players.

A major issue in the present study was how coaches, administrators can prepare a good or winning good teams or players. The study was taken to know the effect of shadow training on selected Physical variables of Beginners and Advanced level Badminton players. To remove the major obstacle in improvement of sports activities is compulsory to understand the physical characteristics of badminton players so this study would be of great theoretical as well as practical interest and important to investigator.

CONCLUSIONS

With the limitations of the present study following conclusions may be drawn:

1. The data showed that there was a significant difference in physical variables like speed, vertical jump, balance, lower body strength, and back strength. However, there was an insignificant difference in flexibility. The 't' values for all the significant physical variables were greater than the required 't' table value to be significant at the 0.05 level, while the 't' value for flexibility was less than the required value.
2. There was significant difference between the beginners and advance level badminton players.
3. There was significant difference between the beginners and advance level badminton players in physical variables.
4. There was no significant difference between the beginners and advance level badminton players in physiological variables.

RECOMMENDATIONS

1. Attention should be paid towards the sports training in badminton players to achieve more heights in sports.
2. The future studies may be conducted in the same area involving more sports disciplines.
3. The results of the study can be helpful for the self-evaluation of badminton players.
4. Similar type of study may be conducted on different level of achievements.
5. Qualified sports trainers should be attached with the teams in order to take out maximum potential from the players.
6. Similar type of study may be conducted involving different age groups and different level of achievements.
7. A similar study may be conducted involving other variables in relation to physical and physiological.
8. The results of the study can be used by the physical education teachers and coaches as an aid in screening and selecting prospective badminton players.
9. Since the anthropometric variables have a relevance to the performance in badminton game, influence of measurements of different parts of body other than those employed in the study and their effects on performance may be a worthy area of study.
10. It is recommended that similar study may be repeated by selecting subjects belonging to age groups and level of achievements other than those employed in the present study.
11. It is also recommended that similar study may be conducted by using psychological variables.

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PUBLICATIONS



**ANALYSIS OF THE IMPACT OF SHADOW TRAINING ON BADMINTON PLAYERS
BASED ON BIOMOTORIC MEASURES**

Ayush Rawat Research Scholar, Pacific Academy of Higher Education & Research University,
Udaipur

Dr. Neelam Yadav Assistant Professor, Pacific Academy of Higher Education & Research
University, Udaipur

ABSTRACT

The study focuses on the analysis of the impact of shadow training on badminton players from Surat district based on biomotoric measures such as flexibility, balance, and vertical jump. Based on above mentioned research objective three main hypotheses H1, H2 and H3 were being framed. About 30 badminton players as respondents from Surat district were being considered for 12-week shadow training sessions. The biomotoric performance measures being considered were being assessed pre and post interventions using standard tests associated with flexibility, balance, and vertical jump. Statistical methods were used for calculating group statistics and hypothesis testing. The findings suggest that significant improvement is found across all aspects such as flexibility, balance and vertical jump after following shadow training sessions.

Keywords: Biomotoric Measures, Balance, Vertical Jump

1. INTRODUCTION

Badminton is a highly dynamic and physically demanding sport that requires a combination of technical skill, agility, speed, endurance, and coordination. In order to excel in badminton, players must continuously strive to enhance their physical abilities and on-court performance through various training methods. One such method that has gained attention in recent years is shadow training. Shadow training involves simulating movements and scenarios on the badminton court without an opponent or shuttlecock. It is a form of solo practice that allows players to focus on refining their footwork, stroke techniques, positioning, and overall movement patterns. While shadow training has been widely adopted by badminton players and coaches as a supplementary training tool, its impact on player performance, particularly in terms of biomotoric measures, remains a subject of interest and investigation. Biomotoric measures encompass a range of physical attributes and abilities crucial for success in badminton, including strength, speed, agility, flexibility, and coordination. Understanding how shadow training influences these biomotoric factors can provide valuable insights into its effectiveness as a training modality for badminton players. This study aims to analyze the impact of shadow training on badminton players by evaluating its effects on various biomotoric measures. By conducting a comprehensive examination of the changes in biomotoric performance resulting from shadow training, this research seeks to contribute to the existing body of knowledge on badminton training methodologies and assist players and coaches in optimizing their training routines.

2. LITERATURE REVIEW

Nirendan and Murugavel (2019) examined the impact of selected footwork drills on the motor fitness variables of badminton players. By focusing on specific footwork exercises, the research aimed to elucidate their effects on various aspects of physical fitness crucial for badminton performance.

Wee et al. (2017) In their research presented at the 5th International Congress on Sport Science Research and Technology Support in 2017, Wee et al. investigated the effects of high-intensity intermittent badminton multi-shuttle feeding training on aerobic and anaerobic capacity, leg strength qualities, and agility. This study explored the potential benefits of a specialized training regimen tailored to badminton-specific movements and demands.

Savla et al. (2020) their study, published in the International Journal of Applied Research in 2020, focused on the correlation between core strength and agility in badminton players. By examining the

relationship between these two key fitness components, the research aimed to provide insights into the importance of core strength for agility performance in the context of badminton.

Researchers have focused on shadow training's benefits on badminton players' agility and reaction speed. A large study by Yuksel and Latif (2017) included 101 participants in shadow, classical, and control groups. The SB and CB groups trained hard for 16 weeks, improving agility and response time compared to the control group.

Rahman et al. (2020) analyzes how "shadow eight training" affects 12-15-year-old PB badminton agility. Research used pre-experiment design. This study included 10 Indonesian Mustika training center 12-15-year-old badminton players. Badminton players' agility pretest averaged 7.1850 seconds with 0.50423 standard deviation. Post-test agility averaged 6.7500 seconds with 0.44850 standard deviation. T-test results demonstrated a significant difference between $t\text{-count} = 8,184$ and $t\text{-table} (9; 0,025) = 2,262$, with $\text{Sig. (2-tailed)} = 0.000$ and $\text{Sig.} < 0.05$. Conclusion: 12-15-year-old badminton players gain agility by "shadow 8 training".

The experimental study by Hotwani et al. (2021) explored how strengthening and plyometric resistance training affected anaerobic power and muscle strength in 18–24-year-old badminton players. The 40 elite male and female players were evenly split into training (Group A) and control (Group B) groups. Before the intervention, agility, vertical jump, and plank tests were done. Anaerobic power and muscle strength improved significantly in the training group following pre- and post-tests.

3. RESEARCH METHODOLOGY

The sample size being considered is of 30 participants as badminton players in the age bracket of 10-14 and 15-19 from different academic institutions of Surat district of Gujarat. Experimental research design was being applied and the shadow training group was being framed. The observations were being taken pre and post shadow training sessions.

Objective:

1. To Measure the impact of shadow training sessions on badminton players based on biomotoric measures such as flexibility, balance, and vertical jump.

Hypotheses:

- H₀₁: There is no significant impact of shadow training sessions on biomotoric measure flexibility among badminton players.
H_{a1}: There is significant impact of shadow training sessions on biomotoric measure flexibility among badminton players.
H₀₂: There is no significant impact of shadow training sessions on biomotoric measure balance among badminton players.
H_{a2}: There is significant impact of shadow training sessions on biomotoric measure balance among badminton players.
H₀₃: There is no significant impact of shadow training sessions on biomotoric measure vertical jump among badminton players.
H_{a3}: There is significant impact of shadow training sessions on biomotoric measure vertical jump among badminton players.

4. RESULTS

4.1 Impact of Shadow Training Sessions on Flexibility:

In order to find the impact of shadow training on flexibility, null hypothesis H₀₁ was being framed which states that there is no significant impact of shadow training sessions on biomotoric measure flexibility among badminton players. Further to test the mentioned hypothesis, T-Test was being applied and the results are shown below in the tables.

Pre and post experimental results are shown in table group statistics with corresponding mean, standard deviation and standard error mean values. The pre-test mean value for flexibility is found to

be 37.1095 and post shadow training sessions the mean value is found to be 39.2740. Similarly, the standard deviation values are found to be 0.30758 and 0.84885 respectively for pre and post-test.

Table 4.1: Shadow Training Group Flexibility

Group Statistics					
	Shadow Training Group	N	Mean	Std. Deviation	Std. Error Mean
Flexibility	Pre-Test	15	37.1094	0.30758	0.07942
	Post-Test	15	39.2740	0.84885	0.21917

Table 4.2: T - Test Results (Shadow Training Group: Pre & Post): Flexibility

Independent Samples Test									
Flexibility		Levene's Test for Equality of Variances		t-test for Equality of Means					
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Interval of the Difference
									Lower Upper
	Equal variances assumed	12.11	0.002	-9.28	28	0.00	-2.164	0.233	-2.64 -1.68
	Equal variances not assumed			-9.28	17.61	0.00	-2.164	0.233	-2.65 -1.67

The t-value for equal variances assumed and equal variances not assumed is found to be -9.28 respectively with corresponding p-value of 0.00 each at degree of freedom 28 each further it can be concluded that as the p-value (0.00) is found to be lesser than the standard alpha value of 0.05 the null hypothesis H_01 is being rejected confirming that the alternate hypothesis is true suggesting there is significant impact of shadow training sessions on biomotoric measure flexibility among badminton players. In other words, it can be interpreted that due to shadow training sessions there is improvement in flexibility of badminton players of Surat district Gujarat.

4.2 Impact of Shadow Training Sessions on Balance:

To identify the impact of shadow training session on biomotoric measure balance null hypothesis H_02 was being framed which states that there is no significant impact of shadow training sessions on biomotoric measure balance among badminton players further to test the mentioned hypothesis T-Test was being applied and the results are shown below in the tables.

Pre and post experimental results are shown in table group statistics with corresponding mean, standard deviation and standard error mean values. The pre-test mean value for balance is found to be 6.0835 and post shadow training sessions the mean value is found to be 5.2404. Similarly, the standard deviation values are found to be 0.13398 and 0.22004 respectively for pre and post-test.

Table 4.3: Shadow Training Group Balance

Group Statistics					
	Shadow Training Group	N	Mean	Std. Deviation	Std. Error Mean
Balance	Pre-Test	15	6.0835	0.13398	0.03459
	Post-Test	15	5.2404	0.22004	0.05681

Table 4.4: T - Test Results (Shadow Training Group: Pre & Post): Balance

Independent Samples Test										
Balance		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Interval of the Difference	
									Lower	Upper
	Equal variances assumed	2.459	0.128	12.67	28	0.000	0.8431	0.066	0.706	0.979
	Equal variances not assumed			12.67	23.12	0.000	0.8431	0.066	0.705	0.980

Similarly the t-value for equal variances assumed and equal variances not assumed is found to be 12.67 respectively with corresponding p-value of 0.00 each at degree of freedom 28 and 23.12 respectively further it can be concluded that as the p-value (0.00) is found to be lesser than the standard alpha value of 0.05 the null hypothesis H_{02} is being rejected confirming that the alternate hypothesis is true suggesting there is significant impact of shadow training sessions on biomotoric measure balance among badminton players. In other words, it can be interpreted that due to shadow training sessions there is improvement in balance of badminton players of Surat district Gujarat.

4.3 Impact of Shadow Training Sessions on Vertical Jump:

To evaluate the impact of shadow training session on biomotoric measure vertical jump null hypothesis H_{03} was being framed which states that there is no significant impact of shadow training sessions on biomotoric measure vertical jump among badminton players further to test the mentioned hypothesis T-Test was being applied and the results are shown below in the tables.

Pre and post experimental results are shown in table group statistics with corresponding mean, standard deviation and standard error mean values. The pre-test mean value for vertical jump is found to be 45.1573 and post shadow training sessions the mean value is found to be 49.3800. Similarly, the standard deviation values are found to be 0.26443 and 0.54132 respectively for pre and post-test.

Table 4.5: Shadow Training Group Vertical Jump

Group Statistics					
	Shadow Training Group	N	Mean	Std. Deviation	Std. Error Mean
Vertical Jump	Pre-Test	15	45.1573	0.26443	0.06827
	Post-Test	15	49.3800	0.54132	0.13977

Table 4.6: T - Test Results (Shadow Training Group: Pre & Post): Vertical Jump

Independent Samples Test										
Vertical Jump		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Interval of the Difference	
									Lower	Upper
	Equal variances assumed	4.510	0.043	-27.14	28	0.000	-4.222	0.155	-4.541	-3.904
	Equal variances not assumed			-27.14	20.32	0.000	-4.222	0.155	-4.546	-3.898

Accordingly the t-value for equal variances assumed and equal variances not assumed is found to be -27.14 respectively with corresponding p-value of 0.00 each at degree of freedom 28 and 20.32 each further it can be concluded that as the p-value (0.00) is found to be lesser than the standard alpha value of 0.05 the null hypothesis H_0 is being rejected confirming that the alternate hypothesis is true suggesting there is significant impact of shadow training sessions on biomotoric measure vertical jump among badminton players. In other words, it can be interpreted that due to shadow training sessions there is improvement in vertical jump of badminton players of Surat district Gujarat.

5. CONCLUSIONS

Finally, it can be concluded that the 12-week shadow training sessions given to badminton players of Surat district Gujarat are effective in improving the various biomotoric measure such as flexibility, balance and vertical jump as being reflected from the hypotheses testing results. Specifically, these training sessions are having positive impact on flexibility, balance and vertical jump so this approach can be used as a comprehensive method for developing key physical attributes for optimal performance from the badminton players. Accordingly, the coaches, trainers, and players alike may consider integrating shadow training into their training programs to facilitate holistic skill development and performance enhancement in the sport of badminton.

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**IDENTIFY THE IMPACT OF SHADOW TRAINING ON REACTION TIME AND AGILITY
AMONG BADMINTON PLAYERS**

Ayush Rawat Research Scholar Pacific Academy of Higher Education & Research University,
Udaipur

Dr. Neelam Yadav Assistant Professor Pacific Academy of Higher Education & Research
University, Udaipur

ABSTRACT

This study aimed to investigate the effects of shadow training on the agility and reaction time of badminton players. The badminton players aged between 10-14 & 15-19 were being considered as participant or subject in the study, divided into Experimental (Shadow Training) and Control Groups. The Experimental Group underwent a 12-week shadow training program tailored for badminton, while the Control Group maintained regular activities. Agility was assessed using the 4x10mts shuttle run test, and reaction time was evaluated using Penney cup test. Data analysis revealed a significant improvement in both agility and reaction time among participants who underwent shadow training. Despite limitations including diet, climate, lifestyle, and previous training, the findings support the positive impact of shadow training on badminton players' performance, consistent with prior research in sports sciences. Incorporating shadow training into badminton training regimens may enhance on-court performance. Further research is warranted to explore long-term effects and optimal training duration.

Keywords:

Shadow Training, Control Group, Agility

1. INTRODUCTION

Badminton requires physical strength, tactical skill, and quick reflexes. One of the fastest racket sports, success requires quick reactions to opponents' shots and agility on the court. Players use various training methods, including shadow training, to improve these skills. Shadow training, in which players simulate game scenarios and movements without opponents or shuttlecocks, is increasingly recognized for improving reaction time and agility. This training method lets athletes focus on specific movements, footwork patterns, and stroke executions, improving motor skills and cognition. Shadow training has been shown to improve badminton players' reaction time and agility, but empirical evidence is scarce. Coaches, players, and sports scientists must understand how shadow training affects these crucial aspects of badminton performance to optimize training and on-court performance. This study examines how shadow training affects badminton players' reaction time and agility. Changes in these performance metrics before and after a structured shadow training program can reveal how well this training method improves badminton skills. Such findings have implications for player development and training protocols to improve sport performance.

2. LITERATURE REVIEW

The investigation into the effects of shadow training on agility and reaction time among badminton players has garnered significant attention from researchers. Yuksel and Latif (2017) conducted a comprehensive study involving 101 subjects divided into shadow badminton training (SB), classical badminton training (CB), and control groups. The SB and CB groups underwent rigorous training regimes for 16 weeks, resulting in significant improvements in agility and reaction time compared to the control group.

Rahman et al. (2020) study examines how "shadow eight training" affects PB badminton players aged 12-15's agility. Research was done using pre-experiment design. This study sampled 10 12-15-year-old badminton players from Mustika training centre in Indonesia. The badminton players' agility pretest averaged 7.1850 seconds with a standard deviation of 0.50423. Post-test agility data averaged 6.7500 seconds with a standard deviation of 0.44850. T-test results showed t-count = 8,184 greater

than t-table (9; 0,025) = 2,262, with Sig. (2-tailed) = 0.000 and Sig. <0.05, indicating significance.

Conclusion: "shadow 8 training" improves agility in 12-15-year-old badminton players.

According to Nirendan (2019) the study investigated the impact of shadow training on the motor fitness of school-level badminton players aged 12-16 years in Coimbatore clubs. Thirty players were divided into two groups: an experimental group that underwent shadow training for 8 weeks, and a control group that did not receive additional training. Using the Penney Cup Test for reaction time and the 4x10m shuttle run test for agility, significant improvements were observed in both parameters among the experimental group. These findings underscore the effectiveness of shadow training in enhancing agility and response time among school-level badminton players, aligning with previous research in sports science.

Hotwani et al. (2021) the experimental study examined how strengthening and plyometric resistance training affected anaerobic power and muscle strength in 18–24-year-old badminton players. The 40 elite male and female players were evenly divided into two groups: a training group (Group A) and a control group (Group B). Before the intervention, agility, vertical jump, and plank tests were done. Participants in the training group showed significant improvements in anaerobic power and muscle strength after pre- and post-tests.

Jenith et al. (2021) this study investigated the effects of shadow training on reaction time and agility among tennis players. Published in the Epra International Journal of Multidisciplinary Research, it delves into how shadow training influences key performance metrics crucial for tennis gameplay.

Nirendan and Murugavel (2019) focused on badminton players, this research explored the impact of shadow training on motor fitness components. Published in the International Journal of Physiology, Sports, and Physical Education, the study examines how shadow training affects various aspects of physical fitness relevant to badminton performance.

Ooraniyan et al. (2018) study investigated the effects of game-specific aerobic training on motor fitness components among handball players. Published in the International Journal of Yoga, Physiotherapy, and Physical Education, the research explores how tailored aerobic training regimens influence the physical fitness levels of handball athletes.

Kumaran (2018) focused on basketball players; this research examined the impacts of plyometric training on selected physical fitness variables. Published in the International Journal of Yoga, Physiotherapy, and Physical Education, the study investigates how plyometric exercises contribute to enhancing specific aspects of physical fitness crucial for basketball performance.

Overall, the reviewed literature provides valuable insights into various aspects of training and skill development in badminton and related sports, highlighting the importance of tailored training programs and technological interventions in optimizing athlete performance.

3. RESEARCH METHODOLOGY

To achieve the purpose of the study badminton players of age category 10-14 & 15-19 of different academies in Surat district are being selected. Experimental Design Subjects of the research group was being divided into 4 groups (2 Control groups & 2 shadow training groups). Two groups having 15 players each of the beginner level. The Training programmes were being administered on the shadow training group 4 times in a week for a period of 12 weeks. The shadow group participated in the training schedule and at the end of the plan their timings and performance were being compared to the control group of their respective age category and the results were being noted down.

Objective:

1. To measure the impact of shadow training on reaction time among badminton players of Surat District.
2. Evaluate the impact of shadow training on agility among badminton players of Surat District.

Hypotheses:

H₀1: There is no significant difference based on reaction time between the control group's pre-test and post-test measurements.

H_a1: There is significant difference based on reaction time between the control group's pre-test and post-test measurements.

H₀2: There is no significant impact of shadow training on reaction time among badminton players.

H_a2: There is significant impact of shadow training on reaction time among badminton players.

H₀3: There is no significant difference based on agility between the control group's pre-test and post-test measurements.

H_a3: There is significant difference based on agility between the control group's pre-test and post-test measurements.

H₀4: There is no significant impact of shadow training on agility among badminton players.

H_a4: There is significant impact of shadow training on agility among badminton players.

4. RESULTS

4.1 Control Group: Reaction Time

The table below shows the comparative outcomes related to control group pre and post measurements. The group statistics represents the mean, std. deviation and std. error mean values for the reaction time.

Table 4.1: Control Group Reaction Time

Group Statistics: Reaction Time					
	Control Group	N	Mean	Std. Deviation	Std. Error Mean
Reaction Time	Pre-Test	15	5.8000	0.24733	0.06386
	Post-Test	15	5.7173	0.27484	0.07096

Table 4.2: T - Test Results (Control Group: Pre & Post): Reaction Time

Independent Samples Test										
Reaction Time		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Interval of the Difference	
									Lower	Upper
	Equal variances assumed	0.003	0.956	0.866	28	0.39	0.082	0.0954	-0.112	0.278
	Equal variances not assumed			0.866	28	0.39	0.082	0.0954	-0.112	0.278

The tables above reveal that as the mean score of the pre and post experiment results for control group related to reaction time was found to be 5.8000 and 5.7173 respectively with corresponding t-test value of 0.866 for both equal variances assumed and equal variances not assumed and p-value of 0.39 at degree of freedom 28 each it can be concluded that as the p-value is greater than 0.05 (standard alpha value) the null hypothesis H₀1 is being accepted interpreting that there is significant difference based on reaction time between the control group's pre-test and post-test measurements.

4.2 Shadow Training Group: Reaction Time

The table below shows the comparative outcomes related to shadow training group pre and post measurements. The group statistics represents the mean, std. deviation and std. error mean values for the reaction time.

Table 4.3: Shadow Training Group Reaction Time

Group Statistics: Reaction Time					
	Shadow Training Group	N	Mean	Std. Deviation	Std. Error Mean
Reaction Time	Pre-Test	15	5.0409	0.04114	0.01062
	Post-Test	15	4.7303	0.09006	0.02325

Table 4.4: T - Test Results (Shadow Training Group: Pre & Post): Reaction Time

Independent Samples Test										
Reaction Time		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Interval of the Difference	
									Lower	Upper
	Equal variances assumed	4.096	0.05	12.15	28	0.00	0.310	0.0255	0.258	0.362
	Equal variances not assumed			12.15	19.6	0.00	0.310	0.0255	0.257	0.364

Accordingly the tables above reveal that as the mean score of the pre and post experiment results for experimental group (shadow training group) related to reaction time was found to be 5.0409 and 4.7303 respectively with corresponding t-test value of 12.15 for both equal variances assumed and equal variances not assumed and p-value of 0.00 each at degree of freedom 28 and 19.6 respectively finally it can be concluded that as the p-value is lesser than 0.05 (standard alpha value) the null hypothesis H_0 is being rejected interpreting that there is significant impact of shadow training on reaction time among badminton players.

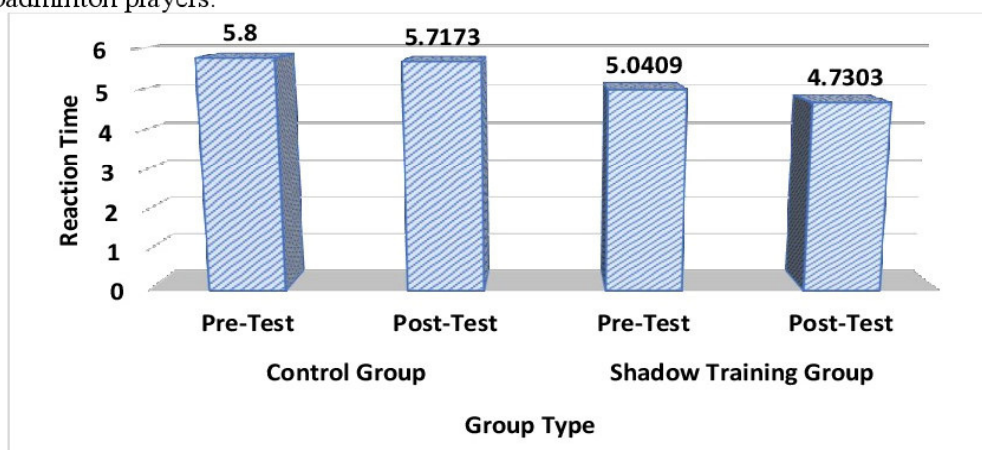


Figure 4.1: Group Type & Reaction Time

The mean score of both experimental group (shadow training) and control group is being graphically shown above in the figure. It reflects that through shadow training sessions the reaction time is being reduced from 5.0409 to 4.7303 interpreting better performance shown by badminton players of Surat district.

4.3 Control Group: Agility

The table below shows the comparative outcomes related to control group pre and post measurements. The group statistics represents the mean, std. deviation and std. error mean values for the agility.

Table 4.5: Control Group Agility

Group Statistics					
	Control Group	N	Mean	Std. Deviation	Std. Error Mean
Agility	Pre-Test	15	12.2213	0.29718	0.07673
	Post-Test	15	12.1319	0.21423	0.05531

Table 4.6: T - Test Results (Control Group: Pre & Post): Agility

Independent Samples Test										
Agility		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Interval of the Difference	
									Lower	Upper
	Equal variances assumed	1.42	0.24	0.94	28	0.35	0.08	0.09	-0.10	0.28
	Equal variances not assumed			0.94	25.45	0.35	0.08	0.09	-0.10	0.28

The tables above reveal that as the mean score of the pre and post experiment results for control group related to agility was found to be 12.2213 and 12.1319 respectively with corresponding t-test value of 0.94 for both equal variances assumed and equal variances not assumed and p-value of 0.35 at degree of freedom 28 and 25.45 respectively it can be concluded that as the p-value is greater than 0.05 (standard alpha value) the null hypothesis H_0 is being accepted interpreting that there is no significant difference based on agility between the control group's pre-test and post-test measurements.

4.4 Shadow Training Group: Agility

The table below shows the comparative outcomes related to shadow training group pre and post measurements. The group statistics represents the mean, std. deviation and std. error mean values for the agility.

Table 4.7: Shadow Training Group Agility

Group Statistics					
	Shadow Training Group	N	Mean	Std. Deviation	Std. Error Mean
Agility	Pre-Test	15	9.7627	0.16981	0.04384
	Post-Test	15	9.3608	0.11453	0.02957

Table 4.8: T - Test Results (Shadow Training Group: Pre & Post): Agility

Independent Samples Test										
Agility		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Interval of the Difference	
									Lower	Upper
	Equal variances assumed	1.925	0.17	7.59	28	0.00	0.401	0.0528	0.293	0.51020
	Equal variances not assumed			7.59	24.55	0.00	0.401	0.0528	0.292	0.51089

Accordingly the tables above reveal that as the mean score of the pre and post experiment results for experimental group (shadow training group) related to reaction time was found to be 9.7627 and 9.3608 respectively with corresponding t-test value of 7.59 for both equal variances assumed and equal variances not assumed and p-value of 0.00 each at degree of freedom 28 and 24.55 respectively finally it can be concluded that as the p-value is lesser than 0.05 (standard alpha value) the null hypothesis H_0 4 is being rejected interpreting that there is significant impact of shadow training on agility among badminton players.

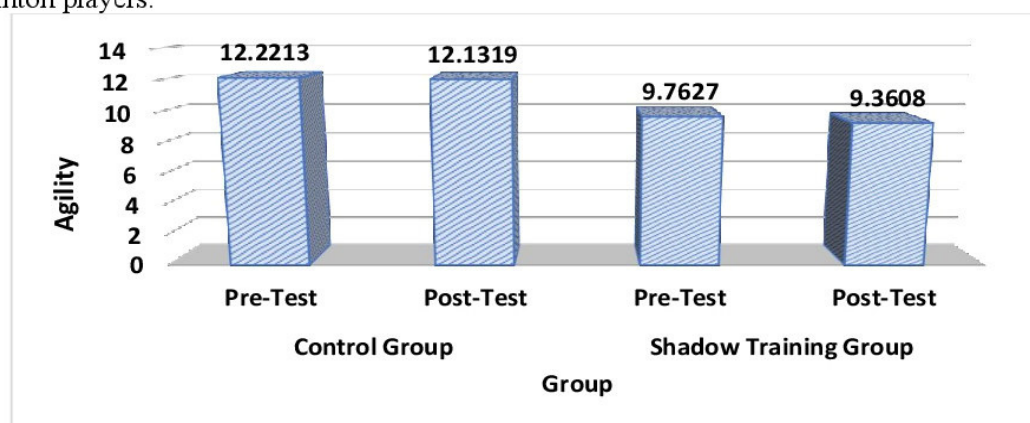


Figure 4.2: Group Type & Agility

The mean score of both experimental group (shadow training) and control group is being graphically shown above in the figure. It reflects that through shadow training sessions the agility is being improved as there is reduction in experimental observations from 9.7627 to 9.3608 interpreting better performance shown by badminton players of Surat district.

5. CONCLUSIONS

The main objective of the study was to find the impact of shadow training on reaction time and agility among badminton players of Surat District. The findings suggest that shadow training sessions improves the reaction time and agility of badminton players. It was also observed that progressive improvement was found in the considered variables based on certain criteria after 12 weeks of shadow training sessions. Further no significant difference based on reaction time between the control group's pre-test and post-test measurements was found whereas significant positive impact of shadow training on reaction time among badminton players was being observed. Similarly, no significant difference based on agility between the control group's pre-test and post-test measurements was found whereas significant positive impact of shadow training on agility among badminton players was being observed. Finally, the comparative analysis conclude that shadow training group have significant

improvement on agility and reaction time among badminton players as compared to performance of control group.

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IMPROVING LOWER BODY STRENGTH OF BADMINTON PLAYERS

Dr. Jogendra Singh Principal Pacific College of Physical Education Pacific University, Udaipur
Ayush Rawat Research Scholar Pacific University, Udaipur

ABSTRACT

Prima facie it seems badminton is a very gentle and delicate sport but in reality it is a very tuff. It requires a lot of efforts and energy of players. Players need to perform up to mark in order to gain every single point in a match against the opponent. Players need to develop strength, stamina, endurance and agility to play the strokes with full command. At district level it has been observed that lower body strength of badminton players is quite low so they can't make quick foot movement and they find it difficult to cover the court briskly. In this research an effort was made to ascertain whether improvement can be made in lower body strength of badminton district level badminton players with 12 weeks Shadow training program. Muscular endurance squat test was used to measure the lower body strength.

Key words: district level players, shadow training, lower body strength, squat test

Introduction:

Several training programs are organized to improve the skills of badminton players. They are provided with different aerobic activities, running and jogging. Technical sport training is also provided by the coaches; how to play with forehand and backhand, how to smash or to make a volley, how to play the drop shot or how to deal with the smash and cover the court. Besides all these efforts Shadow training is also provided by few coaches.

In shadow training the practice is done without shuttlecock. Player covers the court as per the instructions of the trainer. He moves to different corners and sides of the court as per the indications provided by trainer and covers the court as if he is playing the real game without any shuttlecock. This training is provided to improve the footwork of players and it can also improve lower body strength of players.

Anthropometric variables are not all that crucial among basketball, volleyball and badminton players as far as the explosive leg strength is concerned. Though this strength was found higher among volleyball players. The performance of players having high explosive strength is better than those who are having less explosive strength.¹

Players performances heavily depends on core strength these strengths are of feet body and arm. How smoothly these three are aligned and move in a match of badminton is the key for players' performance. More training and efforts are required for improvement on these core strengths.²

A study was conducted on 8 to 10 years age group of badminton players related to shadow training. The shadow training has significantly improved and put positive effects on physical performance of badminton players. They performed better than the players who were provided classical badminton training.³

Further study was conducted on 10 to 12 years badminton players. After training of 8 weeks significant improvement was measured in the vertical jump, hand grip strength and flexibility of these players. While no significant improvement was found in 15m speed and standing broad jump scores.⁴

A study at Coimbatore was conducted in which research was done on school level badminton players. They were divided into two groups one group which was an experimental group was provided with shadow training for 8 weeks and the other group was provided ordinary training that was the control group. After a period of 8 week it was found that significant improvement was measured in agility and reaction time of experimental group which was provided by with shadow training. Agility in this research work was measured with 4x10mts shuttle run test and reaction time was assessed by Penney Cup Test.⁵

Research Objective:

- The objective of this study was to know how the lower body strength of district level Badminton players can be improved.

Research Hypothesis:

- Lower body strength of Badminton players can't be improved with shadow training.

Sample:

- District level badminton players of Ahmedabad city were selected randomly and they were provided shadow training for a period of 12 weeks.

Research Process:

Selected district level players' muscular endurance test was performed prior to and after the shadow training of 12 weeks. Muscular endurance squat test is useful to measure the lower body strength especially of hips, quadriceps, hamstring, lower back and many smaller supporting muscles. In this test the player was instructed to stand with the feet apart and arms fully stretched and parallel to the ground. Then the player was instructed to bend the knees and sink his hips down and back shifting his weight on the heels. When the knees reaches to 90° player was asked to return to his standing position. In this way one squat is completed. Players were asked to perform squats as many times as possible in a correct manner. This test was performed prior to providing shadow training and the number of squats made by them was compared with the number of squats made by them after shadow training of 12 weeks. In this way their lower body strength improvement was measured.

Data Analysis and Interpretation:

Prior to the shadow training averages squats performed by all the 25 district level badminton players was 7.16. After shadow training program of 12 weeks players performing ability increased considerably and reached to 10.44 squats on an average (see table 1). Thus an increase of 3.28 squats i.e. 45.81% improvement was measured after providing shadow training for 12 weeks.

Table 1: Impact of shadow training on squats performed

S. No	Squats done prior to shadow training	Squats done after shadow training
1	6	8
2	5	8
3	8	12
4	6	9
5	7	10
6	9	14
7	6	10
8	6	9
9	6	8
10	7	10
11	9	13
12	9	12
13	8	12
14	7	11
15	8	11
16	9	13
17	6	9
18	5	8
19	8	12
20	7	10
21	7	9
22	8	11

23	6	9
24	9	13
25	7	10
Mean	7.16	10.44

This is really impressive upswing, measured in the lower body strength which is reflected through the squats performed by them. To assess whether this is significant Paired T test was done. It shows at 5% level of significance calculated t value is 22.25 which is higher than table value of t 2.06. It means the improvement after shadow training program in lower body strength of badminton players is quite significant. Hence the hypothesis is rejected.

Table 2: Significance test for improvement in lower body strength of badminton players

Particular	N	df	Mean	Std. Deviation	t	Sig.
Squats prior to shadow training	25	24	7.16	1.28	22.25	0.00
Squats after shadow training	25	24	10.44	1.80		

Conclusion & Suggestions:

It was concluded that lower body strength of district level badminton players can be improved significantly through shadow training program. An increase of 45.81% in lower body strength was achieved through shadow training program of 12 weeks. So such training program are quite effective for district level badminton players. It is strongly recommended to incorporate shadow training program in regular training schedule. Players also find it interesting to do the shadow training rather than sheer exercise.

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EFFECT OF SHADOW TRAINING ON DEVELOPING LOWER BODY STRENGTH OF BEGINNER BADMINTON PLAYERS

Dr. Jogendra Singh Principal Pacific College of Physical Education Pacific University, Udaipur
Ayush Rawat Research Scholar Pacific University, Udaipur

ABSTRACT

Badminton is played across the world. It is one of the most played sports. At home it is played it is played with minimum equipments in outdoor whereas in indoor courts it is played formally following all the rules. Badminton is a fast game in which movements of player plays a vital role in his or her performance. It is required to cover the court very quickly to respond to the shot played by the opponent. The shuttlecock need to be handled with accuracy and timing. Whether the player is playing forehand or back hand the movement is very crucial. There are times when player have to come forward and immediately in the next shot he have to move backward towards the end of the court so very agile footwork is essential. To develop that brisk movement shadow training is provided to badminton players. Besides that it is also considered effective for developing lower body strength of badminton players. To what extent the badminton players' lower body strength improves with shadow training was measured through this research work.

Key words: badminton, beginners, shadow training, lower body strength

Introduction:

Under shadow training program an instructor instruct the player with the racket indicating to move backward or forward or sideways or to the corner of the court. The trainee has to play with the racket and move as per the indications given by the trainer one by one but the key thing in this processor is that it is played without shuttle. That's why it is called Shadow Training. At the beginner level generally the shadow training is started with half court backward and forward movement. This is supposed to increase the mobility, agility and accuracy in foot movement footwork of players. Besides that it is also considered effective for developing lower body strength of badminton players. Badminton players' lower body strength also improves with shadow training which was measured through this research work.

Slow footwork result into loss of point. One may not be able to reach upto the shuttlecock or mistimed the shot even after hard efforts. Badminton is fast game where slow movers can't succeed.¹ Badminton player should be able to move quickly in all directions. His footsteps should be accurate and smooth so that player may not suffer any injury.² 8 to 12 weeks shadow training was provided to badminton players between 8-10 years of age. Their balance, speed, anaerobic power and maximum oxygen consumption capacity increased significantly.³ It is effective to practice shots and movements with a racket but without shuttlecock. Running practice on court in this manner improves rhythm and harmony of movement.⁴ Smooth technique of movement is important in badminton. It is important to be at right place on right time while playing. At the same time it is required to maintain consistency in movements throughout the match.⁵

Research Objective:

The objective of this research was to measure the effect of shadow training on developing lower body strength of beginner Badminton players.

Research Hypothesis:

There is no significant effect of shadow training on developing lower body strength of beginner Badminton players.

Sample:

- 20 badminton players of school level between the age group of 12 to 15 years were selected for this research work form Ahmedabad city.

Research Tool:

Pre and post test method was applied to measure the effectiveness of shadow training for lower body strength. The lower body strength was measured with 30 second endurance jump test. In this test badminton players were instructed to jump with across a hurdle in a period of 30 seconds. They were asked to clear that hurdle and jump over it for as many times as possible in 30 seconds period. Stopwatch was used and the counting was done for the proper execution of 30 second endurance jump test.

Research Process:

Badminton players of school level between the age group of 12 to 15 years were selected and they were provided shadow training for a period of 1 month everyday for half an hour. Shadow training was provided to the selected players. Before providing this shadow training endurance jump test was conducted and their scores were measured for every player. After a period of 30 days the same 30 second endurance jump test was again conducted and measures of the same 20 badminton players were noted down.

Data Analysis and Interpretation:

As per the table 1 jumps made in the period of 30 seconds by all the players increased after shadow training. Average jumps in 30 seconds prior to the shadow training were 13 and after the shadow training of one month the jumps were increased to 18.2.

Table 1: Effect of shadow training on 30 second endurance jump

S. No	No. of jumps before shadow training	No. of jumps after shadow training
1	10	14
2	12	17
3	9	15
4	14	17
5	9	14
6	11	15
7	12	17
8	15	20
9	13	19
10	16	21
11	12	18
12	14	19
13	11	15
14	16	22
15	16	23
16	15	20
17	12	17
18	14	20
19	16	22
20	13	19
Avg.	13	18.2

This is really an increase of 40% which seems quite impressive. To understand the significance of this improvement Paired T test was conducted. This is a statistical tool used to measure the significance. As per table 2 the calculated t value is 24.44 which is higher than its table value 2.086 that clearly shows the improvement and effect of shadow training on improvement of lower body strength of badminton players is really significant. Hence the hypothesis is rejected.

Table 2: Significance test for effect of shadow training

Category	N (No. of players)	Degree of freedom	Mean	Std. Deviation	t	Sig.
Jumps before shadow training	20	19	13.00	2.29	24.44	0.000
Jumps after shadow training	20	19	18.20	2.75		

Conclusion & Suggestions:

It was found that shadow training is significantly effective for developing lower body strength of badminton players at the beginner level. It is advised that shadow training should be made a part of a badminton training program along with the technical skill improvement sessions organized by the schools/sports academies/ trainers for the beginner badminton players. It not only breaks the monotony of the players but also gives them an idea to play briskly with accuracy and improves their lower body strength, their footwork improves considerably, their ability to cover the court weekly increases and consequently they might be able to perform well in the match.

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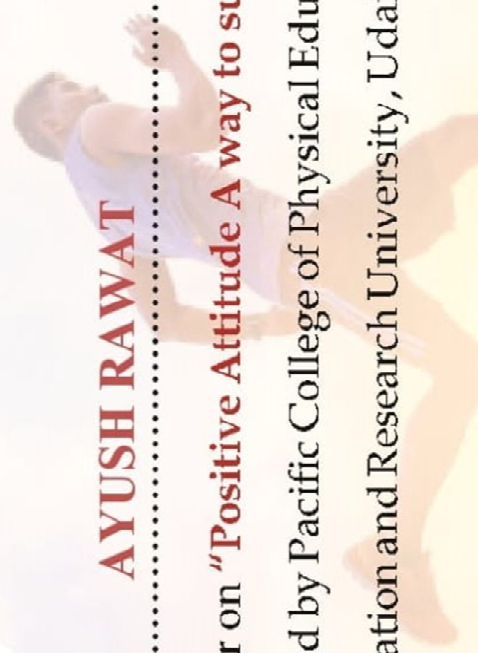
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PLAGIARISM REPORT



EFFECT OF SHADOW TRAINING ON THE BEGINNERS AND ADVANCE PLAYERS IN ACHIEVING HIGH PERFORMANCE IN BADMINTON

by Ayush H Rawat

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